Asset beta for gas pipelines in New Zealand

Final report

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First Gas

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Boxes, figures and tables

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Executive summary

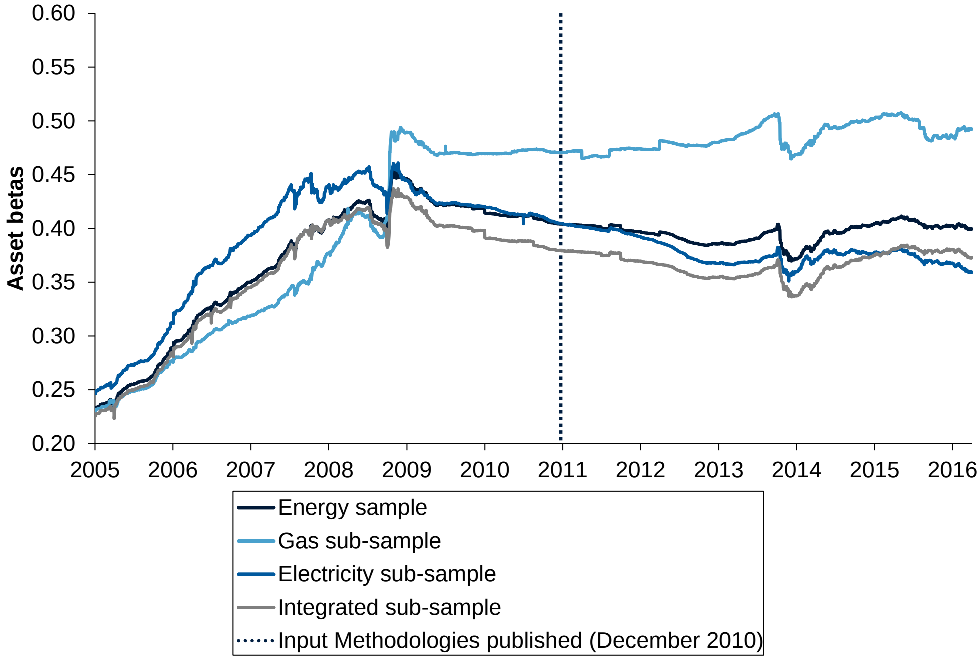
Oxera has been commissioned by First Gas limited ('First Gas') to review the New Zealand Commerce Commission's (the 'Commission') approach to beta estimation for gas pipeline businesses. The Commission is currently undertaking a review of the cost of capital that applies for energy networks in New Zealand as part of its review of Input Methodologies, which is scheduled to be completed in December 2016.[1]

The Commission, in its draft decision in relation to the cost of capital, is proposing to reduce the estimated asset beta that applies to gas pipeline businesses from 0.44 to 0.34.[2] This is based on its view that the cost of capital for gas pipeline businesses should be calculated on the same basis as the asset beta for electricity networks. Specifically, the Commission has first estimated an asset beta for electricity networks based on comparator analysis, and then considered whether an uplift should be applied to gas pipeline businesses to account for any differences in systematic risk exposure.[3]

The Commission has relied on a comparator sample of 74 companies operating in the electricity and gas utilities sectors to derive an asset beta. Critically, the use of a single asset beta for electricity networks (i.e. electricity transmission and distribution) and gas pipeline businesses (i.e. gas transmission and distribution) disregards factors that imply that the two industries face different levels of exposure to systematic risk. As shown in Figure 1 below, asset betas for gas companies within the Commission's comparator sample have remained consistently higher than the asset betas for electricity companies since the publication of the Commission's previous Input Methodologies report (December 2010).[4] Therefore, the Commission's proposal to remove the existing uplift of 0.1 on the asset betas for gas pipeline businesses runs counter to how the market evidence on asset betas has evolved.

[1] Commerce Commission New Zealand (2016), 'Input Methodologies Review', Draft decisions, Media briefing presentation slides, 16 June.
[2] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, p. 5.
[3] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, chapter 4.
[4] Commerce Commission New Zealand (2016), 'Input Methodologies Review', Draft decisions, Media briefing presentation slides, 16 June, slide 3.

Figure 1 Rolling five-year daily asset betas—Commission's sample



Note: Rolling asset betas are presented until 31 March 2016, the same period of analysis undertaken by the Commission. Jersey Electricity (JEL LN Equity) is excluded from this figure because there are multiple missing data points and stale data, as well as a mis-match in trading dates relative to the remaining sample.

Source: Oxera analysis based on data from Bloomberg and Datastream.

The Commission's own 'gas' sub-sample (18 companies) and 'electricity' sub-sample (16 companies) appears more relevant than the whole 'energy' sample, for setting the betas for gas pipeline businesses and electricity networks, respectively. It would be good regulatory practice to set the beta for gas pipeline businesses relative to the 'gas' sub-sample of comparators. The selection of a comparator sample that is matched for 'pure-play' characteristics, would be consistent with the advice of the Commission's expert, Dr Martin Lally.[5] As shown in Table 1 below, the current market evidence supports an asset beta for gas pipeline businesses of 0.44–0.50. If a point estimate for the gas beta was derived based on the Commission's methodology using data over a longer period (i.e. 2006–16), the beta for gas companies would be around 0.42.[6]

If the Commission's prior methodology—i.e. applying an uplift for gas pipeline businesses relative to betas for electricity networks (that are derived from the 'energy' whole sample)—were retained, the market evidence would support an uplift of 0.09–0.14.

[5] Dr Lally suggests that betas should be estimated with reference to 'pure-play' businesses when such comparators exist. In the absence of pure-play comparators, he advocates that the betas of 'multi-divisional firms embodying such pure-plays' should be estimated. See Franks, J., Lally, M. and Myers, S. (2008), 'Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology', 18 December, p. 28.
[6] Oxera understands that the point estimate for the asset beta reported by the Commission is based on a simple average of the four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Table 1 Five-year asset beta estimates of the Commission's sample

Sample	Four-weekly results	Weekly results	Daily results	*Commission's beta estimate for 2006-16*[1]
Gas	0.44 (0.17)	0.45 (0.17)	0.50 (0.13)	*0.42*
Electricity	0.26 (0.08)	0.29 (0.09)	0.33 (0.12)	*0.32*
Integrated	0.26 (0.08)	0.30 (0.08)	0.37 (0.10)	*0.30*
Energy	**0.30 (0.13)**	**0.34 (0.13)**	**0.39 (0.12)**	***0.34***
Difference between 'gas' and whole 'energy' sample	*0.14*	*0.12*	*0.11*	*0.09*

Note: Standard errors are reported in brackets. The cut-off date is set to 31 March 2016, consistent with the Commission's analysis. [1] Oxera understands from a discussion between First Gas and the Commission that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Source: The Commission's asset beta spreadsheet based on the Commission's comparator sample.

There are also a number of theoretical reasons why gas pipeline businesses in New Zealand would face higher systematic risk exposure than electricity networks in New Zealand. As discussed in section 3:

- there are higher demand-side risks for NZ gas pipeline businesses than NZ electricity networks (i.e. higher volume volatility of consumption and higher income elasticity of demand);
- NZ gas pipeline businesses are characterised by higher asset risk relating to their relative immaturity compared with NZ electricity networks. This includes consideration of the following factors:
  - gas pipeline businesses have higher levels of long-run growth options;
  - relatively low penetration rates for the greenfield gas network imply higher asset stranding risk.

A significant methodological point to note is that the Commission's intended 0.1 reduction in the asset beta for gas pipeline businesses is an abrupt and significant change that is brought on by a revised approach. The reduction is not underpinned or supported by a movement in capital market data. Within regulated settings it is desirable to have stable, predictable and consistent tariff-setting policies, by avoiding abrupt changes in regulatory allowed parameters, including the beta. Although this report does not specifically address the issue of maintaining stability, it is rare for a regulator to implement a company-specific change of such magnitude and with such a significant effect (i.e. a reduction in the weighted average cost of capital of around 70 basis points) without robust and reliable underlying evidence. Therefore, even if the Commission is minded to remove an uplift for the gas pipeline businesses, it would be helpful to do so only if the evidence shows that there is a marked change in the evidence base, including in capital market conditions, that warrants this methodological change.

