COMPETITION ECONOMISTS GROUP

Information on equity beta from US companies

June 2013

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1 Executive summary

1. This report identifies energy network companies in the United States that have a similar degree of risk to regulated Australian energy networks. I understand that this work is being performed in the context of a small data pool of Australian listed regulated businesses. The purpose for doing so is to inform an assessment of the CAPM and Fama & French risk factors of Australian energy networks.

2. In order for companies to be useful comparators, they must be publicly listed so that potential risk factors can be estimated from the behaviour of their equity price. Therefore, I begin my analysis by identifying the largest reasonable set of publicly listed companies that might be useful comparators. In performing this step I identify 78 currently listed companies that are classified by SNL Financial (SNL) as being in the 'Power' or 'Gas Utility' industries based in the US. [1]

3. In order to test the comprehensiveness of this starting point, I cross check this set of potential comparators against:

   - companies identified by Bloomberg as "Network Utilities" operating in North America;
   - companies identified by SNL as 'Regulated Energy' companies and/or as having currently valid rate cases with regulatory bodies; and
     - other samples of US regulated energy companies developed by Australian and New Zealand regulators for the same purpose including the New Zealand Commerce Commission, the AER (via its consultant, Henry), and the Essential Services Commission Victoria).

4. I find that our initial starting point ('Power' or 'Gas Utilities" identified by SNL) includes all of the (currently listed) firms identified by these alternative starting points for identification of potential comparable companies. This gives me confidence that I am starting from a sufficiently broad set of potential comparators to ensure that suitable comparators are unlikely to have been excluded. In the remainder of this report, I examine each of these potential comparators in more detail in order to refine the sample down to the most suitable set of comparators.

5. Estimates of relative risk for 70 out of the 78 companies have been sourced from SFG.[2] As explained in the body of this report, eight companies were excluded on the basis that risk factors for these companies could not be reliably estimated due to

[1] These are businesses that have at least some gas or electricity network assets. SNL Financial provides news, financial data and expert analysis across banking, insurance, financial services, real estate, energy and media and communications industries and is based in the US. SNL assigns an industry to companies for which it collects information based on the company's operations.

[2] SFG Consulting, *Regression-based estimates of risk parameters for the benchmark firm, June 2013.*

illiquidity in the market for their equity. SFG has estimated betas for the Capital Asset Pricing Model (CAPM) and co-efficients for the Fama and French 3 factor model (FFM). I have separately sourced my own estimates of the historical average US FFM risk premiums. I rely on both these sets of estimates to arrive at my conclusions.

6. I assess comparability of the US companies to the benchmark by considering the following factors:

   - proportion of regulated assets;
   - regulatory regime;
   - comparison of gas and electricity companies;
   - comparison of US and Australian industry betas; and
   - comparison of US and Australian tax regimes.

7. For each of the potential comparators, I estimate the proportion of total assets which are regulated gas/electricity assets. I then use these estimates to examine any relationship between the proportion of regulated assets and predicted risk under both the CAPM and the FFM. The ultimate goal of this analysis is to set a minimum threshold for the proportion of regulated assets that must be met in order for a company to be included in the final sample.

8. When examining this data I find that some of the businesses in our initial sample have little or no regulated assets as a proportion of the value of total assets. Visual inspection of the data shows a materially larger dispersion in predicted risk premiums and higher average predicted risk for firms with less than 50% of regulated assets than firms with more than 50% regulated assets. The same visual inspection suggests that beyond 50% of regulated assets there is no strong relationship between predicted risk and the percentage of regulated assets. These conclusions are consistent with the outcome of formal statistical tests.

9. Nonetheless, there are a sufficiently large number of firms (56 firms) with more than 50% of regulated assets such that I can further increase the threshold from 50% to 80% while still retaining a reasonably large sample (34 firms). For completeness and notwithstanding the lack of evidence that the level of regulated assets affects predicted risk (beyond the 50% threshold), I report results for both the 50% and 80% thresholds in this report. I use the classifications *'mostly regulated'* and *'highly regulated'* throughout this report to signify that ≥ 50% and ≥80% of a company's total assets are regulated gas/electricity assets respectively.

10. I then examine whether there is a basis for further disaggregating these two samples to reflect other factors that might affect predicted risk. The first characteristic I examine is the nature of the regulatory regime and, specifically:

- whether the regime is classified as incentive based or rate-of-return as those terms are defined in the body of this report (noting that in Australia all regulated energy network businesses are subject to incentive regulation); and
- whether Commissioners of the regulatory body are appointed by the Government or directly elected (noting that in Australia all commissioners of the AER are appointed by the Government).

11. I conclude that there is no basis for assuming that firms subject to different regulatory environments have different predicted risk – under either the CAPM or of the FFM.

12. I also examine whether there is a basis for concluding that predicted risks associated with regulated gas and electricity businesses are different. I use two separate SNL classifications to distinguish between "gas" and "electric" utilities (noting that many of the companies examined have both types of assets). There are only a small number of gas businesses under either of the SNL classification (6 or 4). This is not a sufficiently large sample to make a reliable conclusion on differences in predicted risk.

13. In the light of all of the above analysis, I propose that a primary sample is adopted based on the 56 mostly regulated businesses (with at least 50% of total assets regulated). I also consider that regard should also be had to the smaller sample that results from applying a 80% threshold – total of 34 companies. The reason for giving primacy to the mostly regulated sample is that it is a larger sample and there no evidence that the risk of mostly regulated businesses is different to that of the highly regulated businesses.

14. Relevant statistics for these two samples are described below.

Table 1: CAPM asset beta versus proportion of regulated assets

	# companies	Average	Minimum	Maximum	Standard deviation
Mostly regulated	56	0.35	0.20	0.60	0.08
Highly regulated	34	0.34	0.20	0.55	0.08

Source: SFG, Bloomberg, CEG analysis

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Table 2: FFM relative risk versus proportion of regulated assets

	# companies	Average	Minimum	Maximum	Standard deviation
Mostly regulated	56	0.37	0.21	0.67	0.11
Highly regulated	34	0.38	0.21	0.63	0.11

Source: SFG, Bloomberg, Ken French Data library, Dimson Staunton Marsh (2012), CEG analysis. Relative risk has been calculated as the total unlevered risk premium estimated using the FFM (given the data provided by the SFG) divided by 6.2% - where 6.2% is used as a proxy for the average risk on the market portfolio (sourced from Dimson Staunton Marsh (2012)). This gives an estimate of predicted risk relative to the market. This conversion allows a meaningful comparison to the CAPM asset beta which is itself a measure of unlevered risk relative to the market risk.

15. I have also examined whether industries in Australia and the US tend to have correlated betas. This is relevant to an assessment of whether one can expect that betas measured for US firms provide a reasonable proxy for betas of Australian firms. I conclude that industry betas in Australia and the US are positively correlated which supports the intuitively reasonable conclusion that the US utility betas provide information relevant to an assessment utility relative risk in Australia. I also note that differences in the Australian and US tax regime would, if anything, tend to depress US utility betas relative to Australian utility betas. My conclusion is that relative risk estimates for the 56 companies in the mostly regulated US sample provide a relevant proxy for a regulated Australian energy network.

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2 Introduction

16. My name is Tom Hird, and I have a Ph.D. in Economics from Monash University and over 20 years' experience as a professional economist. My CV is attached in Appendix F.

17. CEG were engaged by the ENA to prepare a report regarding the selection of US energy network companies with a similar degree of risk to regulated Australian energy network companies. The purpose for doing so is to inform an assessment of the CAPM and Fama & French risk factors of Australian energy networks. The ENA's terms of reference are attached at Appendix E.

18. I acknowledge that I have read, understood and complied with the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia"*. I have made all inquiries that I believe are desirable and appropriate to answer the questions put to me. No matters of significance that I regard as relevant have to my knowledge been withheld. I have been provided with a copy of the Federal Court of Australia's *Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia*, and confirm that this report has been prepared in accordance with those Guidelines.

19. I have been assisted in the preparation of this report by Johanna Hansson in CEG's Sydney office. However the opinions set out in this report are my own.

Thomas Nicholas Hird

27 June 2013

3 Potential US comparators to the benchmark company

21. For the purpose of this report I adopt a definition of the benchmark firm as being:

> *A firm that has the same risks as the risks of providing reference services being regulated.*

22. It should be noted that, in the above definition, I do not define a 'one size fits all' definition of the benchmark company. This is because, it may be appropriate, at least in theory, to adopt a different benchmark, in different circumstances. For example, a different benchmark when regulating a gas transmission pipeline to an electricity distribution business. That said, and consistent with the analysis in the rest of this report, I do not consider that the evidence supports attempting to distinguish between different types of regulated businesses.

23. However, given that the reference services are, by definition, being regulated it is appropriate to focus on identifying businesses that have a high proportion of regulated assets. For this purpose I have looked at seven different ways of initially identifying a set of potentially comparable regulated gas or electricity companies.

24. In order for companies to be useful comparators they must be publicly listed so that the sensitivity of their equity price to potential risk factors can be estimated. I begin my analysis by identifying the largest set of publicly listed companies that may be useful comparators. In performing this step I identify 78 currently listed companies that are classified by SNL Financial (SNL) as being in the 'Power' or 'Gas Utility' industries. These 78 companies are described in more detail in Appendix A.

25. In order to test the comprehensiveness of this starting point, I cross check this set of potential comparators with:

- companies identified by Bloomberg as Network Utilities operating in North America;
- companies identified by SNL as 'Regulated Energy' companies and/or as having 'current rate cases' before regulatory bodies; and
- other samples of US regulated energy businesses developed by Australian and New Zealand regulators for the same purpose (described in more detail below).

26. I find that my initial starting set includes all of the companies identified by these alternative sources. This gives me confidence that I am starting from a sufficiently broad set of potential comparators to ensure that no suitable comparators get excluded. I then examine each of these potential comparators in more detail in order to refine my sample to the most suitable comparators.

27. The Bloomberg cross-check on the comprehensiveness of my initial sample has been performed using a functionality called BI (Bloomberg Industries). BI provides key data on a comprehensive set of industries, where the members of each industry are specified by Bloomberg analysts. The industry of particular relevance in this context is called 'Network Utilities' and is specific to North America (but contains US companies only). This set of comparators (Bloomberg Network Utilities) yields 58 companies within the electricity and natural gas sectors, all of which are contained in the initial set of 78 comparators.

28. A further cross check involves identifying companies defined by SNL as 'Regulated Energy' companies. These are companies which have to file annual reports as well as other information with the Federal Energy Regulatory Commission (FERC). I narrowed this set down to electric utilities, gas utilities or diversified utilities on the parent company level[3]. This set of comparators (SNL regulated energy) amounts to 59 companies, all of which are contained in the initial set of 78 companies.

29. A further cross check involves identifying all companies which SNL has classified as having a current 'rate case' under either its own company name or a subsidiary company name (where the company in question is considered to be the ultimate parent company). If a company has a current rate case under a public utility commission, this means that the company's operations (or part of its operations) have prices that are set under a regulatory decision that is 'valid' (has not expired). This does not necessarily capture all regulated business as some may have expired decisions but will, nonetheless, be subject to a new decision process if they attempt to raise their prices. This set of comparators (companies with current rate cases) yields 67 companies, all of which are contained in the initial set of 78 comparators.

30. A further cross check is the sample used by the New Zealand Commerce Commission (NZCC) in its Inputs Methodologies Reasons Paper for Electricity Distribution and Gas Pipeline Services from December 2010. The NZCC identified overseas companies which operate electricity distribution and gas pipeline businesses based on Bloomberg classifications 'Electric – Distribution', 'Electric - Integrated', 'Electric - Transmission', 'Gas - Distribution' and 'Pipelines'. Firms with insufficient history as a listed entity or a market value of below US$100 million were excluded from the sample. For the remaining companies, the NZCC used Bloomberg's segment analysis information to assess the 'nature and extent of electricity distribution / gas pipeline versus non-electricity distribution / gas

[3] There are a total of 305 currently operating electric/gas/diversified utility companies in the 'Regulated Energy' company universe. 70 of these companies are parent companies (i.e. listed companies). Most of the remaining companies are subsidiaries of companies which are not classified as 'Regulated Energy' electric/gas/diversified utilities on the parent company level. Whilst the subsidiaries on their own would be comparable in this context, their (listed) parent companies are not likely to be comparable if they are not required to file with the FERC. The other remaining companies are either private or delisted.

pipeline services provided, and used this information to exclude firms that were not considered sufficiently comparable.[4]

31. The NZ CC sample yields 70 companies from the US, 61 of which are included in our broad SNL comparator set of 78 companies. The companies which are not included have been acquired by other companies since the NZCC study and, therefore, are not currently listed.

32. The AER directed Professor Henry to examine a much smaller set of US firms in the last WACC review, a total of 9 firms. All of these firms that are still listed are included in the initial set of 78 comparators. [5, 6]

33. The final set of comparators is the set of companies examined by the Essential Services Commission Victoria (ESCV) in its 2007 Gas Access Arrangement Draft Decision which included a number of US firms in its analysis of equity beta[7]. All of these 11 firms that are currently listed are captured in the initial set of 78 comparators.

34. The above sets of comparator companies give me confidence that I have identified all potentially relevant comparators.

35. Estimates of relative risk for 70 out of the 78 companies have been sourced from SFG.[8] Eight companies were excluded on the basis that risk factors for these companies could not be reliably estimated due to illiquidity in the market for their equity. SFG has estimated betas for the Capital Asset Pricing Model (CAPM) and co-efficients for the Fama and French 3 factor model (FFM). I have separately sourced my own estimates of the historical average US FFM risk premiums. [9] I rely on both these sets of estimates to arrive at my conclusions.

36. The companies for which asset betas could not be reliably estimated are:

    - Corning Natural Gas (CNIG)

4 New Zealand Commerce Commission (2010) EDB and GPB Input Methodologies Reasons Paper, p. 515

5 AER (2009) *Review of the weighted average cost of capital (WACC) parameters,* p. 476

6 I have adapted Henry's sample to the present time: SRP has changed ticker to NVE, and NST has been acquired by NU. Further EAS has been acquired by IBE SM.

7 ESCV, Gas Access Arrangement Review 2008-2012, Draft Decision, 28 August 2007, p. 309.

8 SFG Consulting, *Regression-based estimates of risk parameters for the benchmark firm, June 2013.*

9 The risk premiums used are 3.58% for SMB and 4.81% for HML (sourced from Kenneth French's data library (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html and are annual average factors 1927 to 2012). The US estimate of the market risk premium is 6.2% sourced from Dimson, Marsh and Staunton: Credit Suisse Global Investment Returns Yearbook (2012). This is the arithmetic mean of excess returns, over the period from 1900 to 2011, is 6.2 per cent.

- Gas Natural (EGAS)
- RGC Resources (RGCO)
- Covanta Holdings (CVA)
- Unitil (UTL)
- Delta Natural Gas (DGAS)
- Chesapeake Utilities (CPK)
- Dynergy Inc (DYN).

37. Once these 8 companies for which betas could not be reliably estimated have been excluded, I am left with a sample of 70 companies.

38. The company tickers and the sets in which they are contained are summarised in Table 3, together with CAPM asset beta estimates and FFM relative risk and co-efficients estimated by SFG.

39. SFG's beta estimates for the CAPM have been estimated using information from 2 January 2002 to 19 November 2012. The FFM 3 factor co-efficients have been estimated over the same time period. For ease of presentation and comparison with the CAPM beta analysis I have, in some sections of this report, converted the unlevered FFM 3 factor co-efficients to a measure of relative risk by first estimating the total FFM predicted risk premium and then dividing by the historical average risk premium for the market of 6.2%.[10] This provides a measure of the predicted unlevered relative risk from the FFM that is directly comparable to the unlevered relative risk embodied in the CAPM asset beta.