1 Introduction

1.1 Background

The Commission, in its draft decision in relation to the cost of capital, is proposing to reduce the estimated asset beta that applies to gas pipeline businesses from 0.44 to 0.34.[7] This is based on its view that the cost of capital for gas pipeline businesses should be calculated on the same basis as the asset beta for electricity networks, removing a 0.1 uplift that currently applies for gas pipeline businesses.[8]

The Commission's draft decision is based to a significant degree on expert advice provided by Dr Martin Lally.

This report demonstrates that the available evidence from the financial markets does support allowing gas pipeline businesses a higher asset beta than electricity networks. Specifically, the report:

- analyses the asset beta for gas pipeline businesses based on a sample that is categorised as a 'gas' sub-sample within the Commission's sample of comparators;
- examines the differences in exposure to systematic risk between gas pipeline businesses and electricity networks (i.e. transmission and distribution) in New Zealand;
- examines whether regulatory estimates of asset betas in other jurisdictions are differentiated between electricity networks and gas pipeline businesses.

A significant methodological point to note is that the Commission's intended 0.1 reduction in the asset beta for gas pipeline businesses is an abrupt and significant change that is brought on by a revised approach. The reduction is not underpinned or supported by a movement in capital market data. Within regulated settings it is desirable to have stable, predictable and consistent tariff-setting policies, by avoiding abrupt changes in regulatory allowed parameters, including the beta. Although this report does not specifically address the issue of maintaining stability, it is rare for a regulator to implement a company-specific change of such magnitude and with such a significant effect (i.e. a reduction in the weighted average cost of capital of around 70 basis points[9]) without robust and reliable underlying evidence. Indeed, the Commission's own experts have, in the past, explicitly endorsed a need for regulatory stability and consistency:

> Professor Franks recommends that the Commission strive for regulatory consistency: (a) Methods for parameter estimation should not be changed unexpectedly and (b) great care should be taken when making large changes to the real cost of capital. If large changes must occur, these could be introduced gradually, or the Commission might apply split costs of capital to new and existing investments.[10]

[7] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, p. 5.
[8] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, chapter 4.
[9] Based on information provided by First Gas.
[10] Franks, J., Lally, M. and Myers, S. (2008), 'Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology', 18 December, p. 5.

1.2 Overview of energy regulation in New Zealand

Summarised below are some of the features of the NZ energy regulatory regime that are salient to assessing drivers of systematic risk.[11]

- While the energy price control period is five years, the rules governing the price controls—i.e. the Input Methodologies—are reviewed at least every seven years.
- Gas pipeline businesses and electricity networks in New Zealand are subject to both price and revenue caps. Historically, distribution has been subject to a price cap, with a view to providing incentives to the suppliers to grow the network, whereas transmission has been subject to a revenue cap. For the next control, the regulator has proposed that only gas distribution in New Zealand will remain subject to a price cap.

Figure 1.1 Future form of regulatory control in New Zealand

	Gas	Electricity
Transmission	Revenue cap	Revenue cap
Distribution	Weighted average price cap	Revenue cap

Note: As shown in the figure, Oxera notes that the Commission has indicated its intention to migrate the electricity distribution network to a revenue cap. This suggests that, in future regulatory periods, only the gas distribution network will retain volume risk under a price cap.

Source: Oxera, based on Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 1: Form of control and RAB indexation for EDBs, GPBs and Transpower, 16 June.

- Under a revenue cap, under-recovered revenues can be rolled forward by one year (referred to as 'an annual unders and overs wash-up mechanism'[12]). However, both gas and electricity transmission are subject to a cap on the wash-up amount, which is aimed at limiting the amount of lost demand that could be recovered through the mechanism in case of catastrophic events. This implies that under- (or over-)recovered revenues cannot necessarily be smoothed over future periods.
- For gas distribution, growth in volumes is dependent on encouraging further gas consumption by existing customers but, more critically, on increasing the number of connections. In contrast, volumes for gas transmission are influenced by load, which in turn depends on commodity prices and macroeconomic factors.

[11] See, for example, Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 1: Form of control and RAB indexation for EDBs, GPBs and Transpower, 16 June.
[12] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, para. 149.

- Electricity distribution accounts for around 75% of combined revenues recovered from electricity distribution and transmission.[13] Gas distribution represents around half of combined revenues recovered from gas distribution and transmission.[14]

1.3 Structure of the report

The report is structured as follows.

- Section 2 presents estimates of the asset beta for gas pipeline businesses in New Zealand using the Commission's sample of energy comparators, including the gas sub-sample relative to the electricity sub-sample.
- Section 3 looks at why gas betas might differ from electricity betas, with reference to potential differentials in drivers of systematic risk.
- Section 4 gives an overview of regulatory precedents for gas pipeline businesses and electricity networks.
- Section 5 concludes.

[13] For year ending March 2011; Electricity Authority (2014), 'Analysis of historical electricity industry costs', January, pp. 7–8
[14] For 2014 calendar year; GAS Industry Company Limited (2016), 'The New Zealand Gas Story; The State and Performance of the New Zealand Gas Industry', July, p. 165.

2 Estimates of an asset beta for gas pipelines in New Zealand

This section outlines how asset betas for gas pipeline businesses (i.e. gas transmission and distribution) in New Zealand are estimated by the Commission based on comparator analysis.

As noted earlier, the Commission is intending to remove a 0.1 uplift on asset betas for gas pipeline businesses relative to electricity networks, from one price control decision to the next. This is an abrupt and significant change that is brought on by a revised methodology. As discussed in this section, the reduction is not supported by a movement in capital market data; indeed, the market evidence points towards further divergence between gas and electricity asset betas than at the time of the Commission's 2010 decision.

This section also describes how the Commission's comparator analysis methodology could be improved with the addition of a few bottom-up tests (e.g. liquidity filters) to verify that the sample is robust for gas beta estimation.

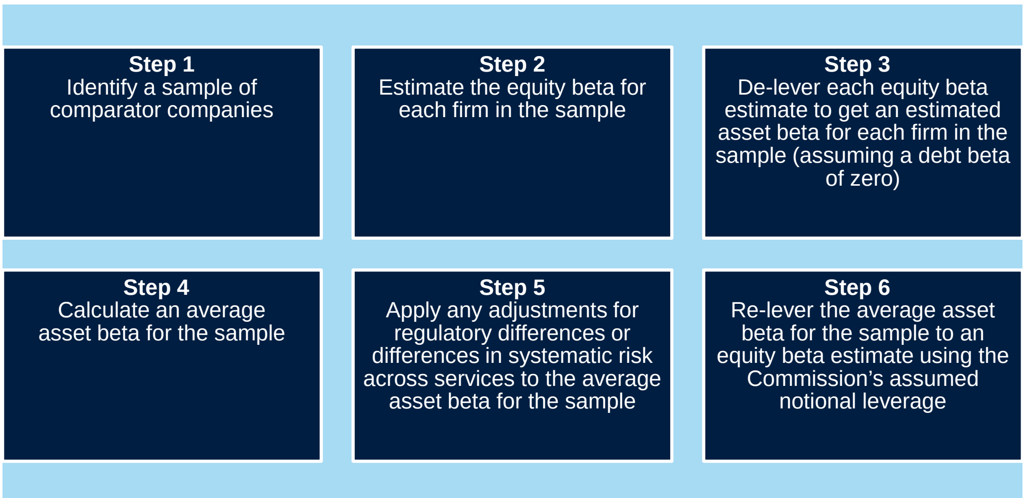
This section is structured as follows.

- Section 2.1 gives an overview of the Commission's methodology for comparator beta estimation.
- Section 2.2 outlines market evidence on how gas and electricity betas have evolved over time.
- Section 2.3 describes Oxera's approach to testing and refining the Commission's comparator sample.

2.1 Overview of the Commission's methodology

The Commission derived the asset beta for gas pipeline businesses and electricity networks based on a sample of companies in electricity, gas distribution, pipelines and multi-utility[15] industries, following a six-step approach (see Figure 2.1).

Figure 2.1 Six-step process for estimating beta



Source: Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions; Topic paper 4: Cost of capital issues', 16 June, pp. 63–64.

[15] ICB defines multi-utilities as 'utility companies with significant presence in more than one utility'.

The Commission used a sample of electricity and gas utilities from New Zealand, Australia, the UK and the USA. International comparators were added to the sample due to the small number of comparable companies in New Zealand. The approach used for sample selection is summarised in Box 2.1.