[10] This is sourced from Dimson, Marsh and Staunton: Credit Suisse Global Investment Returns Yearbook (2012). This is the arithmetic mean of excess returns, over the period from 1900 to 2011, is 6.2 per cent.

Table 3: Broad set of potential US comparators

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
AEE	0.36	0.31	0.38	-0.19	0.05	In	In	In	In	In	In		
AEP	0.39	0.31	0.41	-0.16	-0.01		In	In	In	In	In		
AES	0.46	0.66	0.45	0.22	0.11		In	In	In				
ALE	0.55	0.71	0.49	0.22	0.12	In	In	In	In	In	In		
ATO	0.32	0.39	0.30	0.05	0.08	In	In	In	In	In	In		
AVA	0.33	0.50	0.28	0.21	0.12	In	In	In	In	In	In		
BKH	0.50	0.66	0.46	0.17	0.14		In	In	In	In	In		
CHG	0.34	0.41	0.31	0.19	-0.02	In	In	In	In		In	In	
CMS	0.32	0.25	0.34	-0.10	-0.04	In	In	In	In	In	In		
CNIG	0.17	0.16	0.11	-0.03	0.08		In	In					
CNL	0.44	0.51	0.42	0.08	0.06	In	In	In	In	In	In		In
CNP	0.30	0.32	0.30	-0.02	0.05		In	In	In	In	In	In	In
CPK	0.31	0.47	0.26	0.11	0.19		In	In	In		In		
CPN	0.46	0.47	0.47	-0.15	0.11		In						
CVA	0.46	0.62	0.43	-0.14	0.35		In						
D	0.31	0.26	0.33	-0.20	0.06		In	In	In	In	In		
DGAS	0.21	0.34	0.17	0.08	0.16		In	In	In				
DTE	0.30	0.27	0.31	-0.20	0.10	In	In	In	In	In	In		In
DUK	0.43	0.31	0.45	-0.28	0.03		In	In	In	In	In		
DYN	.	-	.	.	.		In						
ED	0.22	0.18	0.23	-0.21	0.10	In	In	In	In	In	In		
EDE	0.36	0.48	0.32	0.19	0.07	In	In	In	In		In		In

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
EE	0.34	0.51	0.30	0.05	0.23	In	In	In	In	In	In		In
EGAS	0.21	0.30	0.16	0.17	0.06		In						
EGN	0.79	0.88	0.78	-0.06	0.18		In		In				
EIX	0.37	0.36	0.38	-0.09	0.04	In	In	In	In	In	In		
EQT	0.71	0.58	0.74	-0.22	-0.05		In		In				
ETR	0.35	0.25	0.38	-0.33	0.08		In	In	In	In	In		In
EXC	0.42	0.26	0.46	-0.26	-0.08		In	In	In	In	In		In
FE	0.32	0.15	0.37	-0.36	-0.02		In	In	In	In	In		In
GAS	0.32	0.36	0.30	0.06	0.03		In		In	In	In		
GEN	0.60	0.90	0.60	0.14	0.27		In						
GXP	0.45	0.45	0.45	-0.10	0.07	In	In	In	In	In	In		
HE	0.26	0.30	0.24	-0.06	0.11		In	In	In	In	In		
IDA	0.36	0.32	0.36	-0.02	-0.03	In	In	In	In	In	In		
ITC	0.41	0.34	0.44	-0.22	0.03		In			In	In		
LG	0.23	0.27	0.21	0.17	-0.05	In	In		In	In	In		
LNT	0.38	0.45	0.35	0.00	0.13	In	In	In	In	In	In		
MDU	0.78	0.84	0.77	-0.05	0.13		In	In	In	In			
MGEE	0.31	0.38	0.28	0.21	-0.03		In	In	In		In		In
NEE	0.34	0.20	0.38	-0.24	-0.04		In	In	In	In	In		In
NFG	0.66	0.72	0.65	0.00	0.10		In		In	In	In		
NI	0.34	0.37	0.33	-0.14	0.15		In	In	In	In	In	In	
NJR	0.30	0.28	0.28	0.15	-0.11		In		In	In	In	In	
NRG	0.39	0.31	0.42	-0.12	-0.06		In						
NU	0.25	0.25	0.24	-0.03	0.04		In	In	In	In	In	In	

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
NVE	0.31	0.23	0.33	-0.17	-0.01	In	In	In	In	In	In	In	
NWE	0.36	0.39	0.34	0.18	-0.07	In	In	In	In	In	In		
NWN	0.24	0.29	0.21	0.07	0.04	In	In	In	In	In	In		
OGE	0.44	0.57	0.41	0.02	0.20		In	In	In	In	In		
OKE	0.47	0.55	0.45	-0.06	0.17		In		In		In		
ORA	0.75	0.57	0.82	0.15	-0.44		In						
OTTR	0.60	0.78	0.55	0.30	0.06		In	In	In				
PCG	0.38	0.43	0.36	0.11	0.01	In	In	In	In	In	In		
PEG	0.39	0.32	0.40	-0.13	0.00		In	In	In	In	In		
PNM	0.46	0.54	0.45	0.01	0.11	In	In	In	In	In	In		
PNW	0.38	0.38	0.38	-0.04	0.04	In	In	In	In	In	In		
PNY	0.32	0.47	0.27	0.15	0.15	In	In	In	In	In	In		
POM	0.30	0.25	0.31	-0.11	0.02		In	In	In	In	In	In	
POR	0.34	0.35	0.33	0.15	-0.09	In	In	In	In	In		In	
PPL	0.34	0.11	0.39	-0.27	-0.16		In	In		In	In		
RGCO	0.10	0.15	0.08	0.04	0.06		In						
SCG	0.31	0.30	0.31	-0.03	0.01		In	In	In	In	In		
SJI	0.29	0.35	0.26	0.13	0.02		In		In	In	In		
SO	0.20	0.15	0.21	-0.17	0.06	In	In	In	In	In	In		
SRE	0.49	0.35	0.52	-0.21	-0.07		In	In	In	In	In		
STR	0.68	0.65	0.68	-0.25	0.15		In		In	In			
SWX	0.33	0.43	0.30	0.07	0.12	In	In	In	In	In	In		
TE	0.40	0.47	0.39	-0.05	0.14	In	In	In	In	In	In		
TEG	0.42	0.51	0.40	-0.08	0.20	In	In	In	In	In	In		

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
UGI	0.29	0.24	0.29	0.02	-0.08		In	In	In	In	In		
UIL	0.42	0.69	0.35	0.15	0.33	In	In	In	In	In	In	In	
UNS	0.23	0.25	0.22	-0.02	0.05	In	In	In	In	In	In		
UTL	0.12	0.18	0.10	0.06	0.07		In	In	In		In		
VVC	0.32	0.21	0.34	-0.14	-0.06		In	In	In	In	In		
WEC	0.23	0.23	0.23	-0.04	0.03	In	In	In	In	In	In		
WGL	0.29	0.21	0.30	-0.03	-0.10	In	In		In	In	In		
WR	0.30	0.38	0.27	0.10	0.06	In	In	In	In	In	In		In
XEL	0.34	0.29	0.35	-0.09	-0.01	In	In	In	In	In	In		

All risk factor sensitivies are unlevered

4 Proportion of regulated assets

40. The overall beta estimated for a given company reflects, in part, the activities the company engages in. The 70 companies for which asset betas can be reliably estimated will comprise:

    - Companies that own regulated electricity/gas networks only. This is reflective of the operations of the pure play benchmark firm.[11]
    - Companies that own regulated electricity/gas networks and other regulated assets (e.g. regulated energy retail or generation).
    - Companies that own regulated electricity/gas networks, other regulated assets (e.g. regulated energy retail or generation), and non-regulated assets.
    - Companies that own regulated electricity/gas networks, and non-regulated assets only.
    - Companies that own non-regulated electricity/gas assets.

41. The New Zealand Commerce Commission concludes that no adjustment is necessary on the basis of companies engaging in other business activities because there is no evidence or reason to consider that the average asset betas of the comparator group would be unrepresentative of the asset beta for businesses it regulates.[12]

42. Nonetheless, I have gathered information on the percentage of total assets that are regulated gas/electricity assets and the relationship between this variable and asset betas. This will help me assess how close (or far) the potential comparator is to being a 'pure play' natural monopoly gas or electricity company. This information will, in turn, enable me to set a threshold for inclusion in the final sample.

43. To assess the proportion of total assets which are regulated gas/electricity assets it is necessary to first understand the multi-divisional corporate structure of the potential US comparators. Take for example one of the companies in Table 3, Ameren Corporation (AEE). Bloomberg describes Ameren Corporation as:

    > *[…] a public utility holding company. The Company, through its subsidiaries, generates electricity, delivers electricity and distributes natural gas to customers in Missouri and Illinois.*

44. Ameren Corporation has several subsidiaries engaging in different activities operating across Missouri and Illinois. Ameren Corporation's corporate structure is illustrated in Table 4 below.

[11] It is noted that none of the Australian 'comparators' fall in this category.

[12] New Zealand Commerce Commission (2010) *EDB and GPB Input Methodologies Reasons Paper,* p. 527

45. Table 4 shows that Ameren Corporation is the owner of Union Electric, the largest electric utility in Missouri, and also of Ameren Illinois, which is a regulated electric and gas delivery company based on Peoria, Illinois. These two subsidiaries are clearly relevant comparators to the benchmark firm in the sense that they own electric and gas networks.

Table 4: Ameren Corporation corporate structure

- **Ameren Corporation (MO, USA)** - *Power*
  - **Union Electric Company (MO, USA)** - *Power*
  - **Ameren Energy Resources Company, LLC (USA)** - *Other Energy*
    - **Ameren Energy Generating Company (IL, USA)** - *Power*
      - **Electric Energy, Inc. (IL, USA)[1]** - *Wholesale Gen/Trans*
        - **Midwest Electric Power, Inc (IL, USA)** - *Wholesale Gen/Trans*
    - Ameren Energy Marketing Company (MO, USA) - *Other Energy*
  - **Energy Risk Assurance Company (MO, USA)** - *Non-NAIC Rein Cprty*
  - Ameren Services Company (MO, USA) - *Other Energy*
  - **Ameren Transmission Company of Illinois (MO, USA)** - *Wholesale Gen/Trans*
  - **Ameren Illinois Company (IL, USA)** - *Power*
    - AmerenEnergy Resources Generating Company (MO, USA) - *Merchant Generator*
  - Ameren Transmission Company (USA) - *Other Energy*

1. Ownership shared between **Kentucky Utilities Company** (20%) & **Ameren Energy Generating Company** (80%)

Source: SNL Financial

46. A closer look at Ameren Corporation's financials reveals that in FY 2011 Ameren Corporation derived the vast majority of its operating revenues (over 80%) from its subsidiaries Union Electric and Ameren Illinois. Almost all of the remainder of the operating revenues were derived from Ameren Energy Generating Company. All of its revenues are classified by Bloomberg as attributable to electric or gas distribution. Similarly, about 80% of Ameren Corporation's total assets are attributable to Union Electric and Ameren Illinois, with almost all of the remainder of total assets attributable to Ameren Energy Generating Company.[13]

47. I have used segmentation data for the fiscal year ending December 2011 provided by Bloomberg to attribute a proportion of total assets to regulated gas/electricity activities. Where insufficient information is available from Bloomberg to make a distinction between regulated and non-regulated assets, I have relied on annual reports and other information published by the potential comparator companies.

[13] Bloomberg and SEC Form 10-K for Ameren Corporation for fiscal year ended December 31, 2011

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To the extent that companies have attributed (often negative) values to '(reconciling) eliminations'[14] these have been excluded from the total assets.

48. It should be noted that 'regulated' in this instance does not necessarily mean regulated distribution or transmission. For vertically integrated companies (which are common among our sample), regulated activities could also include generation and/or retail sales (i.e. activities which are not regulated in Australia). Further, it is not always possible to determine the exact extent to which a company engages in regulated versus non-regulated electric/gas utility activities (with metering a potential example of unregulated utility activities), although several companies do report an explicit split between regulated and non-regulated utility assets. For ease of reading I refer to 'regulated assets' as opposed to 'regulated gas/electricity assets' in the remainder of this report.

49. As noted above, I perform an analysis of segmentation data to determine what comparability threshold should be set for the proportion of regulated assets. This is a relevant consideration because, on the one hand, if the threshold is set too low then this may result in too many businesses being included that do not have the risk characteristics of a regulated business. On the other hand, if the threshold is set too high then this may result in too many potential comparators being excluded from the final sample and potentially valuable information being lost.

50. As noted previously, I have sourced CAPM asset beta estimates and co-efficient estimates for the Fama and French 3 factor model (FFM) from SFG. Figure 1 shows the CAPM asset betas versus the percentage of regulated assets for each of our 70 potential comparator companies (this represents the full sample of 78 companies less the 8 companies for which a reliable estimates could not be derived).

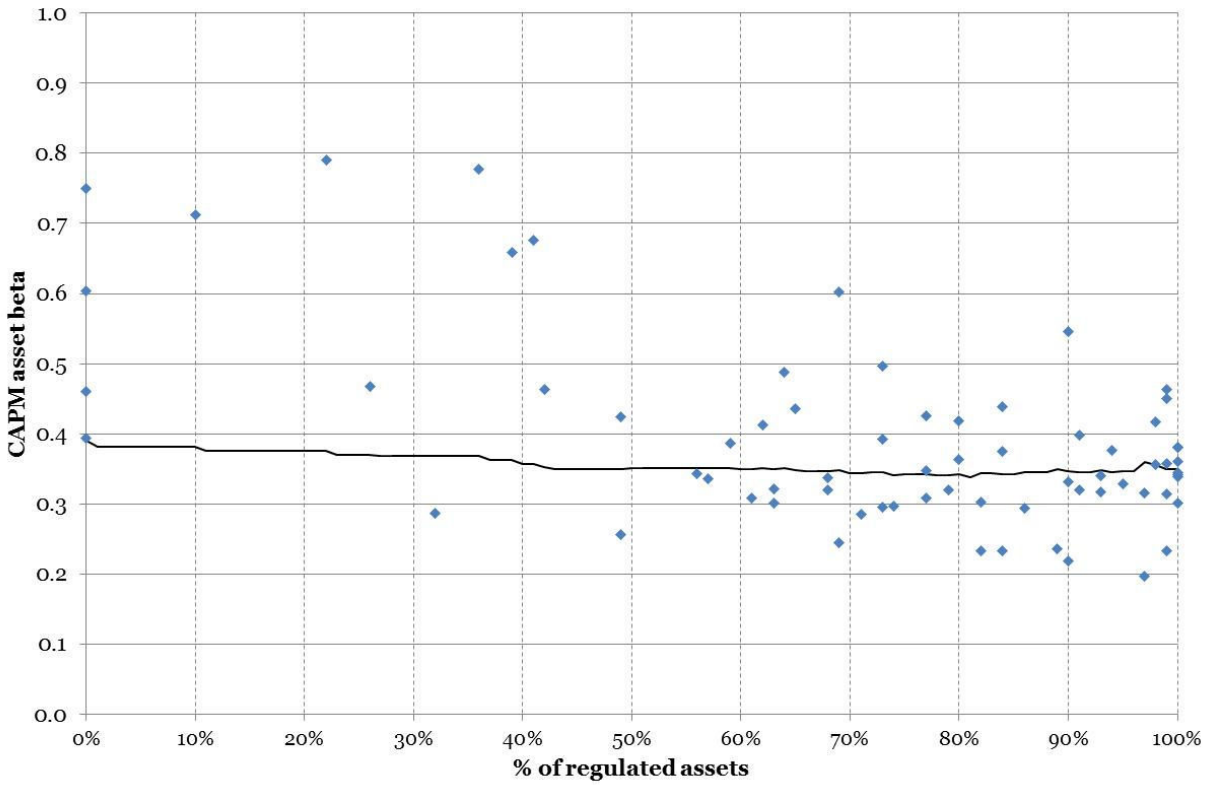
51. For the purpose of comparison with the single factor CAPM asset beta, Figure 2 shows the FFM predicted relative risk of each company versus the percentage of regulated assets. (Appendix B contains the corresponding chart for each of the FFM co-efficients (beta, s and h). This gives an estimate of predicted risk relative to the market. This conversion allows a meaningful comparison to the CAPM asset beta which is itself a measure of unlevered risk relative to the market risk.