Box 2.1 The Commission's approach to comparator selection

Identification of relevant companies
To find relevant comparator companies, the Commission used Industry Classification Benchmarks (ICBs) as reported in the Bloomberg Industry Classification System. The Commission's view was that there were not enough pure-play electricity and gas line comparators available. Therefore, the following four industries were included in the sample based on ICB classifications: **Electricity**, **Gas Distribution**, **Pipelines**, and **Multiutilities**.

Filtering criteria
To filter the resulting sample of companies, the Commission used two criteria: the company should have at least five years of trading data, and a market value of equity greater than US$100m. The latter criterion was used to exclude illiquid firms from the sample.

Company description check
The Commission assessed the nature of each business in the sample using 'Segment Analysis' information from Bloomberg, and excluded companies deemed not to be sufficiently comparable.

Source: Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions; Topic paper 4: Cost of capital issues', 16 June, p. 65.

The Commission estimated a single 'energy' beta to assess the basis of its regulatory allowed betas for electricity and gas companies. The Commission divided the companies within the energy beta sample into three sub-samples: gas, electricity and integrated companies.

The Commission estimated five-year asset betas for the comparator companies based on daily, weekly and four-weekly observations of returns. The asset beta for regulated energy businesses was then estimated by taking a simple average of individual asset betas across the list of comparators.

Importantly, in its 2010 decision, the Commission first estimated the beta for all comparators (i.e. 'energy' beta) and used this as an estimate of the allowed beta for electricity networks. It then derived a beta for gas pipeline businesses by adding 0.1 to the allowed beta for electricity networks to reflect systematic risk faced by gas pipeline businesses that was additional to that facing the electricity networks.[16] The 2016 draft determination does not make such an adjustment: the asset beta adopted for both electricity networks and gas pipeline businesses has been set at the average of the combined 'energy' comparator sample.

2.2 Market evidence on the evolution of gas and electricity beta

Based on the Commission's sample of comparators, it is possible to examine how the asset betas for the various sub-samples (i.e. gas, electricity and integrated) have evolved over time. Figure 2.2 below presents the five-year daily rolling asset betas of the Commission's energy sample, as well as the various sub-samples.

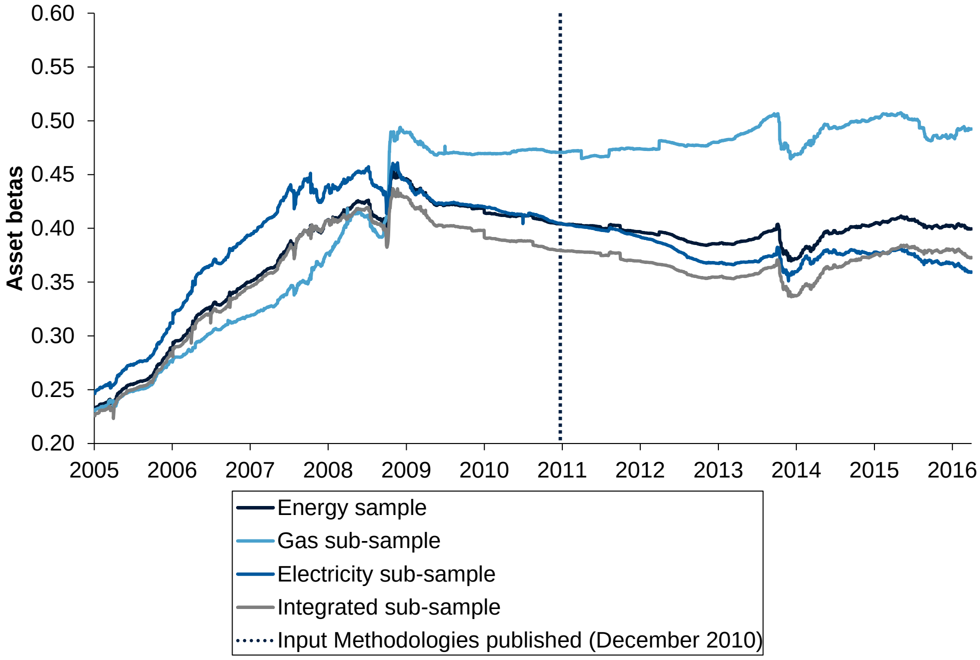
As shown in Figure 2.2, asset betas for gas have remained higher than the asset betas for electricity since the financial crisis in 2008, and for the whole period since the publication of the Commission's previous Input Methodologies in December 2010. This provides strong empirical support for the proposition

[16] Commerce Commission New Zealand (2010), 'Input Methodologies (Electricity Distribution and Gas Pipeline Services)', 22 December, para. 6.5.29.

that gas companies in the Commission’s sample have higher asset betas than electricity companies.

Furthermore, gas and electricity betas appear to have slightly diverged over the period—i.e. the differential has grown over time. If anything, the recent evidence provides stronger support for the Commission’s approach of allowing an asset beta that is higher for gas pipeline businesses than electricity networks in its 2010 decision.

Figure 2.2 Rolling five-year daily asset betas—Commission’s sample

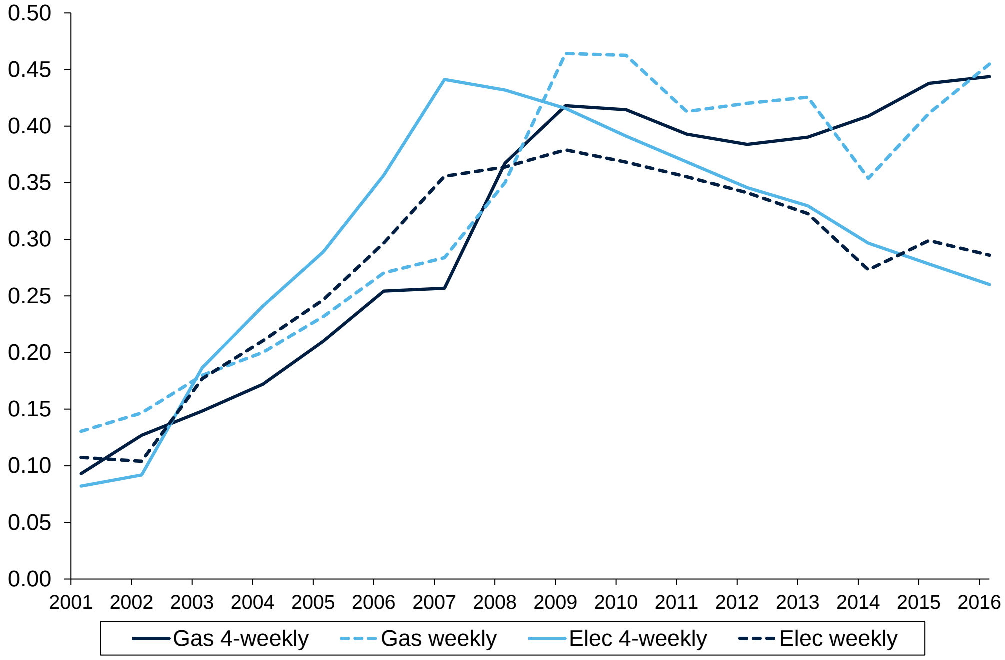


Note: Rolling asset betas are presented until 31 March 2016, the same period of analysis undertaken by the Commission. Jersey Electricity (JEL LN Equity) is excluded from this figure because there are multiple missing data points and stale data, as well as a mismatch in trading dates relative to the remaining sample.

Source: Oxera analysis based on data from Bloomberg and Datastream.

These results also hold using weekly and four-weekly observations, which are reported in the Commission’s spreadsheet. This is illustrated in Figure 2.3.

Figure 2.3 Rolling five-year asset betas—gas and electricity sub-samples



Note: Five-year betas are estimated by the Commission once a year (the analysis cut-off date is 31 March of each year).

Source: Based on the revised version of Figure 7 of the Commission's cost of capital topic paper. For further details, see Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June; and Commerce Commission New Zealand (2016), 'Input-methodologies-review-draft-decisions-Asset-beta-spreadsheet-11-July-2016'.

In December 2010, when the differential between the electricity and gas companies within the whole 'energy' sample was around 0.02–0.08, the Commission concluded that gas pipeline businesses were riskier than electricity networks, with a gas beta that was 0.1 higher than electricity. As shown in the figures above, the differential between electricity and gas companies in the Commission's sample is now larger (i.e. around 0.16–0.18 depending on the observation frequency used). Therefore, the Commission's proposal to remove the existing uplift of 0.1 in the allowed asset beta for gas pipeline businesses runs counter to how the market evidence on asset betas has evolved.

2.3 Oxera's approach to testing and refining the sample of relevant comparator firms for gas

Although the Commission's overall practice for estimating the asset beta is in line with good regulatory practice, in assessing the betas for gas pipeline businesses, the analysis would be more robust if the issues described in this sub-section were addressed.

- Section 2.3.1 describes reasons why a sub-sample within the 'energy' whole sample of comparators might be more relevant for the purpose of estimating an asset beta for gas pipeline businesses, and what the results would be if the Commission were to adopt such a sample.

- Section 2.3.2 sets out Oxera's approach to further refining the sample based on quantitative filters for liquidity and gearing, and presents the results on the basis of this refined sample.
- Section 2.3.3 sets out reasons why the daily estimates of asset betas are robust and why more weight could be placed on estimates of daily betas, in addition to the Commission's reliance on estimates of weekly and four-weekly betas.

2.3.1 A narrower sample of relevant comparators

The Commission relied on a wide list of 74 companies operating in the electricity and gas utilities sectors to derive comparator beta estimates. The use of a single asset beta for electricity networks and gas pipeline businesses disregards the factors that might imply that the two industries face different levels of exposure to systematic risk. These differential factors—between gas pipeline businesses and electricity networks—are assessed in the next section of this report.

Due to the marked divergence in gas and electricity betas since the Commission's 2010 decision in relation to the Input Methodology, it is inappropriate to rely on the estimates based on the 'energy' sample in order to estimate a regulatory allowed asset beta for gas pipeline businesses. Instead, the Commission's own 'gas' sub-sample and 'electricity' sub-sample are more relevant for setting the betas for gas pipeline businesses and electricity networks, respectively. The selection of a comparator sample that is matched for 'pure-play' characteristics, is also consistent with the advice of Dr Lally.[17]

Moreover, using a smaller sample of relatively closely matched comparator companies to estimate the regulatory allowed asset beta is consistent with the approach adopted by international regulators. Table 2.1 summarises the sample size of comparators used by various regulators to set an asset beta allowance for energy companies.

Table 2.1 International regulatory precedents on the number of comparators

Regulator	Comparator sample size
ERA (Dampier to Bunbury Natural Gas Pipeline, 2016)	4
CRE, France (gas, 2015)	7
CRE, France (electricity, 2015)	7
Ofgem, UK (RIIO-ED1, 2014)	5
CC, Northern Ireland (NIE, 2014)	5
Netherlands (TenneT, 2014)	10
AER, Australia (electricity and gas network services, 2013)	9
ERA (Western Power, 2012)	9

Source: Various regulatory determinations.

[17] Dr Lally suggests that betas should be estimated with reference to 'pure-play' businesses when such comparators exist. In the absence of pure-play comparators, he advocates that the betas of 'multi-divisional firms embodying such pure-plays' should be estimated. See Franks, J., Lally, M. and Myers, S. (2008), 'Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology', 18 December, p. 28.

Oxera has used the Commission's asset beta spreadsheet[18] to estimate the asset betas for the Commission's 'gas' sub-sample. Table 2.2 summarises this analysis.

Table 2.2 Five-year asset beta estimates of the Commission's sample

Sample	Four-weekly results	Weekly results	Daily results	*Commission's beta estimate for 2006-16[1]*
Gas	0.44 (0.17)	0.45 (0.17)	0.50 (0.13)	*0.42*
Electricity	0.26 (0.08)	0.29 (0.09)	0.33 (0.12)	*0.32*
Integrated	0.26 (0.08)	0.30 (0.08)	0.37 (0.10)	*0.30*
Energy	**0.30 (0.13)**	**0.34 (0.13)**	**0.39 (0.12)**	***0.34***
Difference between 'gas' and whole 'energy' sample	*0.14*	*0.12*	*0.11*	*0.09*
Difference between 'gas' and 'electricity' sample	*0.18*	*0.17*	*0.16*	*0.10*

Note: Standard errors are reported in brackets. The cut-off date is set to 31 March 2016, consistent with the Commission's analysis. [1] Oxera understands from a discussion between First Gas and the Commission that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Source: The Commission's asset beta spreadsheet based on the Commission's comparator sample.

The results show that the beta for gas companies within the whole 'energy' sample is considerably higher than that for the electricity companies in the sample. The Commission currently uses the whole 'energy' sample to set a beta for electricity networks of 0.34. The 'energy' beta is pulled up by the inclusion of the 'gas' sub-sample, and pulled down by the inclusion of both the 'integrated' and 'electricity' sub-samples. Since First Gas is a pure-play gas pipeline business, setting its beta with reference to integrated and electricity comparators leads to an under-estimation of its allowed beta, compared with setting the beta on the basis of the 'gas' sub-sample. To the extent that the beta estimates for integrated companies also reflect their activities in electricity networks, deriving a regulatory allowed asset beta on the basis of the energy sample could lead to an underestimation of the asset beta for gas pipeline businesses.

This evidence suggests that if the Commission were to use its own 'gas' and 'electricity' comparator sub-samples to set separate betas for gas and electricity, respectively, the evidence would justify a beta that is higher for gas pipeline businesses by up to 0.10–0.18. As shown in Table 2.2, the current market evidence supports an asset beta for gas pipeline businesses of 0.44–0.50. As shown in Table 2.2, if a point estimate for the gas beta was derived based on the Commission's methodology using data over a longer period (i.e. 2006–16), the beta for gas companies would be around 0.42.[19]

[18] Commerce Commission New Zealand (2016), 'Input-methodologies-review-draft-decisions-Asset-beta-spreadsheet-11-July-2016'.
[19] Oxera understands that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

If the Commission’s prior methodology—i.e. applying an uplift for gas pipeline businesses relative to betas for electricity networks (that are derived from the ‘energy’ whole sample)—were retained, the market evidence would support an uplift of 0.09–0.14.

Table 2.2 also shows the standard errors of the beta estimates, as per the Commission’s methodology. While the standard error of five-year daily asset betas based on the gas sub-sample is higher than that based on the energy and electricity samples, the standard error based on the gas sub-sample is lower than the standard errors of betas used by the Commission in other determinations. For example, the Commission relied on datasets with standard errors of 0.30–0.31 when estimating the allowed beta for airports.[20] This provides support that a narrower sample of relevant gas comparators is sufficiently robust for beta estimation within the Commission’s comparator analysis.

2.3.2 Refining the Commission’s sample

Oxera has applied quantitative and qualitative filters to check that the Commission’s comparator sample permits accurate beta estimation for gas pipeline businesses in New Zealand. As shown below, applying these additional filters leads to the exclusion of obvious outliers. Although this does not materially affect the final estimates of asset betas, Oxera notes that applying these filters allows for testing of the robustness of the analysis and findings.

To identify comparators for which the beta can be accurately estimated, Oxera starts with the original energy sample of 74 companies used by the Commission, and applies quantitative filters for liquidity and gearing.

- Liquidity filters are designed to exclude illiquid comparators whose observable market betas may be distorted by low trading volumes and frequencies.
- Gearing filters are designed to exclude comparators that have gearing levels for which an assumption of a zero debt beta would be inappropriate.[21]

Applying the liquidity and gearing filters has reduced the Commission’s comparator sample from 74 to 67 companies. The statistical analysis subsequently presented in this report is based on the filtered comparator sample of 67 companies. Detailed results of the filtering process, on a company-by-company basis, are included in Appendix A2. The application of these quantitative filters has reduced the gas sub-sample from 18 companies in the Commission’s sample to 15 as a refined gas sub-sample.

Oxera then assessed further evidence on whether the refined gas sub-sample of 15 companies is appropriate for estimating the beta for gas pipeline businesses in New Zealand. Oxera primarily considered the proportion of revenue generated from the relevant gas business activities[22] and cross-checked that the qualitative description of the company is consistent with a pure-play gas company. Oxera concluded that there is not enough evidence to further exclude any companies from the list of 15 identified in the filtered gas

[20] Commerce Commission New Zealand (2016), ‘Input-methodologies-review-draft-decisions-Asset-beta-spreadsheet-11-July-2016’.
[21] The Commission assumed a zero debt beta.
[22] As reported by Bloomberg according to Bloomberg Industry Classification System (BICS).

sub-sample.[23] The detailed company descriptions and BICS classifications are presented in Appendix A3.