52. The black line in each of the charts illustrates the sample average assuming the threshold has been set at a given point. For example, if the threshold was set at zero regulated assets the black line shows the average for all of the 70 points shown in each chart. This average is just below 0.4 for the CAPM unlevered asset beta (predicted relative risk) and just above 0.4 for the FFM unlevered predicted relative risk. If the threshold is set at 50% regulated assets then the average predicted unlevered relative risk falls to 0.35/0.37 for the CAPM/FFM.

[14] That is, the removal of the effect of inter-company transactions.

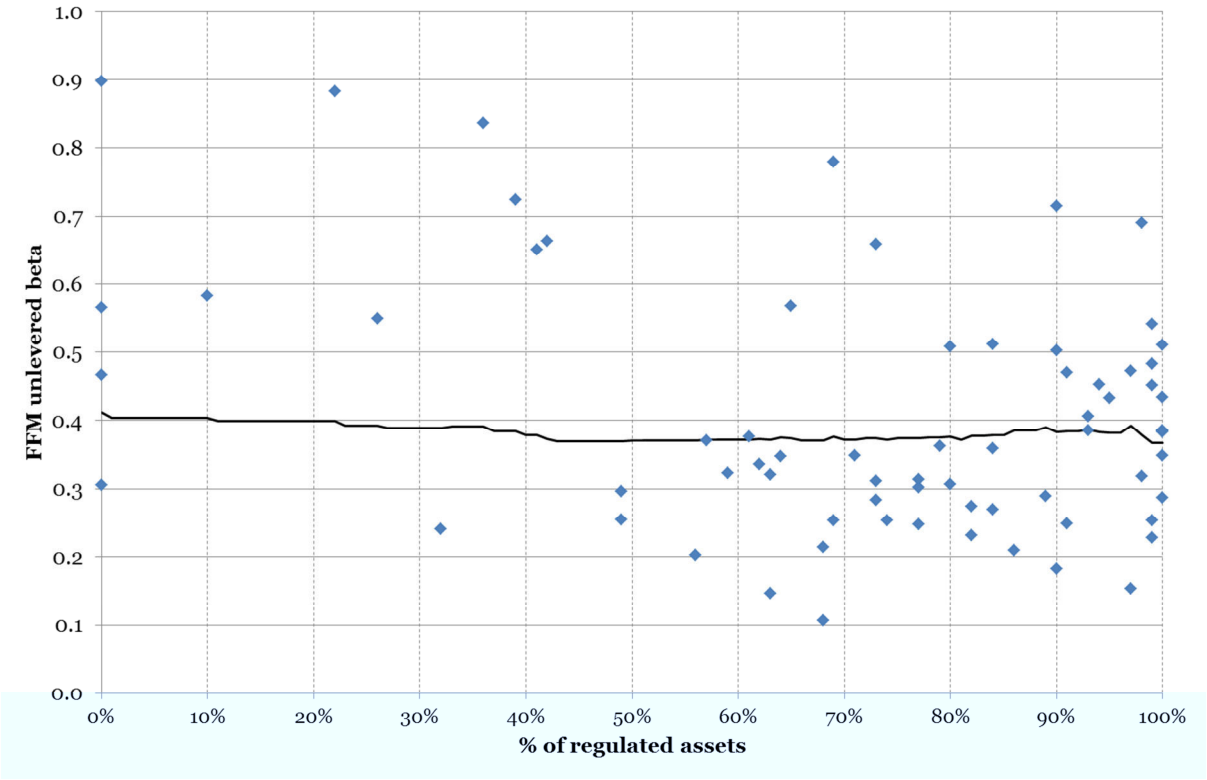
53. The figures illustrate that, when the percentage of regulated gas/electricity assets make up less than 50% of total assets, both the CAPM and FFM relative risk estimates are highly dispersed (and some are relatively high). However, for businesses with a percentage of regulated gas/electricity assets as a proportion of total assets greater than 50%, this dispersion is smaller and there is no obvious relationship with the estimated asset beta. This is consistent with the average asset beta (black line) being more or less flat as the threshold for inclusion in the sample is increased beyond 50% of regulated assets. Indeed, predicted CAPM relative risk is almost the same when the threshold is set at 90% as when the threshold is set at 50% (both 0.35). FFM relative risk is actually higher (0.38 vs. 0.37)

Figure 1: CAPM asset beta vs. percentage of regulated assets



Source: ENA, Bloomberg, CEG analysis

Figure 2: FFM relative risk vs. percentage of regulated assets



Source: ENA, Bloomberg, CEG analysis

54. The lack of relationship between the average asset beta/relative risk and the percentage of regulated gas/electricity assets beyond a threshold of 50% is also illustrated in Table 5 below. With no threshold (i.e. with all 70 companies) the average CAPM asset beta is 0.39 and the average FFM relative risk is 0.41. The average CAPM asset beta falls from 0.39 continuously to 0.35 once the threshold reaches 50%, and the average FFM relative risk falls from 0.41 to 0.37. Beyond 50% both the average CAPM asset beta and the FFM relative risk remain relatively constant at around 0.34 – 0.35 and 0.37 – 0.40 respectively.

Table 5: Average asset beta at various thresholds for % of regulated assets

Threshold	≥0%	≥10%	≥20%	≥30%	≥40%	≥50%	≥60%	≥70%	≥80%	≥90%	≥100%
Average CAPM asset beta	0.39	0.38	0.38	0.37	0.36	0.35	0.35	0.34	0.34	0.35	0.35
Average FFM relative risk	0.41	0.40	0.39	0.38	0.37	0.37	0.37	0.38	0.38	0.40	0.39

Source: ENA, Bloomberg, CEG analysis

55. These results are confirmed by regression analysis. Specifically, a linear ordinary least squares regression was performed regressing unlevered CAPM relative risk (asset beta) and the unlevered FFM relative risk against the proportion of regulated assets for the 56 businesses with 50% or more regulated assets. The results are presented in Table 6 and Table 7 respectively.

Table 6: Regression of CAPM asset betas against % of regulated assets

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.398998	0.064617	6.174836	8.931E-08
% of regulated assets	-0.05818	0.076573	-0.7598	0.450678

Source: ENA, Bloomberg, CEG analysis

Table 7: Regression of FFM relative risk against % of regulated assets

	Coefficients	Standard error	t-Stat	P-value
Intercept	0.198459	0.114843	1.728092	0.089687
% of regulated assets	0.201557	0.136092	1.481033	0.144409

Source: ENA, Bloomberg, CEG analysis

56. There is a small negative coefficient (-0.06) on the % of regulated assets for the CAPM asset beta and a somewhat higher positive coefficient (0.20) for the FFM relative risk measure. Neither coefficient is statistically different to zero. In fact, the P-value is 45% and 14% respectively, which is consistent with a conclusion that there is a 45% / 14% probability of obtaining an estimated coefficient at least as extreme even if the true coefficient were zero. Standard tests of significance adopt P-value 'significance' thresholds of 5% or less.

57. The analysis above indicates that the percentage of regulated assets does not significantly impact the relative risk of businesses with regulated assets of more than 50%of total assets. That said, companies with a higher proportion of regulated gas/electricity assets are - based on *a priori* reasoning only - more likely to be comparable to the benchmark company in terms of the activities they actually engage in.

58. In light of the above observations, I focus my analysis on two thresholds resulting in a broader and a narrower sample respectively. The broader sample includes the set of companies for which at least 50% of total assets are regulated assets. I classify this sample set as **mostly regulated**. The narrower sample includes the set of companies for which at least 80% of total assets are regulated assets. I classify this sample set as **highly regulated**. However, as can be seen from Table 5 above – the average relative risk is not materially affected by where the threshold is placed.

59. Table 8 below describes the average unlevered CAPM relative risk (asset beta) for each of the sample sets, together with the number of companies, the minimum, the maximum and the standard deviation within each sample. Table 9 sets out the same information as Table 8 but for the FFM relative risk estimates.

Table 8: CAPM asset betas vs. proportion of regulated assets

	# companies	Average	Minimum	Maximum	Standard deviation
All	70	0.39	0.20	0.79	0.13
Mostly regulated	56	0.35	0.20	0.60	0.08
Highly regulated	34	0.34	0.20	0.55	0.08

Source: ENA, Bloomberg, CEG analysis

Table 9: FFM relative risk vs. proportion of regulated assets

	# companies	Average	Minimum	Maximum	Standard deviation
All	70	0.41	0.11	0.90	0.18
Mostly regulated	56	0.37	0.11	0.78	0.14
Highly regulated	34	0.38	0.15	0.71	0.13

Source: ENA, Bloomberg, CEG analysis

60. I have also investigated the proportion of total operating revenues which can be attributed to regulated gas/electricity activities, but conclude that the information provided by the companies on total assets is more robustly segmented for our purposes, and therefore more reliable. That said; the analysis based on the proportion of regulated operating revenues does not yield materially different results (see Appendix C).

5 Other potential influences on relative risk

61. This section assesses the influences of different factors on the relative risk of the potential US comparators with a view to applying restrictions to the above initial samples. The factors considered include:

    - regulatory regime;
    - comparison of gas and electricity companies;
    - market structure; and
    - tax regime.

62. This section further assesses whether any quantitative adjustments to the predicted relative risk of the potential US comparators are necessary as a consequence of any perceived differences between the operating environment of the comparators and the benchmark Australian company.

5.1 Regulatory regime

5.1.1 Rate-of-return vs. incentive regulation

63. It has been claimed that differences in regulatory regimes could, in theory, give rise to materially different levels of systematic risk for utility companies.

64. In the US, regulated utilities have traditionally been subjected to rate-of-return regulation, albeit with a lag between a company applying for a price increase (i.e. filing a rate case) and the Commission making a decision. Under 'rate-of-return' regulation regulated business or their customers are entitled to request a review of prices if they believe costs and prices have diverged. This contrasts with 'incentive regulation' under which businesses/customers must wait fixed time periods until prices can be adjusted to reflect unexpected variations in costs.

65. Of course, even under 'rate of return' regulation, the existence of a regulatory lag while a price review application is reviewed means that, in reality, a business is exposed to lags in adjustment to its prices under both systems. That is, the existence of a regulatory lag means that, in reality, all US regulated businesses, even 'rate of return' regulated businesses, are subject to a form of 'incentive regulation' in that cost increases/reductions are not automatically and simultaneously passed onto customers.

66. Nonetheless, it might be argued that rate-of-return regulation such as that traditionally adopted in the United States exposes companies to lower risk than the

more high powered incentive based regulation adopted in Australia. For the purpose of this report the important questions are whether:

- the power of that incentive is different across businesses within the US and between those businesses and Australian businesses; and
- whether any such differences in power have any impact on predicted relative risk.

67. There are US states that have more high powered incentive regimes including fixed period price-cap regulation similar to that applying to many businesses in Australia (Australian electricity transmission businesses are subject to a revenue cap). Under such a regulatory regime the company will be directly impacted by any changes in costs/volumes whilst the price remains fixed. This means that the company can potentially earn higher than normal profits, but is also exposed to the risk that costs/volumes may increase/fall in response to changing market conditions. Other things equal, the shorter the periods between price cap resets, the lower the power of the incentive regime for the regulated company.

68. Alexander, Mayer and Weeds found that high-powered incentive schemes such as price cap regulation resulted in higher risks relative to low-powered incentive schemes such as rate-of-return regulation (but as discussed below, we do not):[15]

> *The results show a clear pattern at the level of individual utility sectors and for regulatory regimes as a whole. Regimes with low-powered incentives tend to co-exist with low asset beta values, while high-powered incentives imply a significantly higher beta values. These results, in accordance with existing comparisons of regulatory regimes, seem to imply that companies under RPI-X regulation are exposed to much higher levels of systematic risk in comparison with those under rate-of-return regulation, and that the cost of capital for these forms is therefore likely to be higher.*

69. The findings of Alexander et al. are referred to approvingly by the New Zealand Commerce Commission's adviser Dr Lally, who notes that[16]:

> *Firms subject to "rate of return regulation" (price regulation with frequent resetting of prices) should have low sensitivity to real GNP shocks, because the regulatory process is geared towards achieving a fixed rate of return.*

70. Dr Lally recommended an upward adjustment to account for the incentive based regulatory regime in New Zealand and the length of time between price resets

[15] Alexander, Mayer & Weeds (1996) *Regulatory structure and risk: An international comparison,* The World Bank.

[16] Lally (2005) *The weighted average cost of capital for electricity lines businesses,* Victoria University of Wellington, p. 37

when he estimated betas in 2005 for electricity distribution businesses and in 2004 and 2008 for gas pipeline businesses.[17]

71. The New Zealand Commerce Commission however, in its Input Methodologies Paper, concluded, on the basis of empirical evidence it reviewed, that it was not necessary to make an adjustment to the asset beta estimate to account for different levels of systematic difference due to regulatory policy.[18]

72. In recent years, several US states have moved towards incentive-based forms of regulation for electricity regulation. In 2009, a paper was published by John Kwoka which compiled information on whether state-based Commissions used some form of incentive regulation[19]. Twenty of the state-based Commissions answered that they did use incentive-based regulation, whereas 19 answered that they did not. This suggests that the regulatory regime adopted by state-based Commissions is changing from the traditionally adopted rate-of-return regulation. A summary of the information collected by Kwoka is reproduced in Appendix D.

73. I also note recent research by Gaggero who concludes:[20]

> *This paper tests empirically whether regulation characterized by high incentives implies more risk to firms than regulation characterized by low incentives. Using a worldwide panel of 170 regulated companies operating in electricity, gas, water, telecommunication and transportation sectors during the period 1995–2004, I find that different regulatory regimes do not result in different levels of risk to their regulated firms.*

74. In order to test any relationship between incentive regulation and the estimated betas in our sample, I have used Kwoka's work to classify each of the potential US comparators as operating under incentive regulation, non-incentive regulation or both. As most companies operate in more than one state, I have combined this information with the states where the company is regulated by a State Public Commission to make this classification. If a company is subject to both incentive and non-incentive regulation, it has been classified as 'both'. Some companies could not be classified because their state(s) of operation had not been assigned a type of regulation by Kwoka. I note that this is the same approach used by the New Zealand Commerce Commission Input Methodologies Paper.

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17 New Zealand Commerce Commission (2010) *EDB and GPB Input Methodologies Reasons Paper,* p. 531

18 New Zealand Commerce Commission (2010) *EDB and GPB Input Methodologies Reasons Paper*, p. 542

19 Kwoka, J. (2009) *Investment adequacy under incentive regulation,* Northeastern University pp 24-25

20 Gaggero, A., Bulletin of Economic Research 64:2, 2010.

75. The states in which each of the 70 potential US comparators is regulated by a State Public Commission (i.e. the states where it has a current rate case in place), and the overall regulatory regime assigned to each company, are summarised in Table 10 below. The companies for which SNL does not list the state in which they have regulated assets are not assigned states of operation or an overall regulatory regime. Further, there are three companies operating solely in states to which Kwoka has not assigned a type of regulation. These three companies have not been assigned an overall regulatory regime either. The table also assigns a selection mechanism for Commissioners to each company; this is discussed in section 5.1.2.