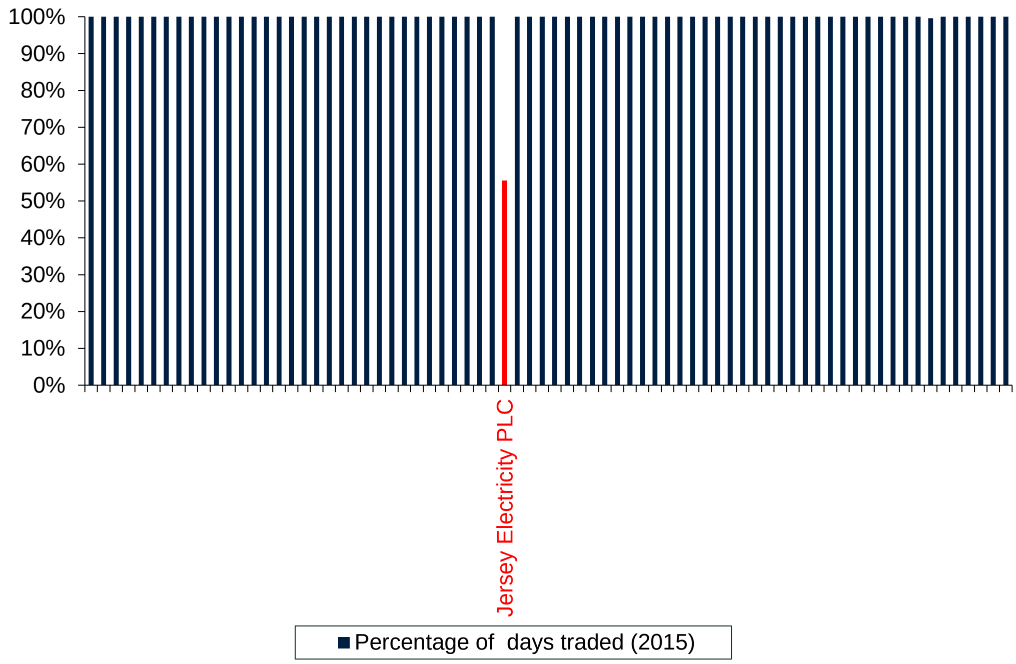
Liquidity

The Commission relied on the market value of equity in order to screen out illiquid companies. This is a simple and high-level proxy for illiquidity, and the use of this measure could lead to illiquid firms being retained in the comparator sample. For statistical analysis, the implication is that more well-defined measures of liquidity (such as percentage of free float, extent of the bid–ask spread) could be used to exclude illiquid companies to facilitate the robustness of the beta estimation exercise.

A necessary condition for reliable beta estimates is that securities markets are sufficiently liquid. Liquidity is a difficult concept to define and is subject to interpretation. It is therefore useful to look at a range of measures, such as the percentage of days traded, free-float shares as a percentage of total shares and average bid–ask spread.

The percentage of days traded is a simple measure of liquidity that indicates the proportion of trading days in a year when at least one share of a company was traded. A small proportion of days traded would indicate that the shares are relatively thinly traded and the company is likely to be illiquid. As shown in Figure 2.4, applying this filter leads to one company (Jersey Electricity) being excluded as an outlier.

Figure 2.4 Percentage of days traded

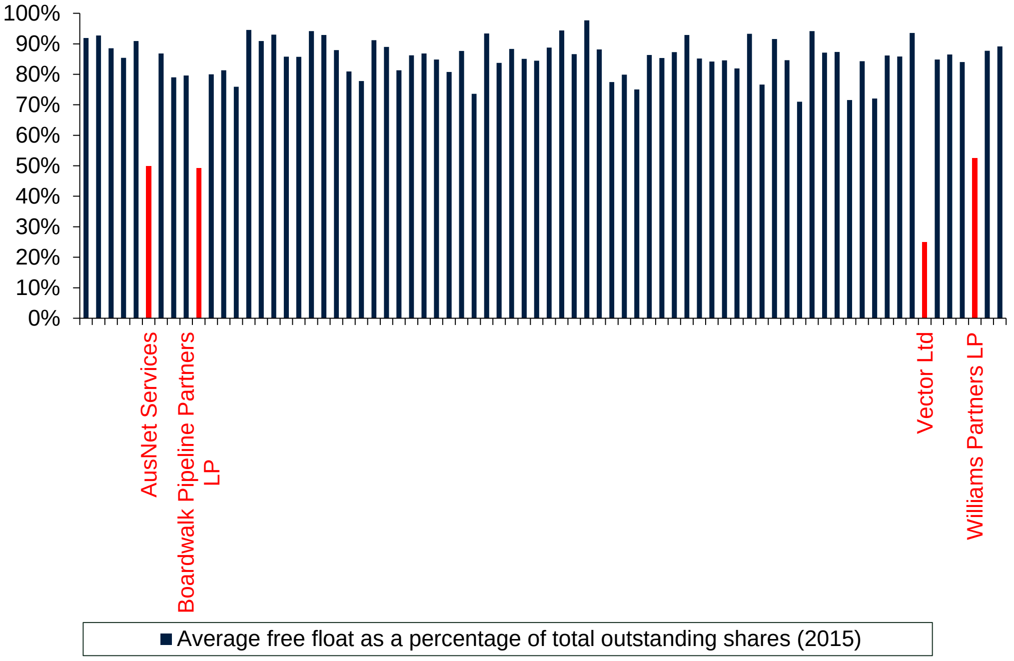


Source: Oxera analysis based on data from Datastream.

[23] For example, there is only one company (Questar Corporation) that derives less than half of its revenue from provision of gas services. However, the business description of the company includes 'interstate gas transportation', which is a regulated activity in the USA. Therefore, it is not possible to conclude that this company is not a relevant comparator.

The free float of a company is the proportion of shares that can be publicly traded. A small proportion of shares floated would create an impediment to active trading. For example, it would make it more difficult for an investor to exit a long position. Stocks with a low free float could therefore be considered less liquid. As shown in Figure 2.5 below, four companies (AusNet Services (Australia), Boardwalk Pipeline Partners LP (USA), Vector Ltd (New Zealand), and Williams Partners LP (USA)) are excluded on this basis.

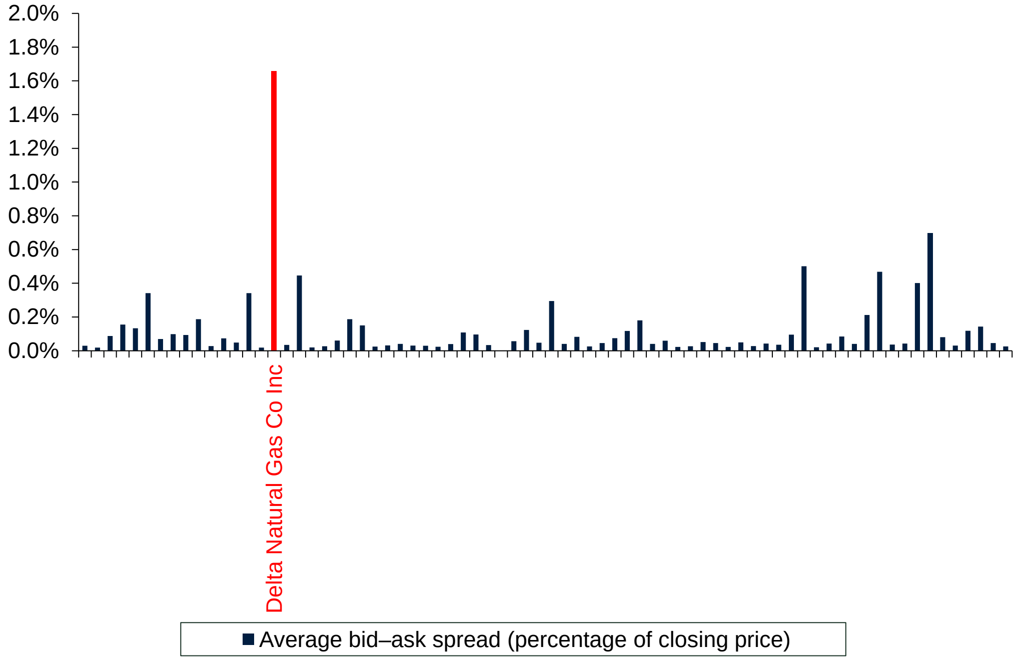
Figure 2.5 Average free float as a percentage of total outstanding shares



Source: Oxera analysis based on data from Datastream.

The bid–ask spread is a widely accepted measure of liquidity because it indicates how easy it is to buy and sell an asset at fair prices. It is the difference between the lowest price at which an asset is offered for sale in a market and the highest price that is offered for the purchase of the asset. The lower the bid–ask spread, the more liquid the stock. A relatively narrow bid–ask spread would imply that an individual can buy and sell the underlying asset at similar prices. It can also be a sign that there are a large number of buyers and sellers in the market. Applying this filter leads to the exclusion of Delta Natural Gas Co (USA) as an outlier.

Figure 2.6 Average bid–ask spread (percentage of closing price)



Note: The analysis cut-off date is 31 March 2016. Data not available for Jersey Electricity (JEL LN Equity).

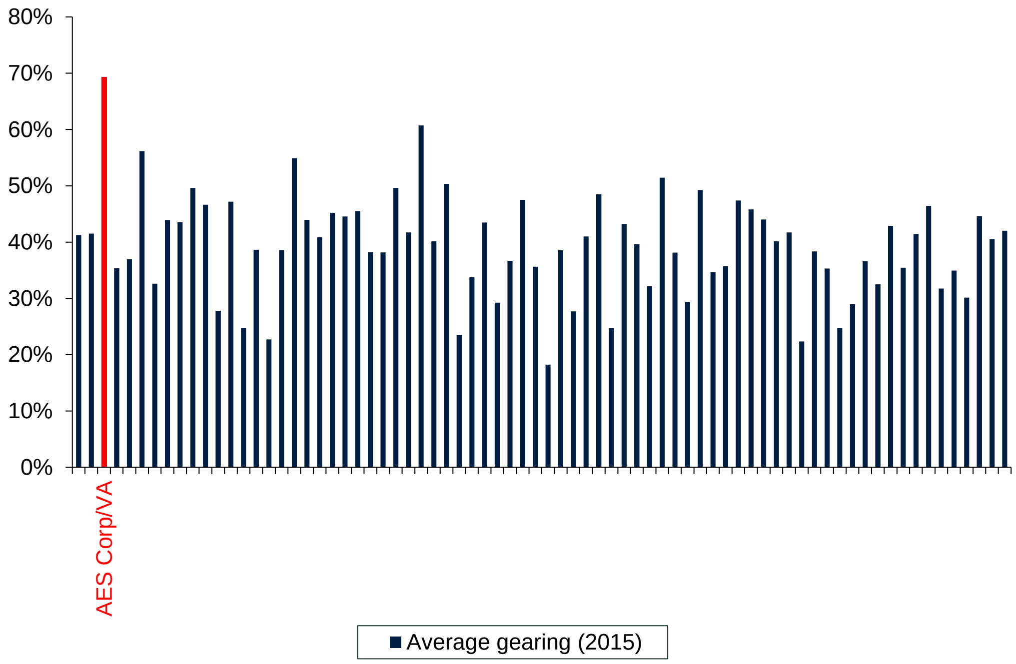
Source: Oxera analysis based on data from Bloomberg.

Gearing

The Commission assumed a zero debt beta to derive asset betas.[24] For companies with limited default risk, the debt beta may indeed be very close to zero, in which case a zero debt beta assumption is generally consistent with good regulatory practice.

However, as the gearing of a company increases, a zero debt assumption may no longer be valid. Energy regulatory precedents in the UK, from Ofgem, indicate that the usage of a zero debt beta is consistent with notional gearing levels of between 55% and 65% for electricity transmission and gas distribution companies. As shown in Figure 2.7, AES Corp (USA) is excluded based on its average gearing levels.

Figure 2.7 Average gearing



Source: Oxera analysis based on data from Datastream.

Market evidence on asset beta based on a refined sample

Oxera has used the Commission's asset beta spreadsheet[25] to estimate the asset betas for the refined sample of comparators, using the filters described above. Table 2.3 summarises this analysis.

Table 2.3 Five-year asset betas estimates of the refined sample

Sample	Four-weekly results	Weekly results	Daily results	*Commission's beta estimate for 2006-16[1]*
Gas	0.42 (0.16)	0.45 (0.16)	0.51 (0.12)	*0.43*
Electricity	0.27 (0.05)	0.30 (0.06)	0.36 (0.08)	*0.33*
Integrated	0.26 (0.08)	0.31 (0.08)	0.37 (0.10)	*0.31*
Energy	**0.30 (0.11)**	**0.34 (0.11)**	**0.40 (0.11)**	***0.34***

[24] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions; Topic paper 4: Cost of capital issues', 16 June, p. 64.
[25] Commerce Commission New Zealand (2016), 'Input-methodologies-review-draft-decisions-Asset-beta-spreadsheet-11-July-2016'.

Difference between 'gas' and whole 'energy' sample	*0.12*	*0.11*	*0.11*	*0.09*
Difference between 'gas' and 'electricity' sample	*0.15*	*0.15*	*0.16*	*0.10*

Note: Standard errors are reported in brackets. The asset beta estimates presented above are based on a simple average of betas for comparators in each sample. If a market capitalisation weighted average were used, the difference between the 'gas' and whole 'energy' samples would be 0.16–0.21, whereas the difference between the 'gas' and 'electricity' samples would be 0.21–0.25, based on five year betas for 2011–16. The cut-off date is set to 31 March 2016, consistent with the Commission's analysis. [1] Oxera understands from a discussion between First Gas and the Commission that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Source: The Commission's asset beta spreadsheet based on the Commission's comparator sample after applying liquidity and gearing filters.

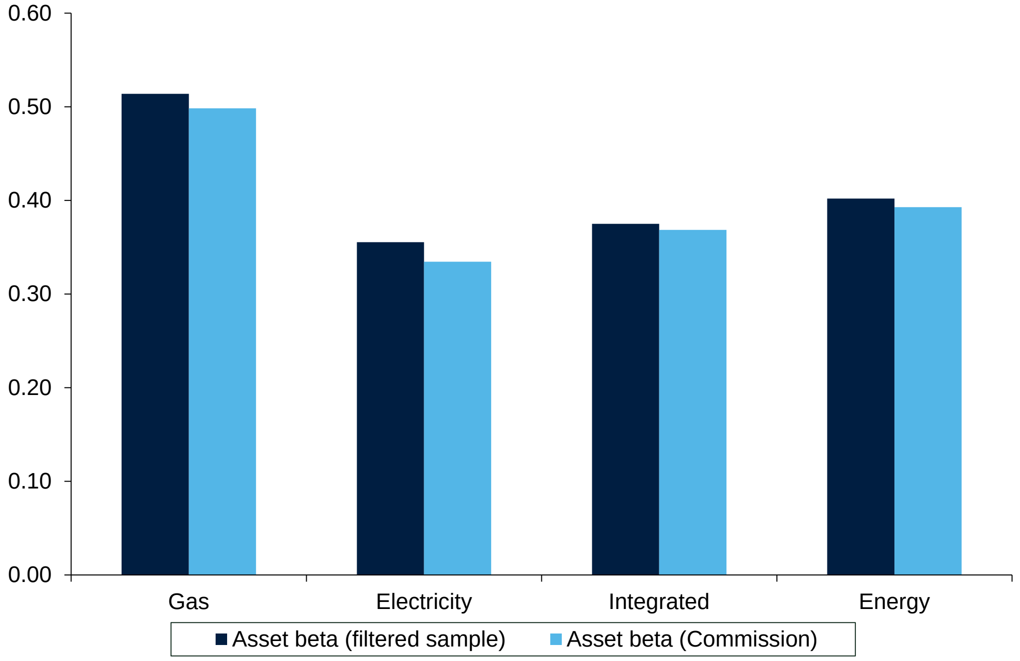
The results for the refined comparator sample show that the beta for gas companies within the whole 'energy' sample remains considerably higher than that for the electricity companies in the sample.[26] This evidence suggests that if the Commission were to now use the refined 'gas' and 'electricity' comparator sub-samples to set separate betas for gas and electricity, respectively, the evidence would justify a beta that is higher for gas pipeline businesses by up to 0.10–0.16. As shown in Table 2.3, the current market evidence supports an asset beta for gas pipeline businesses of 0.42–0.51. Furthermore, Table 2.3 shows that if a point estimate for the gas beta was derived based on the Commission's methodology using data over a longer period (i.e. 2006–16), the beta for gas companies would be around 0.43.[27]

If the Commission's prior methodology—i.e. applying an uplift for gas pipeline businesses relative to betas for electricity networks (that are derived from the 'energy' whole sample)—were retained, the market evidence would support an uplift of 0.09–0.12 for the refined sample. A detailed overview of individual asset betas is presented in Appendix A1.