Table 10: States, regulatory regime and selection of Commissioners

Company	Overall states with rate cases	Type of regulation	Selection of Commissioners
AEE	IL, MO	Incentive	Appointed
AEP	AR, IN, KY, LA, MI, OH, OK, TN, TX, VA, WV	Both	Both
AES	IN, OH	Non-incentive	Appointed
ALE	MN	-	Appointed
ATO	GA, KS, KY, LA, MO, MS, TN, TX	Both	Both
AVA	ID, OR, WA	Incentive	Appointed
BKH	CO, SD, WY, IA, KS, NE	Both	Both
CHG	NY	Incentive	Appointed
CMS	MI	Non-incentive	Appointed
CNL	LA	Incentive	Elected
CNP	TX, AR, LA, MN, OK	Both	Both
CPN	-	-	-
DTE	MI	Non-incentive	Appointed
DUK	IN, KY, OH, FL, NC, SC	Both	Both
ED	NY, NJ	Incentive	Appointed
EDE	MO, KS	Both	Appointed
EE	TX, NM	Non-incentive	Both
EGN	AL	Incentive	Elected
EIX	CA	Incentive	Appointed
EQT	PA	Non-incentive	Appointed
ETR	AR, LA, TX, MS	Both	Both
EXC	IL, MD, PA	Both	Appointed
FE	OH, VA, WV, MD, NJ, PA	Both	Both
GAS	FL, GA, IL, NJ, TN, VA	Both	Both
GEN	-	-	-
GXP	MO, KS	Both	Appointed
HE	HI	-	Appointed
IDA	ID, OR	Incentive	Appointed
ITC	-	-	-
LG	MO	Incentive	Appointed
LNT	MN, IA, WI	Incentive	Appointed
MDU	WY, MT, ND, ID, WA	Incentive	Both
MGEE	WI	-	Appointed
NEE	FL	Incentive	Appointed
NFG	NY, PA	Both	Appointed
NI	IN, KY, MA, OH, PA, VA	Both	Both
NJR	NJ	Incentive	Appointed
NRG	-	-	-

Company	Overall states with rate cases	Type of regulation	Selection of Commissioners
NU	NH, MA, CT	Both	Appointed
NVE	CA, NV	Incentive	Appointed
NWE	MT, NE, SD	Incentive	Elected
NWN	OR, WA	Incentive	Appointed
OGE	AR, OK	Non-incentive	Elected
OKE	KS, OK, TX	Non-incentive	Both
ORA	-	-	-
OTTR	MN, ND	Incentive	Both
PCG	CA	Incentive	Appointed
PEG	NJ	Incentive	Appointed
PNM	TX, NM	Non-incentive	Both
PNW	AZ	Non-incentive	Elected
PNY	NC, SC, TN	Non-incentive	Both
POM	DE, MD, NJ, DC	Incentive	Appointed
POR	OR	Incentive	Appointed
PPL	KY, VA, PA	Both	Both
SCG	NC, SC	Non-incentive	Both
SJI	NJ	Incentive	Appointed
SO	GA, MS, FL, AL	Both	Both
SRE	AL, CA	Incentive	Both
STR	UT	Non-incentive	Appointed
SWX	AZ, CA, NV	Both	Both
TE	FL	Incentive	Appointed
TEG	IL, MI, MN, WI	Both	Appointed
UGI	PA	Non-incentive	Appointed
UIL	CT, MA	Both	Appointed
UNS	AZ	Non-incentive	Elected
VVC	IN, OH	Non-incentive	Appointed
WEC	MI, WI	Non-incentive	Appointed
WGL	DC, MD, VA	Both	Both
WR	KS	Non-incentive	Appointed
XEL	TX, MN, CO, SD, NM, WI, ND	Both	Both

Source: SNL Financial, Kwoka, CEG analysis

76. First, I note that out of the 70 companies, 24 are classified as exposed to incentive regulation only across all states where they operate under the regulation of a public utility Commission. 21 companies are exposed to both incentive and non-incentive regulation and 17 companies are exposed to non-incentive regulation only. Eight companies are not classified.

77. Table 11 and Table 12 summarise the number of companies (i) exposed to some form of incentive regulation in all states where it operates under the regulation of a public utility commission, (ii) not exposed to incentive regulation anywhere it operates under a public utility commission and (iii) exposed to both incentive and non-incentive regulation in the states where it operates under the regulation of a public utility commission.

78. The only difference between Table 11 and Table 12 is that the former relies on the 'mostly regulated' sample and the latter on 'highly regulated' sample (see paragraph 55 for these distinctions).

Table 11: Type of regulation (Mostly regulated companies)

Type of regulation	Number of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard variation
Incentive only	22	0.35	0.09	0.36	0.13
Non-incentive only	12	0.33	0.07	0.37	0.13
Both	19	0.35	0.07	0.35	0.16

Source: Bloomberg, Kwoka, CEG analysis

Table 12: Type of regulation (Highly regulated companies)

Type of regulation	Number of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard variation
Incentive only	15	0.34	0.06	0.36	0.10
Non-incentive only	9	0.32	0.07	0.37	0.12
Both	9	0.35	0.08	0.40	0.16

Source: Bloomberg, Kwoka, CEG analysis

79. The tables above indicate that incentive regulation is associated with a slightly higher average CAPM asset beta (0.35 vs. 0.33 in the mostly regulated sample and 0.34 vs. 0.32 in the highly regulated sample). This empirical finding is consistent with a view that regulation with more high-powered incentives is generally associated with higher asset betas. However, the relatively small differences between the samples are consistent with the results being due to chance alone.

80. Moreover, the FFM relative risk estimates suggest the opposite - with non-incentive regulation associated with a marginally higher average FFM relative risk in both samples.

81. In addition, firms subject to both types of regulation have the highest (or equal highest) relative risk predictions under both samples and models, except for the FFM relative risk in the mostly regulated sample. This is consistent with there

being no statistical difference in predicted relative risk associated with the type of regulation the company is exposed to.

82. This is confirmed by formal statistical analysis. Applying Welch's t-test to the CAPM asset betas I find that there is no statistically reliable difference between the 'incentive only' and 'non-incentive only' samples for the wider mostly regulated sample of businesses. The p-value for this test is 40.8% suggesting a greater than 40% probability that any difference between them is due to chance (i.e., of observing the same difference in the samples even if there were no true relationship between the type of regulation and asset beta). I do not attempt to test whether the difference is statistically significantly different for the smaller set of only highly regulated companies because the small number of non-incentive regulation observations (9) makes applications of most tests relying on the central limit theorem (such as Welch's t-test) less reliable. [21]

83. Applying Welch's t-test to the FFM relative risk estimates I find that the p-value is 97.2% for the 'mostly regulated' sample consistent with the results based on the CAPM asset betas.

5.1.2 Elected versus appointed Commissioners

84. The commissioners governing the US Public Utility Commissions are, in most states, appointed to the positions, rather than elected. However, in 13 states, Commissioners are elected. In two of these states the Commissioners are elected by the legislature, and in the remaining 11 they are elected by the general population. There are usually 3 to 7 Commissioners, who tend to have a legal background, but can also be economists or accountants.

85. In Australia, the three member board of the Australian Energy Regulator (AER) is appointed pursuant to the *Competition and Consumer Act 2010* by the Governor-General for a term of up to five years. Pursuant to the inter-governmental Australian Energy Market Agreement, the Chairman of the ACCC is to recommend the appointment of one member and the other two are to be recommended by at least five of the participating jurisdictions' members of the Ministerial Council on Energy (or six if Western Australia elects to join).

86. It could be argued that elected Commissioners will be associated with more uncertainty and a higher level of risk on the basis that there are political conflicts of interest created by the Commissioner in question having to run for election whilst at the same time promising to raise utility rates.

[21] Welch's t-test relies on the central limit theorem – which states that the distribution of the mean of a sample approaches normality as the sample size rises. For small sample sizes this result may not be able to be relied on (depending on how far from the normal distribution is the distribution of observations within that sample).

87. I have classified the US companies as having either appointed, elected or both as their selection method for Commissioners (see Table 10 above). I have done this based on the states in which they engage in regulated activities, and also estimated an average asset beta for each category. The results are summarised in Table 13 and Table 14 below.

Table 13: Section of Commissioners (Mostly regulated companies)

Selection method	Number of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard deviation
Appointed only	30	0.34	0.07	0.36	0.13
Elected only	3	0.34	0.10	0.38	0.13
Both	21	0.37	0.09	0.37	0.17

Source: Bloomberg, SNL Financial, CEG analysis

Table 14: Selection of Commissioners (Highly regulated companies)

Selection method	Number of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard deviation
Appointed only	22	0.35	0.08	0.39	0.09
Elected only	3	0.34	0.10	0.38	0.13
Both	8	0.32	0.07	0.37	0.14

Source: Bloomberg, SNL Financial, CEG analysis

88. The empirical results do not support a conclusion that companies operating only in states with elected Commissioners are different from companies operating in states with appointed or both types of Commissioners. I do not attempt to test whether the difference is statistically significantly different because the small number of elected only observations (3) makes applications of most tests relying on the central limit theorem (such as Welch's t-test) less reliable I conclude that there is no reliable basis to conclude that the use of elected Commissioners in some states significantly alters CAPM or FFM risk exposure relative to the use of appointed Commissioners.

5.1.3 Summary

89. The evidence examined in this report suggests that differences in regulatory regime within the US do not have an appreciable effect on measured risk.

5.2 Electricity vs. gas

90. It has been argued that there are significant differences between electricity distribution businesses and gas pipeline businesses (gas transmission and distribution) in regards to growth options, the nature of the product and the composition of customers, all of which could influence the level of predicted risk. The New Zealand Commerce Commission considered that gas pipeline businesses warranted a "modestly" higher asset beta that electricity distribution businesses in New Zealand, and as such recommended a margin of 0.1 to reflect this higher risk:[22]

> *The Commission [...] accepts that in New Zealand, GPBs may face higher systematic risk than EDBs [...]. At present, there is no evidence in New Zealand to suggest that this situation has changed. Therefore, the Commission considers that it is appropriate to apply the upward adjustment of 0.1 used on past decisions to the asset beta estimate, after any other adjustments have been made.*

91. The AER noted in its 2009 WACC parameters review for electricity transmission and distribution network providers that there are a sufficient number of United States comparators to exclude gas only businesses from the sample. The AER noted that:[23]

> *The AER considers that businesses which either own or operate electricity networks are closer comparators than businesses that solely own or operate gas networks. The AER notes that Henry has updated the portfolio estimates from United States data to exclude gas only businesses.*

92. However, in 2010, the AER concluded that, consistent with recent draft decisions at the time, the empirical evidence from the 2009 WACC parameters review contained the best available estimate of the equity beta to apply to a gas distribution network services provider. The AER went on to comment that:[24]

> *Although the WACC review was conducted in an electricity context, gas and electricity businesses are close comparators. Further, the sample set of data used to derive the equity beta is predominantly made up of gas businesses.*

93. There are two different classifications used by SNL that are relevant to an assessment of the difference in risk between gas and electricity businesses. Specifically:

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22 New Zealand Commerce Commission (2010) *EDB and GPB Input Methodologies Reasons Paper,* p. 545

23 AER (2009) *Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters,* p. 264

24 AER (2010) *Jemena Access arrangement proposal for the NSW gas networks 2010 - 2015,* p. 125

- SNL classifies all companies in our sample into either an electric 'Power' or 'Gas utility'. In doing so, SNL decides in which set to allocate business that have both gas and electric assets;[25]
- SNL also classifies these businesses into three categories: electric, gas and diversified (gas and electric) utilities.

94. In the following two sections I perform analysis based on each of these approaches to categorisation by SNL.

5.2.1 Power versus gas utilities

95. The average and standard deviation of the CAPM asset betas and the FFM un-levered relative risk in the power and gas utility comparator sets are summarised in Table 15 for mostly regulated companies and in Table 16 for highly regulated companies. The empirical evidence in the larger sample points to a higher relative risk, on average, among the electric than the gas utilities.

Table 15: Industry (Mostly regulated companies)

	# of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard deviation
Power	46	0.36	0.08	0.38	0.15
Gas Utility	9	0.29	0.04	0.34	0.08

Source: Bloomberg, CEG analysis

Table 16: Industry (Highly regulated companies)

	# of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard deviation
Power	28	0.35	0.08	0.39	0.14
Gas Utility	6	0.29	0.04	0.34	0.10

Source: Bloomberg, CEG analysis

96. I do not attempt to test whether the difference is statistically significantly different because the small number of gas observations (9 and 6 respectively) makes applications of most tests relying on the central limit theorem (such as Welch's t-test) less reliable. However, the above evidence clearly does not lend support to the common assumption, such as practiced by the NZ Commerce Commission, that gas businesses have higher risks than electricity businesses.

[25] One company, Pembina Pipeline Corporation (PPL), is defined by SNL as 'midstream'.

5.2.2 Electric, gas and diversified

97. As already discussed, SNL Financial separately classifies each of the potential US comparator companies by their 'Regulatory Industry', that is, as either electric, gas or diversified utilities. However, this classification only applies to companies that are in the SNL regulated energy sample (see Table 3). The average and standard deviation for the CAPM and FFM relative risk in each sample is summarised in Table 17 for mostly regulated companies and in Table 18 for highly regulated companies.

98. The tables indicate that a similar relationship to that demonstrated above remains; the average asset beta among electric and diversified utilities is higher than among gas utilities.

Table 17: Regulatory industry (Mostly regulated companies)

	# of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard deviation
Electric	18	0.38	0.08	0.40	0.18
Gas	4	0.30	0.04	0.39	0.08
Diversified	28	0.35	0.08	0.35	0.13

Source: Bloomberg, CEG analysis

Table 18: Regulatory industry (Highly regulated companies)

	# of companies	Average CAPM asset beta	Standard deviation	Average FFM relative risk	Standard deviation
Electric	12	0.37	0.07	0.43	0.14
Gas	4	0.30	0.04	0.39	0.08
Diversified	16	0.34	0.08	0.37	0.14

Source: Bloomberg, CEG analysis

99. Once more, I do not attempt to test whether the difference is statistically significantly different because the small number of gas observations (4 in both samples) makes applications of most tests relying on the central limit theorem (such as Welch's t-test) less reliable.

5.2.3 Electric, gas and diversified

100. The evidence in this report does not lend support to the common assumption that gas businesses have higher risks than electricity businesses.

5.3 Comparing US equity betas to Australian equity betas

101. This section examines two issues that should be considered in comparing equity betas estimated for US firms relative to the US market to betas estimated for Australian firms relative to the Australian market. The issues addressed are:

- whether we might expect measured betas for a particular industry group in the United States to be comparable to betas for that industry group in Australia; and
- whether the tax regime in the US raises/lowers risk relative to the Australian tax regime.

102. We conclude that generally industry betas in Australia and the United States are correlated. Those industries with the largest differences in beta are also those with the smallest numbers of Australian firms, suggesting that variation due to sampling is likely to be an important source of these differences.

103. Additional, we show that an upwards adjustment to US equity betas would be warranted to compare them to Australian equity betas in light of the higher corporate taxes in the US.

5.3.1 Comparability of US and Australian betas

104. The key advantage in sourcing measures of relative risk from US comparators is that this provides a much deeper pool of data with which to assess the riskiness of providing regulated electricity and gas network services. This is particularly important because the population of listed Australian comparable firms is so shallow.

105. However, this relies on the assumption that industries that have high/low risk measured risk in Australia will similarly have high/low measured risk in the US. If measures of relative risk in Australia and the US were not correlated (or inversely correlated) then adding US comparable would not improve the quality of the available data.