It should be noted that the effect of the filtering criteria does not materially change the conclusions from the asset beta analysis using the Commission's original sample of 74 comparators. Figure 2.8 compares the filtered asset betas by comparator category to the original Commission sample. In addition, the standard errors of the asset beta estimated based on the gas sub-sample have marginally improved, falling from 0.17 to 0.16 for four-weekly and weekly asset betas and from 0.13 to 0.12 for daily asset betas.

[26] The differential still holds if market capitalisation weighted average asset betas are considered as reported in Appendix A1.
[27] Oxera understands that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Figure 2.8 Comparison of daily five-year asset betas—Commission's sample relative to refined sample

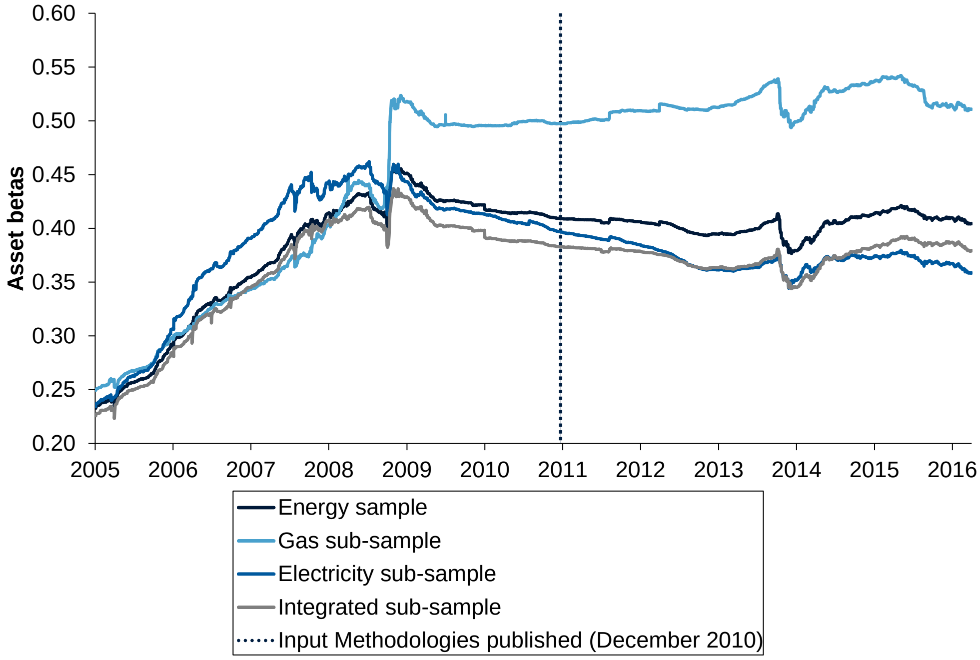


Note: The analysis cut-off date is 31 March 2016.

Source: Oxera analysis based on data from Bloomberg, Datastream and the Commission's asset beta spreadsheet.

Figure 2.9 below presents five-year daily rolling asset betas of the Commission's energy sample after applying liquidity and gearing filters. Based on a refined sample of comparators, the market evidence supports asset betas for gas having been persistently higher than those for electricity, and that this difference has grown over time.

Figure 2.9 Rolling five-year daily asset betas



Note: Rolling asset betas are presented until 31 March 2016, the same period of analysis undertaken by the Commission.

Source: Oxera analysis based on data from Bloomberg and Datastream.

In summary, all of the market evidence in this section consistently shows that the Commission's proposal to remove the existing uplift of 0.1 on the asset betas for gas pipeline businesses runs counter to how the market evidence on asset betas has evolved. This evidence suggests that if the Commission were to now use the refined 'gas' and 'electricity' comparator sub-samples to set separate betas for gas pipeline businesses and electricity networks, respectively, the evidence would justify a beta that is higher for gas pipeline businesses by up to 0.10–0.16. The selection of such a comparator sample that is matched for 'pure-play' characteristics, would also be consistent with the advice of Dr Lally.[28]

2.3.3 Frequency of observations for beta estimation

The Commission placed little weight on daily asset beta estimates, based on such estimates being too 'noisy' and potentially biased due to the presence of illiquid stocks.[29]

While the use of daily betas could produce imprecise estimates of asset beta in the presence of illiquid stocks, it provides a useful estimate of the asset beta due to an increase in the number of observations in the beta regression. When combined with sufficient liquidity checks to tackle volatility issues, daily betas can provide robust results.

Oxera considers that it is consistent with good regulatory practice to use daily beta estimates as well as other frequencies (e.g. weekly or monthly). For example, the UK Competition and Markets Authority (CMA, formerly the Competition Commission) used daily regressions to estimate beta in its determination on Northern Ireland Electricity, while it considered daily, weekly, and monthly asset betas in its decision on Bristol Water.[30] In addition, Ofgem relied on daily observations to calculate the asset beta for electricity distribution companies.[31]

Table 2.4 presents the standard errors of asset betas for the energy sample based on the Commission's methodology for estimating standard errors.[32]

Table 2.4 Standard errors of five-year asset betas for the energy sample

Sample	Four-weekly results	Weekly results	Daily results
Gas	0.16	0.16	0.12
Electricity	0.05	0.06	0.08

[28] Dr Lally suggests that betas should be estimated with reference to 'pure-play' businesses when such comparators exist. In the absence of pure-play comparators, he advocates that the betas of 'multi-divisional firms embodying such pure-plays' should be estimated. See Franks, J., Lally, M. and Myers, S. (2008), 'Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology', 18 December, p. 28.
[29] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions; Topic paper 4: Cost of capital issues', 16 June, pp. 71–72.
[30] Competition Commission New Zealand (2014), 'Northern Ireland Electricity Limited price determination', 26 March, Appendix 13.3; Competition and Markets Authority (2015), 'Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991', 6 October, Appendix 10.1.
[31] Ofgem (2013), 'Strategy decision for the RIIO-ED1 electricity distribution price control; Financial issues', p. 22.
[32] Commerce Commission New Zealand (2010), 'Input methodologies (electricity distribution and gas pipeline services) Reasons paper', 22 December, para. H11.19; Lally, M. (2008), 'The weighted average cost of capital for gas pipeline businesses', 28 October, Appendix 3.

Integrated	0.08	0.08	0.10
Energy	**0.11**	**0.11**	**0.11**

Source: The Commission's asset beta spreadsheet based on its energy sample after applying liquidity and gearing filters.

As shown in Table 2.4, the standard errors of asset betas based on daily observations are in line with the standard errors from weekly or four-weekly regressions. Therefore, once issues relating to liquidity have been sufficiently addressed, there is no evidence to suggest that daily estimates are less reliable than the weekly or monthly betas.

Furthermore, although the standard error of five-year daily asset betas based on the gas sub-sample is higher than that based on the energy and electricity sub-samples, it is lower than the standard errors of betas used by the Commission in other determinations. For example, the Commission relied on datasets with standard errors of 0.30–0.31 when estimating the regulatory allowed asset beta for airports. [33] This suggests that a narrower sample of relevant gas comparators is sufficiently robust.

Finally, there is no academic consensus for selecting the optimal frequency of observations for beta estimation. Some academics have relied on lower-frequency observations, for example weekly or monthly.[34] On the other hand, Daves, Ehrhardt and Kunkel (2000) recommended the use of daily returns for the purposes of financial management of a company due to the lower standard errors of the beta estimates.[35] In addition, Cenesizoglu and Reeves (2013) have outlined a mixed-frequency approach for measuring systematic risk—combining both daily and monthly observations in a single asset pricing model. The authors found that daily observations improve the explanatory power of the model.[36]

Therefore, there does not appear to be compelling evidence to reject the usage of daily asset betas in determining the allowed asset beta for gas pipeline businesses.