106. To assess this, we have conducted an analysis of differences in equity betas across different sectors of the Australian and US equity markets. We find that:

- beta estimates in the same industry group are positively correlated in the Australian and US markets; and
- where there are large divergences in beta estimates in the two countries, there is generally a small number of firms represented in the Australian sector.

107. These results support a conclusion that differences in estimated equity betas between Australia and the US for particular industry sectors are likely to be at least partly explained by the small numbers of Australian firms that are sampled.

108. We have compared equity betas across different industries in Australia and the US using indices compiled by FTSE on an industry basis. There are 9 industry indices in Australia and 10 in the US (Australia does not have a technology index).

109. Beta estimates are compiled across the entire period for which index data is available (January 1994 to May 2013) and also the sub-period consistent with betas used in this report (January 2002 to May 2013). These betas, and the beta rank associated with each industry index in both countries, are reported in Table 19 below together with the average number of firms in each index over the latter period.

Table 19: Beta estimates across industry indices in Australia and the United States

		Oil and gas	Basic materials	Industrials	Consumer goods	Healthcare	Consumer services	Telecommunications	Utilities	Financials	Technology
27 Jan 1994 to 30 Mar 2013	*Beta estimates*										
	Australia	1.12	1.12	0.93	0.57	0.63	0.89	0.46	0.43	0.96	
	USA	0.64	1.08	1.10	0.83	0.65	1.00	0.81	0.56	1.22	1.32
	Correlation	**0.54**									
	Rank of beta estimates										
	Australia	2	1	4	7	6	5	8	9	3	
	USA	8	3	2	5	7	4	6	9	1	
	Rank correlation	0.52									
28 Jan 2002 to 30 Mar 2013	*Beta estimates*										
	Australia	1.15	1.24	1.00	0.52	0.57	0.81	0.34	0.47	1.00	
	USA	0.71	1.24	1.13	0.79	0.66	0.98	0.87	0.72	1.26	
	Correlation	**0.60**									
	Rank of beta estimates										
	Australia	2	1	4	7	6	5	9	8	3	
	USA	8	2	3	6	9	4	5	7	1	
	Rank correlation	0.52									

		Oil and gas	Basic materials	Industrials	Consumer goods	Healthcare	Consumer services	Telecommunications	Utilities	Financials	Technology
28 Jan 2002 to 30 Mar 2013	*Average number of firms*										
	Australia	7.1	15.9	12.9	5.6	7.4	19.2	1.8	3.3	29.6	
	USA	38.8	29.3	76.2	52.3	71.7	101.9	16.4	37.3	126.2	73.0
	Absolute difference in beta	0.44	0.00	0.12	0.27	0.09	0.17	0.53	0.25	0.25	
	Correlation between absolute difference in beta and avg Australian firms	**-0.40**									
	Rank of average firms										
	Australia	6	3	4	7	5	2	9	8	1	
	USA	6	8	3	5	4	2	9	7	1	
	Absolute difference in beta	2	9	7	3	8	6	1	5	4	
	Correlation between absolute difference in rank and avg Australian firms	-0.53									

Source: CEG analysis, beta estimates provided by SFG.

110. Table 19 above indicates that generally betas by industry type are positively correlated between Australia and the US. Aside from oil and gas, where there appears to be clear differences in the beta estimates, industries that have high betas in Australia also have high betas in the US, and similarly for medium and low betas.

111. There are some differences in the levels of beta for the same industry between Australia and the United States. Aside from oil and gas, there are also large divergences in telecommunications, utilities, financials and consumer goods.

112. However, Table 19 also shows that these largest divergences in beta are also associated with those industries in which the Australian indices are populated by the fewest firms.[26]

113. For the five industries with an average of less than 10 firms in the Australian index (telecommunications, utilities, consumer goods, oil and gas and healthcare) the average absolute difference in beta estimates is 0.32. For the four industries with an average of more than 10 firms in the Australian index (financials, consumer Service, industrials and basic materials) the average absolute difference in beta estimates is 0.14. The correlation between the absolute differences in beta and the average number of Australian firms in each index is -0.40.

5.3.2 Differences in tax regime

114. Another potential source of difference between the US and Australia might result from differences in corporate tax rates and how these influence the effect of gearing on relative risk.

115. Several different 'leverage formulas' can be used to estimate the impact of leverage on relative risk. The choice of leverage formula will have no net impact on this process if the same formula and the same inputs are used in each case. Specifically, if:

- the same leverage formula is used when delevering and levering; and
- the same inputs are used in this formula (e.g. if the formula requires a tax or debt beta term then this term is the same in the US and Australia).

116. The formula used to de-lever US CAPM and FFM risk sensitivities used in this report is the same formula that the AER and Henry used in the AER's most recent WACC review. However, it might be argued that the US corporate tax system is different to the Australian corporate tax system and that different assumptions about the corporate tax rate should be adopted.

[26] The only notable exception to this relationship is the finance sector, which has relatively large number of firms in the Australian index but continues to exhibit lower beta than in the United States.

117. The Hamada leverage formula attempts to take into account the interactions between tax and leverage:

$$Levered\ relative\ risk = Unlevered\ relative\ risk(1 + (1 - t_c) * \frac{D}{E})$$

where t_c is the corporate tax rate, D is the amount of debt finance and E is the amount of equity finance.

118. The above equation collapses to the leverage equation used in the last AER WACC review by the AER if the value of $t_c t_c$ is set equal to zero.

119. Setting a positive value for $t_c t_c$ recognises that the taxation authorities have an implicit equity stake in cash-flows. The value of this stake increases/falls with profitability and consequently has the effect of reducing the volatility of post-tax cash flows. This means that increases in leverage (D/E) have a more muted impact on the level of relative risk than would be the case if there was no corporate tax rate.

120. In Australia the corporate tax rate is 30%, however, the operation of the imputation system reduces the effective rate of corporations' tax to 30% * (1-γ) – where γ is the value of imputation credits. This gives an effective corporate tax rate in Australia of 22.5% if γ is set at 0.25. In the US the federal corporate tax rate on large businesses is 35% (not including any state based taxes). There are no imputation credits in the US and, consequently, there is no reduction associated with the value of γ as is the case in Australia.

121. Once this is recognised, it is clear that any adjustment for differences in corporate tax rates between the US and Australia will tend to increase the beta estimate that is relevant for Australia.

122. Consider a thought experiment where the tax regime in the US was made equivalent to that in Australia. In this case, the riskiness of all assets in the US would increase – but would, consistent with the Hamada equation, increase most rapidly for those businesses with high gearing (such as regulated utilities). Consequently, the relative risk of utilities would increase if the US corporate tax rate reflected the Australian corporate tax rate.

123. This suggests that, at least in relation to this possible source of difference, US utility betas are likely to be a conservative proxy for (underestimate of) betas of Australian utilities.

6 Final sample and results

124. In this report, I have segmented the sample of potential proxies with reliable estimates of relative risk into mostly regulated companies (regulated gas/electricity assets account for at least 50% of total assets) and highly regulated companies (regulated gas/electricity assets account for at least 80% of total assets).[27]

125. I conclude that:

- Companies for which regulated gas/electricity assets are less than 50% of the total assets should likely be excluded from the sample.
- Including any or all companies with between 50% and 80% proportion of regulated gas/electricity assets in the final does not materially impact the average estimated beta.

126. In light of this, the final CEG comparator set consists of the 56 companies in the mostly regulated sample. The final CEG comparator set is presented in Table 20.

127. The average CAPM estimate of unlevered relative risk (asset beta) in this sample is 0.35, and the average FFM estimate of unlevered relative risk is 0.38.

128. I note that some researchers have found that regimes with more high-powered incentives seem to be associated with higher asset. However, my analysis found no statistically significant evidence that the nature of the regulatory regime systematically affected measures of relative risk. This is consistent with other researchers who have been unable to find such a relationship.

129. Nonetheless, the only adjustments made by other regulators/practitioners that I am are aware of have been to increase estimates of US relative risk on the grounds that the US regulatory regime was low risk.

    Similarly, I have examined whether the pattern of industry betas in the US is similar to Australia and have found that this is the case. I have also examined differences in the US and Australian tax regimes and conclude that, if anything, these would reduce US utility betas relative to Australian utility betas.

[27] For completeness, I note that two of the "highly regulated" companies are not considered 'regulated energy' at the parent company level by SNL: Laclede Group Inc (LG) and WGL Holdings (WGL). Both of these companies have main subsidiaries which are considered regulated energy companies by SNL. For Laclede Group Inc, the subsidiary is Laclede Gas Company (a regulated gas utility) and for WGL Holdings the subsidiary is Washington Gas Light Company (also a regulated gas utility) (both of which have rate cases). As these regulated subsidiaries account for over 80% of total assets on the parent company level being considered 'regulated' under our definition, I conclude these companies constitute appropriate comparators

Table 20: Final comparator set

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
SO	0.20	0.15	0.21	-0.17	0.06	In	In	In	In	In	In		
ED	0.22	0.18	0.23	-0.21	0.10	In	In	In	In	In	In		
LG	0.23	0.27	0.21	0.17	-0.05	In	In		In	In	In		
UNS	0.23	0.25	0.22	-0.02	0.05	In	In	In	In	In	In		
WEC	0.23	0.23	0.23	-0.04	0.03	In	In	In	In	In	In		
NWN	0.24	0.29	0.21	0.07	0.04	In	In	In	In	In	In		
NU	0.25	0.25	0.24	-0.03	0.04	In	In	In	In	In	In	In	
SJI	0.29	0.35	0.26	0.13	0.02	In	In		In	In	In		
WGL	0.29	0.21	0.30	-0.03	-0.10	In	In		In	In	In		
NJR	0.30	0.28	0.28	0.15	-0.11	In	In		In	In	In	In	
POM	0.30	0.25	0.31	-0.11	0.02	In	In	In	In	In	In	In	
WR	0.30	0.38	0.27	0.10	0.06	In	In	In	In	In	In		In
CNP	0.30	0.32	0.30	-0.02	0.05	In	In	In	In	In	In	In	In
DTE	0.30	0.27	0.31	-0.20	0.10	In	In	In	In	In	In		In
MGEE	0.31	0.38	0.28	0.21	-0.03	In	In	In	In		In		In
SCG	0.31	0.30	0.31	-0.03	0.01	In	In	In	In	In	In		
NVE	0.31	0.23	0.33	-0.17	-0.01	In	In	In	In	In	In	In	
PNY	0.32	0.47	0.27	0.15	0.15	In	In	In	In	In	In		
ATO	0.32	0.39	0.30	0.05	0.08	In	In	In	In	In	In		
GAS	0.32	0.36	0.30	0.06	0.03	In	In		In	In	In		
CMS	0.32	0.25	0.34	-0.10	-0.04	In	In	In	In	In	In		
VVC	0.32	0.21	0.34	-0.14	-0.06	In	In	In	In	In	In		

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
FE	0.32	0.15	0.37	-0.36	-0.02	In	In	In	In	In	In		In
SWX	0.33	0.43	0.30	0.07	0.12	In	In	In	In	In	In		
AVA	0.33	0.50	0.28	0.21	0.12	In	In	In	In	In	In		
NI	0.34	0.37	0.33	-0.14	0.15	In	In	In	In	In	In	In	
PPL	0.34	0.11	0.39	-0.27	-0.16	In	In	In		In	In		
POR	0.34	0.35	0.33	0.15	-0.09	In	In	In	In	In		In	
CHG	0.34	0.41	0.31	0.19	-0.02	In	In	In	In		In	In	
XEL	0.34	0.29	0.35	-0.09	-0.01	In	In	In	In	In	In		
NEE	0.34	0.20	0.38	-0.24	-0.04	In	In	In	In	In	In		In
EE	0.34	0.51	0.30	0.05	0.23	In	In	In	In	In	In		In
ETR	0.35	0.25	0.38	-0.33	0.08	In	In	In	In	In	In		In
IDA	0.36	0.32	0.36	-0.02	-0.03	In	In	In	In	In	In		
EDE	0.36	0.48	0.32	0.19	0.07	In	In	In	In		In		In
NWE	0.36	0.39	0.34	0.18	-0.07	In	In	In	In	In	In		
AEE	0.36	0.31	0.38	-0.19	0.05	In	In	In	In	In	In		
EIX	0.37	0.36	0.38	-0.09	0.04	In	In	In	In	In	In		
LNT	0.38	0.45	0.35	0.00	0.13	In	In	In	In	In	In		
PNW	0.38	0.38	0.38	-0.04	0.04	In	In	In	In	In	In		
PCG	0.38	0.43	0.36	0.11	0.01	In	In	In	In	In	In		
PEG	0.39	0.32	0.40	-0.13	0.00	In	In	In	In	In	In		
AEP	0.39	0.31	0.41	-0.16	-0.01	In	In	In	In	In	In		
TE	0.40	0.47	0.39	-0.05	0.14	In	In	In	In	In	In		
ITC	0.41	0.34	0.44	-0.22	0.03	In	In			In	In		
UIL	0.42	0.69	0.35	0.15	0.33	In	In	In	In	In	In	In	

	CAPM asset beta	FFM relative risk	FFM beta factor	FFM s factor	FFM h factor	CEG final	SNL all	SNL reg. energy	Rate cases	BB	NZCC	Henry	ESCV
TEG	0.42	0.51	0.40	-0.08	0.20	In	In	In	In	In	In		
DUK	0.43	0.31	0.45	-0.28	0.03	In	In	In	In	In	In		
OGE	0.44	0.57	0.41	0.02	0.20	In	In	In	In	In	In		
CNL	0.44	0.51	0.42	0.08	0.06	In	In	In	In	In	In		In
GXP	0.45	0.45	0.45	-0.10	0.07	In	In	In	In	In	In		
PNM	0.46	0.54	0.45	0.01	0.11	In	In	In	In	In	In		
SRE	0.49	0.35	0.52	-0.21	-0.07	In	In	In	In	In	In		
BKH	0.50	0.66	0.46	0.17	0.14	In	In	In	In	In	In		
ALE	0.55	0.71	0.49	0.22	0.12	In	In	In	In	In	In		
OTTR	0.60	0.78	0.55	0.30	0.06	In	In	In	In				
Average	0.35	0.37	0.34	-0.02	0.04								

Source: CEG analysis

Appendix A Description of comparator companies

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
SO	The Southern Company is a public utility holding company which, through its subsidiaries, generates, wholesales, and retails electricity. It also offers wireless telecommunications services, and provides businesses with two-way radio, telephone, paging, and Internet access services as well as wholesales fibre optic solutions.	0.2 / 0.15	In	In	In	In	In	In			97%	Power	Electric Utility	Both
ED	Consolidated Edison, through its subsidiaries, provides a variety of energy related products and services and supplies electric service as well as supplies electricity to wholesale customers.	0.22 / 0.18	In	In	In	In	In	In			90%	Power	Diversified Utility	Incentive
LG	The Laclede Group is the parent company for Laclede Gas Company, a public utility involved in the retail distribution of natural gas. Laclede also operates underground natural gas storage fields and transports and stores liquid propane.	0.23 / 0.27	In	In		In	In	In			84%	Gas Utility	N/A	Incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
UNS	UNS Energy Corp is the holding company of Tucson Electric Power Company. It generates, purchases, transmits, distributes, and sells electric energy to retail and wholesale customers.	0.23 / 0.25	In	In	In	In	In	In			99%	Power	Diversified Utility	Non-incentive
WEC	Wisconsin Energy Corporation is a diversified energy holding company which, through its subsidiaries, provides utility services such as distributing electric, gas, steam, and water.	0.23 / 0.23	In	In	In	In	In	In			82%	Power	Diversified Utility	Non-incentive
NWN	Northwest Natural Gas Company distributes natural gas to customers in western Oregon, as well as portions of Washington. The Company services residential, commercial, and industrial customers. Northwest Natural supplies many of its non-core customers through gas transportation service, delivering gas purchased by these customers directly from suppliers.	0.24 / 0.29	In	In	In	In	In	In			89%	Gas Utility	Gas Utility	Incentive
WGL	WGL Holdings, through its Washington Gas Light Company subsidiary, sells and delivers natural gas and other energy-related products and services. The Company serves residential, commercial, and industrial customers throughout metropolitan Washington, D.C. and the surrounding region.	0.29 / 0.21	In	In		In	In	In			86%	Gas Utility	N/A	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
WR	Westar Energy, Inc. is an electric utility company servicing customers in Kansas. The company provides electric generation, transmission and distribution services.	0.3 / 0.38	In	In	In	In	In	In		In	100%	Power	Electric Utility	Non-incentive
DTE	DTE Energy Company, a diversified energy company, develops and manages energy-related businesses and services nationwide. The Company, through its subsidiaries, generates, purchases, transmits, distributes, and sells electric energy in southeastern Michigan. DTE is also involved in gas pipelines and storage, unconventional gas exploration, development, and production.	0.3 / 0.27	In	In	In	In	In	In		In	82%	Power	Diversified Utility	Non-incentive
NVE	NV Energy, through its subsidiaries, generates, transmits, and distributes electric energy and provides natural gas services.	0.31 / 0.23	In	In	In	In	In	In	In		99%	Power	Diversified Utility	Incentive
PNY	Piedmont Natural Gas Company is an energy and services company that primarily transports, distributes, and sells natural gas. Piedmont also, through subsidiaries, markets natural gas to customers in Georgia, and distributes propane in various states.	0.32 / 0.47	In	In	In	In	In	In			97%	Gas Utility	Gas Utility	Non-incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
ATO	Atmos Energy Corporation distributes natural gas to utility customers. Its non-utility operations includes to provide natural gas marketing and procurement services to large customers. Atmos Energy also manages company-owned natural gas storage and pipeline assets.	0.32 / 0.39	In	In	In	In	In	In			93%	Gas Utility	Gas Utility	Both
CMS	CMS Energy Corporation, through its subsidiaries, provides electricity and/or natural gas. It also invests in and operates non-utility power generation plants in the US and abroad.	0.32 / 0.25	In	In	In	In	In	In			91%	Power	Diversified Utility	Non-incentive
SWX	Southwest Gas Corporation purchases, transports, and distributes natural gas to residential, commercial, and industrial customers in portions of Arizona, Nevada, and California. The Company also provides construction services to utility companies, including trenching and installation, replacement, and maintenance services for energy distribution systems.	0.33 / 0.43	In	In	In	In	In	In			95%	Gas Utility	Gas Utility	Both
AVA	Avista Corporation, through Avista Utilities, generates, transmits, and distributes electric and natural gas. Avista's other businesses include Avista Advantage and Avista Energy.	0.33 / 0.5	In	In	In	In	In	In			90%	Power	Diversified Utility	Incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
POR	Portland General Electric Company is an electric utility involved in the generation, purchase, transmission, distribution, and sale of electricity in Oregon. The Company also participates in the wholesale market by purchasing and selling electricity and natural gas to utilities and energy marketers.	0.34 / 0.35	In	In	In	In	In		In		100%	Power	Electric Utility	Incentive
CHG	CH Energy Group, Inc. is the parent company of the regulated subsidiary, Central Hudson Gas & Electric Corporation which is a combination natural gas and electric utility.	0.34 / 0.41	In	In	In	In		In	In		93%	Power	Diversified Utility	Incentive
XEL	Xcel Energy provides electric and natural gas services. It offers a variety of energy-related services, including generation, transmission, and distribution of electricity and natural gas throughout the United States.	0.34 / 0.29	In	In	In	In	In	In			100%	Power	Diversified Utility	Both
EE	El Paso Electric Company generates, distributes, and transmits electricity in west Texas and southern New Mexico. The Company also serves wholesale customers in Texas, New Mexico, California, and Mexico. El Paso Electric owns or has partial ownership interests in electrical generating facilities.	0.34 / 0.51	In	In	In	In	In	In		In	100%	Power	Electric Utility	Non-incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
IDA	IDACORP is the holding company for Idaho Power Company, an electric utility and IDACORP Energy, an energy marketing company. Idaho Power generates, purchases, transmits, distributes, and sells electric energy in southern Idaho, eastern Oregon, and northern Nevada. IDACORP Energy maintains electricity and natural gas marketing operations.	0.36 / 0.32	In	In	In	In	In	In			98%	Power	Electric Utility	Incentive
EDE	The Empire District Electric Company generates, purchases, transmits, distributes, and sells electricity. Empire also provides water service to several towns in Missouri.	0.36 / 0.48	In	In	In	In		In		In	99%	Power	Electric Utility	Both
NWE	NorthWestern Corporation, doing business as NorthWestern Energy, provides electricity and natural gas in the Upper Midwest and Northwest serving customers in Montana, South Dakota, and Nebraska.	0.36 / 0.39	In	In	In	In	In	In			100%	Power	Diversified Utility	Incentive
AEE	Ameren Corporation is a public utility holding company which, through its subsidiaries, generates electricity, delivers electricity and distributes natural gas in Missouri and Illinois.	0.36 / 0.31	In	In	In	In	In	In			80%	Power	Diversified Utility	Incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
EIX	Edison International, through its subsidiaries, develops, acquires, owns, and operates electric power generation facilities worldwide. The Company also provides capital and financial services for energy and infrastructure projects, as well as manages and sells real estate projects. Additionally, Edison provides integrated energy services, utility outsourcing, and consumer products.	0.37 / 0.36	In	In	In	In	In	In			84%	Power	Electric Utility	Incentive
LNT	Alliant Energy Corporation's subsidiaries serve electric, natural gas, and water customers in Illinois, Iowa, Minnesota, and Wisconsin.	0.38 / 0.45	In	In	In	In	In	In			94%	Power	Diversified Utility	Incentive
PNW	Pinnacle West Capital Corporation is a utility holding company which, through its subsidiary, provides either retail or wholesale electric service to most of the State of Arizona. The Company, through a subsidiary, also is involved in real estate development activities in the western United States.	0.38 / 0.38	In	In	In	In	In	In			100%	Power	Electric Utility	Non-incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
PCG	PG&E Corporation is a holding company which holds a public utility operating in northern and central California that provides electricity and natural gas distribution; electricity generation, procurement, and transmission; and natural gas procurement, transportation, and storage.	0.38 / 0.43	In	In	In	In	In	In			100%	Power	Diversified Utility	Incentive
TE	TECO Energy, Inc. is a diversified, energy-related utility holding company. The Company, through various subsidiaries, provides retail electric service to customers in west central Florida, as well as purchases, distributes, and markets natural gas for residential, commercial, industrial, and electric power generation customers. Teco also has coal operations.	0.4 / 0.47	In	In	In	In	In	In			91%	Power	Diversified Utility	Incentive
UIL	UIL Holdings Corporation, through The United Illuminating Company, provides electricity and energy-related services to customers and municipalities in Connecticut. The Company's other subsidiary, United Resources Inc., is the umbrella for UIL's non-regulated business units.	0.42 / 0.69	In	In	In	In	In	In	In		98%	Power	Electric Utility	Both
TEG	Integrys Energy Group distributes electricity and natural gas to customers in the upper midwestern United States.	0.42 / 0.51	In	In	In	In	In	In			80%	Power	Diversified Utility	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
CNL	Cleco Corporation generates, transmits, distributes, and sells electric energy to customers in Louisiana. The Company, through a subsidiary, also markets energy and energy management services. In addition, the Company is involved in energy asset development opportunities in the Southeastern region of the United States.	0.44 / 0.51	In	In	In	In	In	In		In	84%	Power	Electric Utility	Incentive
GXP	Great Plains Energy provides electricity in the Midwest United States. It develops competitive generation for the wholesale market. Great Plains is also an electric delivery company with regulated generation. In addition, the Company is an investment company focusing on energy-related ventures nationwide that are unregulated with high growth potential.	0.45 / 0.45	In	In	In	In	In	In			99%	Power	Electric Utility	Both
PNM	PNM Resources Inc. is a holding company which, through its subsidiaries, generates, transmits, and distributes electricity. PNM Resources also transmits, distributes, and sells natural gas.	0.46 / 0.54	In	In	In	In	In	In			99%	Power	Electric Utility	Non-incentive
ALE	ALLETE generates, transmits, distributes, markets, and trades electrical power for retail and wholesale customers in upper Midwest US.	0.55 / 0.71	In	In	In	In	In	In			90%	Power	Diversified Utility	NA

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
NU	Northeast Utilities is a public utility holding company which, through its subsidiaries, provides retail electric service to customers in Connecticut, New Hampshire, and western Massachusetts. Northeast also distributes natural gas throughout Connecticut.	0.25 / 0.25		In	In	In	In	In	In		69%	Power	Diversified Utility	Both
SJI	South Jersey Industries is an energy services holding company which provides regulated, natural gas service to residential, commercial, and industrial customers in southern New Jersey. South Jersey also markets total energy management services, including natural gas, electricity, demand-side management, and consulting services throughout the eastern United States.	0.29 / 0.35		In		In	In	In			71%	Gas Utility	N/A	Incentive
NJR	New Jersey Resources Corporation provides retail and wholesale energy services to customers in New Jersey and in states from the Gulf Coast to New England, and Canada. The Company's principal subsidiary, New Jersey Natural Gas Co., is a local distribution company serving customers in central and northern New Jersey.	0.3 / 0.28		In		In	In	In	In		73%	Gas Utility	N/A	Incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
POM	Pepco Holdings, Inc. is a diversified energy company. The Company primarily distributes, transmits, and supplies electricity and supplies natural gas to customers in New Jersey, Delaware, Maryland, and the District of Columbia.	0.3 / 0.25		In	In	In	In	In	In		74%	Power	Diversified Utility	Incentive
CNP	CenterPoint Energy is a public utility holding company which, through its subsidiaries, conducts activities in electricity transmission and distribution, natural gas distribution and sales, interstate pipeline and gathering operations, and power generation.	0.3 / 0.32		In	In	In	In	In	In	In	63%	Power	Diversified Utility	Both
MGEE	MGE Energy is a public utility holding company. The Company's principal subsidiary generates and distributes electricity to customers in Dane County, Wisconsin. MGE also purchases, transports, and distributes natural gas in several Wisconsin counties.	0.31 / 0.38		In	In	In		In		In	61%	Power	Diversified Utility	NA

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
SCG	SCANA Corporation is a holding company involved in regulated electric and natural gas utility operations, telecommunications, and other energy-related businesses. The Company serves electric customers in South Carolina and natural gas customers in South Carolina, North Carolina, and Georgia. SCANA also has investments in several southeastern telecommunications companies.	0.31 / 0.3		In	In	In	In	In			77%	Power	Diversified Utility	Non-incentive
D	Dominion Resources a diversified utility holding company which generates, transmits, distributes, and sells electric energy in Virginia and northeastern North Carolina. The Company produces, transports, distributes, and markets natural gas to customers in the Northeast and Mid-Atlantic regions of the United States.	0.31 / 0.26		In	In	In	In	In			79%	Power	Diversified Utility	Both
GAS	AGL Resources Inc. primarily sells and distributes natural gas to customers in Georgia and southeastern Tennessee. The Company also holds interests in other energy-related businesses, including natural gas and electricity marketing, wholesale and retail propane sales, gas supply services, and consumer products.	0.32 / 0.36		In		In	In	In			79%	Gas Utility	N/A	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
VVC	Vectren Corporation distributes gas in Indiana and western Ohio and electricity in southern Indiana. The Company's subsidiaries provide energy-related products and services, including energy marketing, fiber-optic telecommunications services, and utility related services. Vectren's services include materials management, debt collection, locating, trenching and meter reading services.	0.32 / 0.21		In	In	In	In	In			68%	Power	Diversified Utility	Non-incentive
FE	FirstEnergy Corp. is a public utility holding company. The Company's subsidiaries and affiliates are involved in the generation, transmission and distribution of electricity, exploration and production of oil and natural gas, transmission and marketing of natural gas, and energy management and other energy-related services.	0.32 / 0.15		In	In	In	In	In		In	63%	Power	Electric Utility	Both
NI	NiSource Inc's subsidiaries provide natural gas, electricity and other products and services to customers located within a corridor that runs from the Gulf Coast through the Midwest to New England.	0.34 / 0.37		In	In	In	In	In	In		57%	Power	Diversified Utility	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
PPL	PPL Corporation is an energy and utility holding company. The Company, through its subsidiaries, generates electricity from power plants in the northeastern and western United States, and markets wholesale and retail energy primarily in the northeastern and western portions of the United States, and delivers electricity in Pennsylvania and the United Kingdom.	0.34 / 0.11		In	In		In	In			68%	Midstream	Electric Utility	Both
NEE	NextEra Energy, Inc. is a clean energy company. The Company, through its subsidiaries, generates, transmits, distributes, and sells electric energy utilizing natural gas, wind and nuclear resources.	0.34 / 0.2		In	In	In	In	In		In	56%	Power	Electric Utility	Incentive
ETR	Entergy Corporation is an integrated energy company that is primarily focused on electric power production and retail electric distribution operations. The Company delivers electricity to utility customers in Arkansas, Louisiana, Mississippi, and Texas. Entergy also owns and operates nuclear plants in the northern United States	0.35 / 0.25		In	In	In	In	In		In	77%	Power	Diversified Utility	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
PEG	Public Service Enterprise Group Incorporated is a public utility holding company which, through its subsidiaries, generates, transmits, and distributes electricity and produces natural gas in the Northeastern and Mid Atlantic United States.	0.39 / 0.32		In	In	In	In	In			59%	Power	Diversified Utility	Incentive
AEP	American Electric Power Company is a public utility holding company which provides electric service, consisting of generation, transmission and distribution, on an integrated basis to their retail customers.	0.39 / 0.31		In	In	In	In	In			73%	Power	Electric Utility	Both
ITC	ITC Holdings Corporation is a holding company which through its subsidiaries transmits electricity from electricity generating stations to local electricity distribution facilities. ITC invests in electricity transmission infrastructure improvements as a means to improve electricity reliability and reduce congestion.	0.41 / 0.34		In			In	In			62%	Power	N/A	-
DUK	Duke Energy Corporation is an energy company located primarily in the Americas that owns an integrated network of energy assets. The Company manages a portfolio of natural gas and electric supply, delivery, and trading businesses in the United States and Latin America.	0.43 / 0.31		In	In	In	In	In			77%	Power	Diversified Utility	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
OGE	OGE Energy Corp, through its principal subsidiary Oklahoma Gas and Electric Company, generates, transmits, and distributes electricity to wholesale and retail customers in communities in Oklahoma and western Arkansas. The Company, through Enogex Inc., operates natural gas transmission and gathering pipelines, has interests in gas processing plants, and markets electricity.	0.44 / 0.57		In	In	In	In	In			65%	Power	Electric Utility	Non-incentive
SRE	Sempra Energy is an energy services holding company with operations throughout the United States, Mexico, and other countries in South America. The Company, through its subsidiaries, generates electricity, delivers natural gas, operates natural gas pipelines and storage facilities, and operates a wind power generation project.	0.49 / 0.35		In	In	In	In	In			64%	Power	Diversified Utility	Incentive
BKH	Black Hills Corporation is a diversified energy company which generates wholesale electricity, produce natural gas, oil and coal, and market energy.	0.5 / 0.66		In	In	In	In	In			73%	Power	Diversified Utility	Both

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
OTTR	Otter Tail Corporation, through its utility business units, provides electricity and energy services to customers in Minnesota, North Dakota, and South Dakota. Its Varistar Corporation unit operates manufacturing, plastics, health services, construction, entertainment, telecommunications, and transportation businesses with customers across the United States and Canada.	0.6 / 0.78		In	In	In					69%	Power	Electric Utility	Incentive
HE	Hawaiian Electric Industries is a diversified holding company that delivers a variety of services to the people of Hawaii. The Company's subsidiaries offer electric utilities, savings banks and other businesses, primarily in the state of Hawaii.	0.26 / 0.3		In	In	In	In	In			49%	Power	Electric Utility	NA
UGI	UGI Corporation distributes and markets energy products and services. The Company is a domestic and international distributor of propane. UGI also distributes and markets natural gas and electricity, and sells related products and services in the Middle Atlantic region of the United States.	0.29 / 0.24		In	In	In	In	In			32%	Power	Diversified Utility	Non-incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
NRG	NRG Energy owns and operates a diverse portfolio of power-generating facilities, primarily in the United States. The Company's operations include energy production and cogeneration facilities, thermal energy production, and energy resource recovery facilities.	0.39 / 0.31		In							0%	Power	N/A	-
EXC	Exelon Corporation is a utility services holding company which, through its subsidiaries, distributes electricity to customers in Illinois and Pennsylvania. Exelon also distributes gas to customers in the Philadelphia area as well as operates nuclear power plants in states that include Pennsylvania and New Jersey.	0.42 / 0.26		In	In	In	In	In		In	49%	Power	Diversified Utility	Both
CPN	Calpine Corporation acquires, develops, owns, and operates power generation facilities, as well as sells electricity and provides thermal energy for industrial customers.	0.46 / 0.47		In							0%	Power	N/A	-

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
AES	The AES Corporation acquires, develops, owns, and operates generation plants and distribution businesses in several countries. The Company sells electricity under long term contracts and serves customers under its regulated utility businesses. AES also mines coal, turns seawater into drinking water, and develops alternative sources of energy.	0.46 / 0.66		In	In	In					42%	Power	Electric Utility	Non-incentive
OKE	ONEOK, Inc. is a diversified energy company involved in the natural gas and natural gas liquids business across the United States.	0.47 / 0.55		In		In		In			26%	Gas Utility	N/A	Non-incentive
GEN	GenOn Energy, Inc. is an independent power producer that generates and wholesales electricity. The Company sells electricity to investor-owned utilities, municipalities, cooperatives, and other companies that serve end users or purchase power at wholesale for resale.	0.6 / 0.9		In							0%	Power	N/A	-
NFG	National Fuel Gas Company is an integrated natural gas company with operations in all segments of the natural gas industry, including utility, pipeline and storage, exploration and production, and marketing operations. The Company operates across the United States.	0.66 / 0.72		In		In	In	In			39%	Gas Utility	N/A	Both

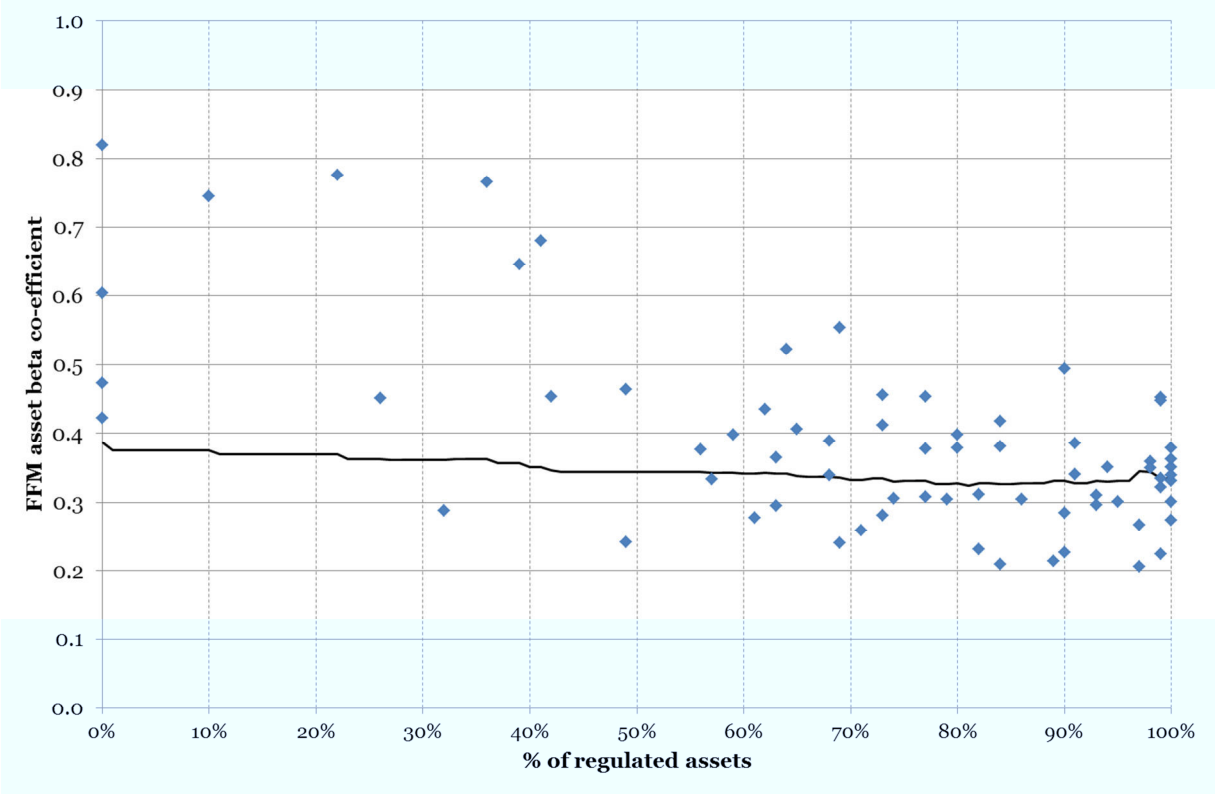
Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
STR	Questar Corporation is a natural gas-focused energy company. The Company's operations include gas and oil exploration and production, midstream field services, energy marketing, interstate gas transportation, and retail gas distribution.	0.68 / 0.65		In		In	In				41%	Gas Utility	N/A	Non-incentive
EQT	EQT Corporation is an integrated energy company with emphasis on Appalachian area natural-gas supply, transmission and distribution. The Company, through its subsidiaries, offer natural gas products to wholesale and retail customers.	0.71 / 0.58		In		In					10%	Gas Utility	N/A	Non-incentive
ORA	Ormat Technologies designs, develops, builds, owns and operates geothermal power plants.	0.75 / 0.57		In							0%	Power	N/A	-
MDU	MDU Resources Group, through its subsidiaries, operates as a construction materials and contracting business. The Company mines, processes, and sells construction aggregates; produce and sell mix and supply liquid asphalt; and supply ready mixed concrete for use in most types of construction. MDU also distributes natural gas and electric.	0.78 / 0.84		In	In	In	In				36%	Power	Diversified Utility	Incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
EGN	Energen Corporation is a diversified energy holding company. The Company acquires, develops, explores, and produces oil, natural gas and natural gas liquids in the continental United States. The Company also purchases, distributes and sells natural gas, principally in central and north Alabama.	0.79 / 0.88		In		In					22%	Gas Utility	N/A	Incentive
CNIG	Corning Natural Gas Corporation purchases and distributes gas through its own pipeline distribution and transmission systems. The Company serves residential, commercial, industrial, and municipal customers in the Corning, New York area. Corning also sells gas burning appliances, provides tax preparation services, operates a real estate agency, and owns a retail complex.	0.17 / 0.16		In	In						100%	Gas Utility	Gas Utility	-
RGCO	RGC Resources and its subsidiaries distribute and sell natural gas and propane.	0.1 / 0.15		In							100%	Gas Utility	N/A	-
UTL	Unitil Corporation, a public utility holding company, conducts a combination electric and gas utility distribution operations and is also involved in energy planning, procurement, marketing, and consulting activities.	0.12 / 0.18		In	In	In		In			99%	Power	Diversified Utility	Incentive

Ticker	Description	Asset beta estimate	CEG final sample	SNL all	SNL reg. energy	Rate cases	BB network utilities	NZCC	Henry	ESCV	% regulated assets	Industry	Industry	Type of regulation
DGAS	Delta Natural Gas Company distributes, stores, transports, gathers, and produces natural gas. It also, through its subsidiaries, buys and sells gas, as well as operates underground storage and production properties.	0.21 / 0.34		In	In	In					97%	Gas Utility	Gas Utility	Non-incentive
CPK	Chesapeake Utilities Corporation is a utility company that provides natural gas transmission and distribution, propane distribution, and information technology services.	0.31 / 0.47		In	In	In		In			80%	Power	Diversified Utility	Both
EGAS	Gas Natural Inc is a natural gas utility which also markets and distributes natural gas and conducts interstate pipeline operations.	0.21 / 0.3		In							64%	Gas Utility	N/A	-
CVA	Covanta Holding Corporation conducts operations in waste disposal, energy services, and specialty insurance. The Company also owns and operates waste-to-energy and power generation projects.	0.46 / 0.62		In							0%	Power	N/A	-
DYN	Dynegy Inc. provides electricity to markets and customers throughout the United States. The Company's sell electric energy, capacity and ancillary services on a wholesale basis from its power generation facilities.	-		In							0%	Power	N/A	-

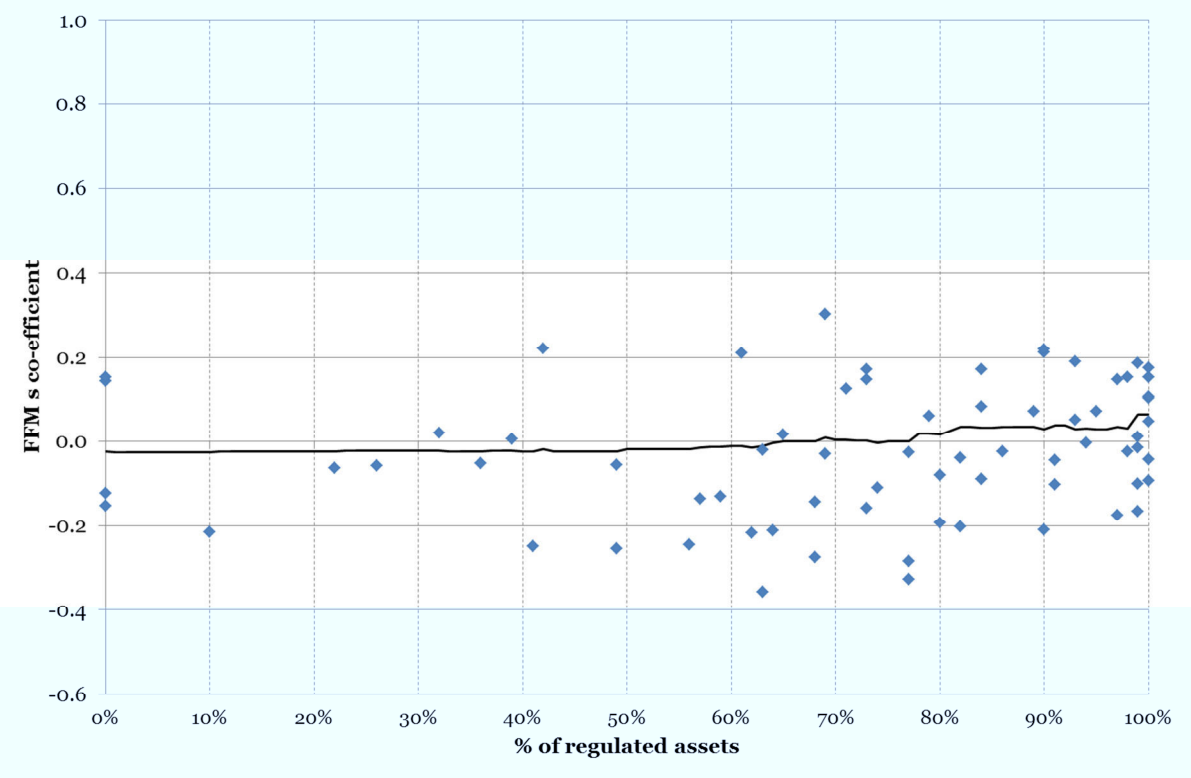
Appendix B FFM factors and regulated assets

Table 21: FFM beta co-efficient vs. proportion of regulated assets



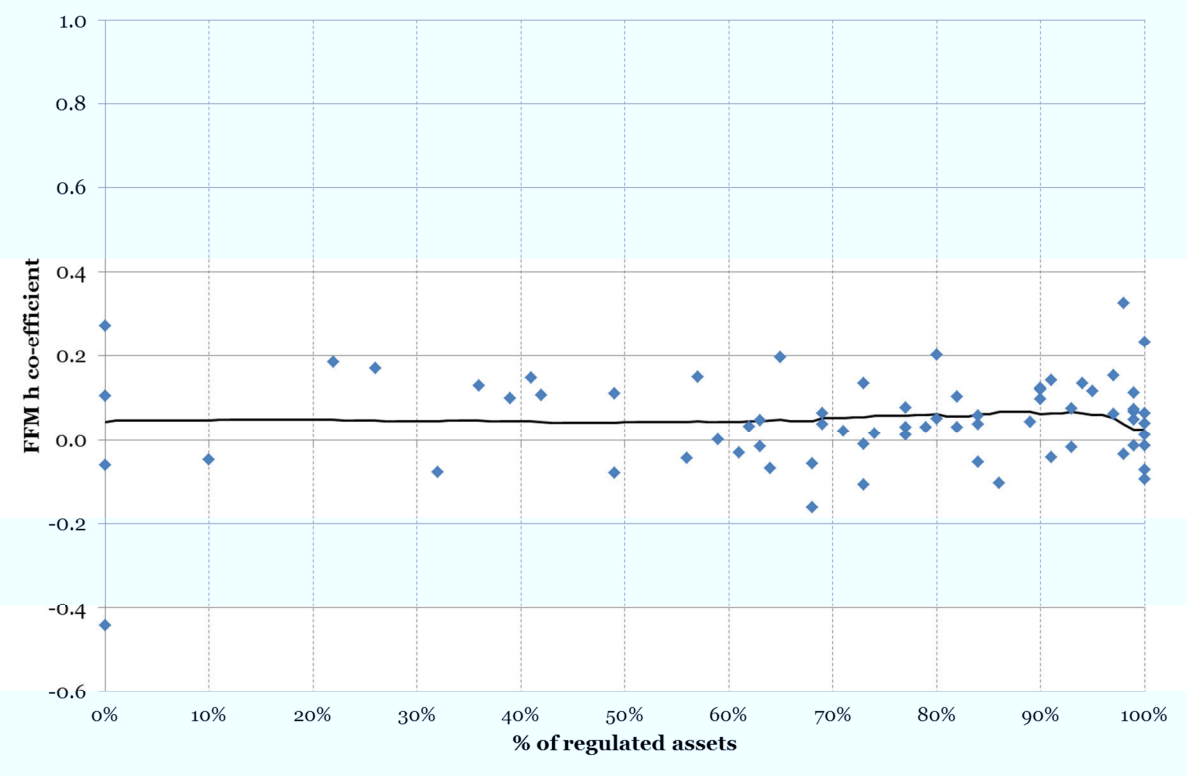
Source: ENA, Bloomberg and CEG analysis

Table 22: FFM s co-efficient vs. proportion of regulated assets



Source: ENA, Bloomberg and CEG analysis

Table 23: FFM h co-efficient vs. proportion of regulated assets

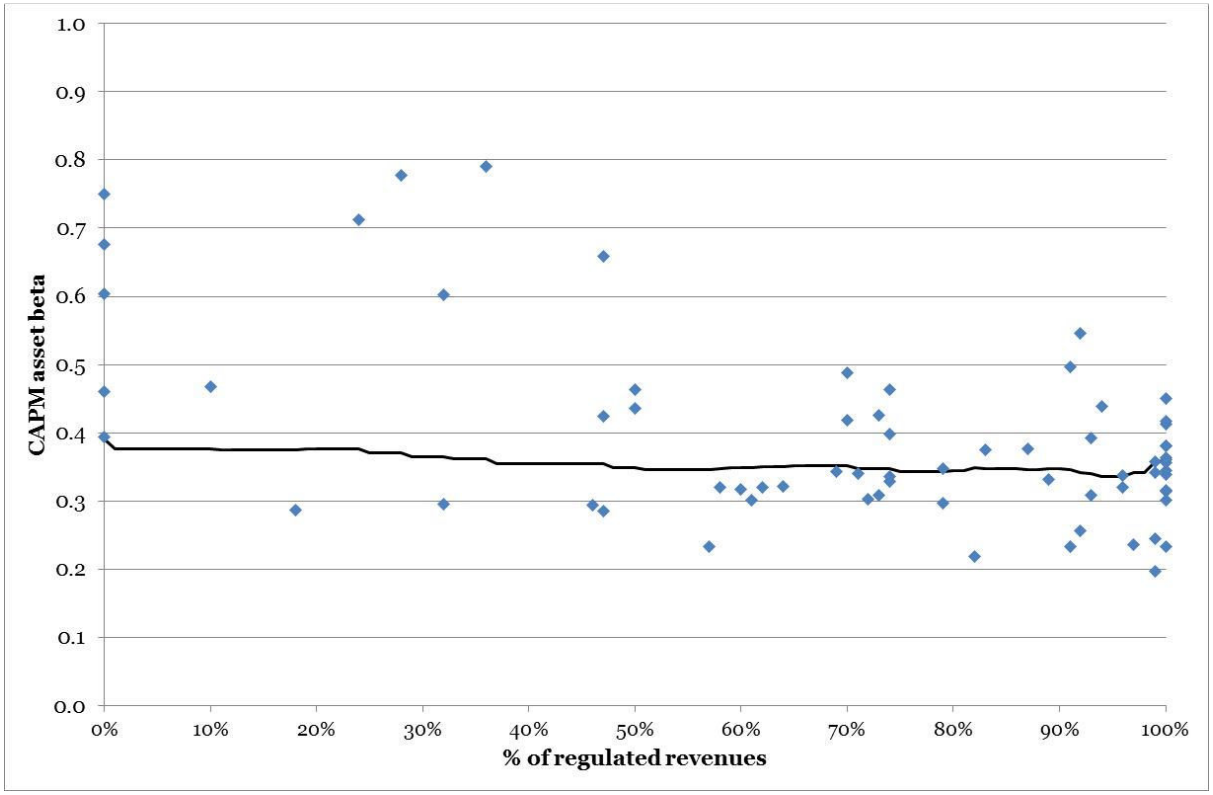


Source: ENA, Bloomberg and CEG analysis

Appendix C Regulated operating revenues

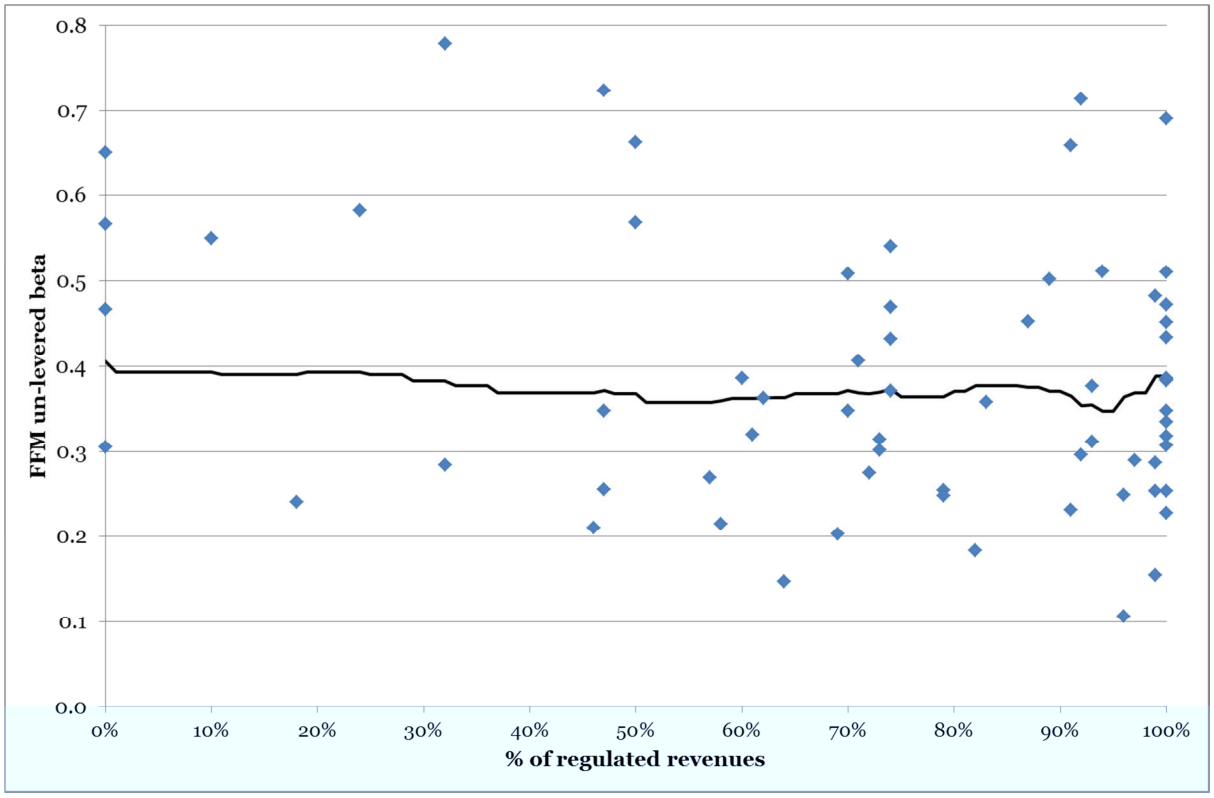
130. The following two figures show the CAPM asset beta and the FFM relative risk versus the proportion of regulated operating revenues. The figures show that the outcome of using regulated operating revenues as opposed to regulated assets is not significantly different, which makes our conclusions more reliable.

Table 24: CAPM asset beta vs. proportion of regulated operating revenues



Source: ENA, Bloomberg, CEG analysis

Table 25: FFM relative risk vs. proportion of regulated operating revenues



Source: ENA, Bloomberg, CEG analsysis

131. Table 26 shows the average CAPM asset beta assuming that 'mostly regulated' and 'highly regulated' refers to revenues rather than assets. That is, mostly (highly) regulated assumes that ≥ 50 % (80%) of total revenues are derived from regulated gas/electricity activities.

132. Table 27 shows the same information but for FFM relative risk.

Table 26: CAPM asset beta versus proportion of regulated operating revenues

	# companies	Average	Minimum	Maximum	Standard deviation
All	70	0.39	0.20	0.79	0.13
Mostly regulated	54	0.35	0.20	0.55	0.07
Highly regulated	33	0.34	0.20	0.55	0.08

Source: ENA, Bloomberg, CEG analysis

Table 27: FFM relative risk versus proportion of regulated operating revenues

	# companies	Average	Minimum	Maximum	Standard deviation
All	70	0.41	0.11	0.90	0.18
Mostly regulated	54	0.37	0.11	0.71	0.14
Highly regulated	33	0.37	0.11	0.71	0.14

Source: ENA, Bloomberg, CEG analysis

Appendix D Regulatory regimes in US states

133. In 2009, an American academic, John Kwoka, published a paper which compiled and collected information on US states with incentive regulation. A summary of the information collected by Kwoka is reproduced below.

Table 28: Incentive regulation in US states

State	Incentive regulation	Quality provisions	Investment provisions
Alabama	Yes (PF)	M	
Alaska	No		
Arkansas	No	M	
Arizona	No		
California	Yes (Q, SS)	P	Partial
Colorado	No (Q, SS)	P	Partial
Connecticut	No	M	
Delaware	No	P	
District of Columbia	No	T	
Florida	Yes (PF. SS)	P	Yes
Georgia	No		
Hawaii		M	
Idaho		P	
Illinois	Yes (SS)	M	
Indiana	No	M	
Iowa	Yes (SS)	M	
Kansas	No	M	
Kentucky	No	M	
Louisiana	Yes (SS, PF)	P	
Maine	Yes (PF, SS)	P	
Maryland	No	M	
Massachusetts	Yes (SS, Q)	P	Yes
Michigan	No	P	
Minnesota		P	
Mississippi	Yes (PF)	P	
Missouri	Yes (PF)	M	
Montana	Yes (SS)		
Nebraska			
Nevada		M	
New Hampshire	Yes (PF, Q)		Partial
New Jersey	Yes (SS, Q)	P	Partial
New Mexico	No		
New York	Yes (PF, SS, Q)	P	Partial
North Carolina			
North Dakota	Yes (SS)	P	
Ohio	No	T	
Oklahoma	No	T	
Oregon	Yes (PF)	P	
Pennsylvania	No (PF)	T	
Rhode Island	Yes (SS)	P	
South Carolina	No		
South Dakota	Yes (SS, PF, Q)		

State	Incentive regulation	Quality provisions	Investment provisions
Tennessee			
Texas		P	
Utah	No	P	
Vermont		P	
Virginia	Yes	M	
Washington	Yes (SS)	P	
West Virginia			
Wisconsin		M	
Wyoming			

Legend:

Under incentive regulation, PF means price freeze or moratorium

SS means sliding scale or earnings sharing

Q means adjustment on quality based outcomes

Under Quality Provisions, M means monitoring program

T means quality targets established

P means penalties

Source: Kwoka 2009

Appendix E Terms of reference

E.1 Background

134. The Australian Energy Regulator (AER) is developing *Rate of Return Guidelines* that will form the basis of the regulated rate of return applied in energy network decisions. The AER published an issues paper in late December 2012 and a formal consultation paper in early May 2013 under the recently revised National Electricity Rules (NER) and National Gas Rules (NGR).

135. The AER undertook its last review of the weighted average cost of capital (WACC) in 2009 under a previous version of the NER.

136. The new NER and NGR require the AER, when determining the rate of return, to consider (amongst other things):

    - Relevant estimation methods, financial models, market data and other evidence for determining the rate of return[28].

137. Cost of equity can be determined using the Black and Sharpe-Lintner Capital Asset Pricing Models (CAPMs) and the Fama & French 3-factor model (Fama & French model). The CAPMs and Fama & French model require risk factors to be estimated. These risk factors can be estimated from regressions of historical stock return data.

138. As further detailed below, the Energy Network Association (ENA) would like to engage you to provide your opinion on comparable United States listed companies for estimating the CAPMs and Fama & French risk factors within the scope of the *allowed rate of return objective*[29]:

> *[t]he 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 applied to the [Service Provider] in respect of the provision of [services]*

E.2 Scope of work

139. The ENA requests you to propose a set of United States listed companies with a similar degree of risk to Australian energy networks which can be used for estimating the CAPMs and Fama & French risk factors of regulated Australian energy networks. In doing so, assess those factors which might be expected to

[28] NER 6.5.2 (e)(1), 6A.6.2 (e)(1) and NGR 87 (5)(a).

[29] NER 6.5.2(c), 6A.6.2(c) and NGR 87 (3).

influence the comparability of the energy network CAPM and Fama & French risk factors between the Unites States and Australia.

140. The ENA requests the consultant to provide a report which must:

- Attach these terms of reference;
- Attach the qualifications (in the form of a curriculum vitae) of the person(s) preparing the report;
- Identify any current or future potential conflicts;
- Comprehensively set out the bases for any conclusions made;
- Only rely on information or data that is fully referenced and could be made reasonably available to the AER or others;
- Document the methods, data, adjustments, equations, statistical package specifications/printouts and assumptions used in preparing your opinion[3];
- Include specified wording at the beginning of the report stating that "[the person(s)] acknowledge(s) that [the person(s)] has read, understood and complied with the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia*" as if your brief was in the context of litigation;
- Include specified wording at the end of the report to declare that "[the person(s)] has made all the inquiries that [the person(s)] believes are desirable and appropriate and that no matters of significance that [the person(s)] regards as relevant have, to [the person(s)] knowledge, been withheld"; and
- State that the person(s) have been provided with a copy of the Federal Court of Australia's "Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia" and that the Report has been prepared in accordance with those Guidelines, refer to Annexure A to these Terms of Reference or alternatively online at <*http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7*>.
- The ENA intends to submit the consultant report to the AER in response to the consultation paper. Accordingly the report will become a public report.

[3] Note: this requires you to reveal information that you might otherwise regard as proprietary or confidential and if this causes you commercial concern, please consult us on a legal framework which can be put in place to protect your proprietary material while enabling your work to be adequately transparent and replicable.

Appendix F Tom Hird CV

COMPETITION ECONOMISTS GROUP

Economics of competition, regulation and damages

Curriculum Vitae

Dr Tom Hird / Director

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Key Practice Areas

Tom Hird is a founding Director of CEG's Australian operations. In the six years since its inception CEG has been recognised by Global Competition Review (GCR) as one of the top 20 worldwide economics consultancies with focus on competition law. Tom has a Ph.D. in Economics from Monash University. Tom is also an Honorary Fellow of the Faculty of Economics at Monash University and is named by GCR in its list of top individual competition economists.

Tom's clients include private businesses and government agencies. Tom has advised clients on matters pertaining to: cost modeling, valuation and cost of capital.

In terms of geographical coverage, Tom's clients have included businesses and government agencies in Australia, Japan, Korea, the UK, France, Belgium, the Netherlands, New Zealand, Macau, Singapore and the Philippines. Selected assignments include:

Selected Projects

- Advice to Chorus New Zealand on the estimation of the cost of capital;
- Advice to Wellington Airport on the estimation of the cost of capital;
- Advice to Vector on appeal of the New Zealand Commerce Commission decision on the cost of capital.
- Expert evidence in relation to the cost of capital for Victorian gas transport businesses.
- Advice to Everything Everywhere in relation to the cost of capital for UK mobile operators - including appearance before the UK Commerce Commission.
- Expert evidence to the Australian Competition Tribunal on the cost of debt for Jemena Electricity Networks.
- Advice to Integral Energy on optimal capital structure.
- Advice to ActewAGL on estimation of the cost of debt
- Advising NSW, ACT and Tasmanian electricity transmission and distribution businesses on the cost of capital generally and how to estimate it in the light of the global financial crisis.
- Advice in relation to the appeal by the above businesses of the Australian Energy Regulator (AER) determination.

- Expert testimony to the Federal Court of Australia on alleged errors made by the Australian Competition and Consumer Commission (ACCC) in estimating the cost of capital for Telstra.
- Advice to T-Mobile (Deutsche Telekom) on the cost of capital for mobile operators operating in Western Europe.
- Advising Vivendi on the correct cost of capital to use in a discounted cash flow analysis in a damages case being brought by Deutsche Telekom.
- Advising the AER on the cost capital issues in relation to the RBP pipeline access arrangement.
- Advising the ENA on the relative merits of CBASpectrum and Bloomberg's methodology for estimating the debt margin for long dated low rated corporate bonds.
- Advising the Australian Competition and Consumer Commission, Australia on the correct discount rate to use when valuing future expenditure streams on gas pipelines.