[33] Commerce Commission New Zealand (2016), 'Input-methodologies-review-draft-decisions-Asset-beta-spreadsheet-11-July-2016'.
[34] For example, Fama, E.F. and MacBeth, J.D. (1973), 'Risk, Return, and Equilibrium: Empirical Tests', *The Journal of Political Economy*, **81**:3. (May - Jun., 1973), p. 614; and Jagannathan, R. and Wang, Z. (1996), 'The Conditional CAPM and the Cross-Section of Expected Returns', March, p. 19.
[35] Daves, P.R., Ehrhardt, M.C. and Kunkel, R.A. (2000), 'Estimating systematic risk: the choice of return interval and estimation period', *Journal of Financial and Strategic Decisions*, **13**:1, Spring.
[36] Cenesizoglu, T. and Reeves, J.J. (2015), 'CAPM, Components of Beta and the Cross Section of Expected Returns', 12 November.

3 Differences in fundamental risks between gas and electricity networks

The possible differences in systematic risks faced by gas pipeline businesses and electricity networks need to be carefully considered and appropriately reflected in the cost of capital estimates for these networks.

This section outlines a number of potentially relevant differences between gas and electricity networks in New Zealand. The section is structured as follows.

- Section 3.1 provides an overview of the factors that the Commission's expert, Dr Lally, considers relevant in assessing systematic risk.
- Section 3.2 presents analysis that supports the finding that there are higher demand-side risks for NZ gas pipeline businesses than NZ electricity networks (i.e. higher volume volatility of consumption and higher income elasticity of demand).
- Section 3.3 discusses how NZ gas pipeline businesses are characterised by higher asset risk relating to their relative immaturity compared with NZ electricity networks. This includes consideration of the following factors:
  - gas pipeline businesses have higher levels of long-run growth options;
  - relatively low penetration rates for the greenfield gas network imply higher asset stranding risk.

3.1 Classification of systematic risk drivers

Since the Commission's draft decision is largely based on Dr Lally's expert advice, it is useful to examine his classification of systematic risk drivers in order to understand how the beta for gas pipelines might be calibrated in New Zealand (see Table 3.1 below).

Table 3.1 Dr Lally's classification of systematic risk drivers

Factor	Excerpt from Dr Lally's assessment	Oxera comment	Higher gas network risk?
Nature of product or service	'The first factor is industry, i.e. the nature of the product or service. Firms producing products with low income elasticity of demand (necessities) should have lower sensitivity to real GNP shocks than firms producing products with high income elasticity of demand (luxuries), because demand for their product will be less sensitive to real GNP shocks… Rosenberg and Guy (1976, Table 2) document statistically significant differences in industry betas after allowing for various firm specific characteristics, and these differences accord with intuition about the income elasticities of demand. For example energy suppliers have particularly low betas whilst recreational travel is particularly high.'	See section 3.2—evidence on i) volatility in average consumption per connection point and ii) volatility in the number of connection points suggests that gas has more volatile demand than electricity in New Zealand, implying higher asset risk for gas networks	✓
Nature of the customer	'The second factor is the nature of the customer. There are a number of aspects to this. One of them is the split between private and public sector demand. Firms producing a product whose demand arises exclusively from the public sector should have lower sensitivity to real GNP shocks than for firms producing a similar product demanded exclusively by the private sector, because demand should then be less sensitive to real GNP shocks. A second aspect of customer composition is the residency mix, i.e., demand from foreigners tends to reduce the asset beta... A third aspect of customer composition is the personal/business mix, and the former may be less sensitive to GNP shocks in the case of gas pipeline businesses.'	See section 3.2—Houston Kemp finds that residential consumers in New Zealand are more sensitive to GNP shocks than industrial consumers. This is plausible, as the gas market in New Zealand is not mature and consumers have the option to switch off their connection to the mains gas network	✓
Fixed vs variable pricing	The third factor is pricing structure. Firms with revenues comprising both fixed and variable elements should have lower sensitivity to real GNP shocks than firms whose revenues are entirely variable. Such fixed components are embodied in the revenues of gas pipeline businesses.	See section 3.2—since gas customers in New Zealand can choose to switch off their connection to the mains gas network (but not to the electricity network) to avoid fixed daily charges, this implies higher asset risk for gas networks	✓
Contractual restraints	The fourth factor is the duration of contract prices with suppliers and customers. The effect of this on beta will depend upon the type of shock and the firm's reaction to it in the absence of a temporarily fixed price. For example, in the absence of any such restrictions on prices, and in the face of a positive economy-wide demand shock, a firm might increase its output price. However an output price that is contractually fixed for some period prevents a firm from immediately acting in that way, and thereby reduces the firm's beta. By contrast, in the presence of an adverse cost shock (which induces an adverse economy-wide reduction in output), the same restriction on output price also prevents a firm from immediately raising its output price to mitigate the adverse cost shock, and this magnifies its beta. In respect of the gas pipeline businesses, long-term contracts exist with some of their customers, and in some cases with their suppliers.	Since contractual arrangements with suppliers and customers will vary for each network, Oxera has not assessed these arrangements on an industry-wide basis for gas and electricity in New Zealand	n/a

Factor	Excerpt from Dr Lally's assessment	Oxera comment	Higher gas network risk?
Form of control	'The fifth factor is the presence of regulation… Price cap regulation involves a regulator setting prices for a fixed term (commonly five years), except in respect of "uncontrollable" costs for which automatic "pass-through" is permitted…The fact that significant macro-economic cost shocks may not induce a rapid revision to prices, along with the exposure to divergences between efficient and actual costs, implies that firms subject to this form of regulation will face greater risk than firms subject to rate-of-return regulation… Lally (2002c) attributes part of the difference in asset betas to market leverage differences, but this still leaves a substantial residue, apparently attributable to the difference in regulatory regime.'	**Implications** The nature of regulation in the USA is different—e.g. due to a greater use of rate of return regulation, firms are less likely to suffer from cost shocks. Other things being equal, US betas are likely to be lower. The largely US-centric sample of gas comparators may understate the beta for NZ gas networks, so the Commission may consider selecting a point estimate at the top of its range from the analysis of comparator betas As Dr Lally acknowledges elsewhere, he expects the form of the cap to have an impact. It is reasonable to expect higher risk for gas networks under a price cap than for electricity networks under a revenue cap[1]	✓
Monopoly power	'The sixth factor is the degree of monopoly power, i.e. price elasticity of demand. So long as firms act to maximise their cash flows, theory offers ambiguous results…The empirical results in this area are equally mixed…In respect of gas pipeline businesses, they seem to be local monopolists but their monopoly power may be diluted by the countervailing power of their large customers and the presence of competing power sources. So, if monopoly power affects beta, then the effect of any such countervailing power and competing energy sources would be to mitigate that beta effect.'	Dr Lally's view of the extent to which monopoly power influences the beta is inconclusive. Oxera has not assessed this factor	n/a
Growth options	'The seventh factor is the extent of the firm's real options, most particularly the option to adopt new products ("growth" options)… The existence of such growth options should increase the firm's sensitivity to real GNP shocks, because the values of these growth options should be more sensitive to real GNP shocks than the firm's value exclusive of them, and these two value components should be positively correlated…Prima facie, gas pipeline businesses do not have significant growth options arising from new products. However their networks are incomplete and therefore the option to expand their existing networks may be significant.'	See section 3.3—the relative immaturity of the NZ gas networks implies significantly higher asset risk via growth options than mature electricity networks	✓

Factor	Excerpt from Dr Lally's assessment	Oxera comment	Higher gas network risk?
Operating leverage	'The eighth factor is operating leverage. If firms have linear production functions and demand for their output is the only random variable, then firms with greater operating leverage (higher fixed operating costs to total operating costs) should have greater sensitivity to real GNP shocks because their cash flows will be more sensitive to own demand, and hence to real GNP shocks.'	Due to data availability issues, it has not been possible for Oxera to undertake analysis of operating leverage for NZ gas and electricity networks over the whole price control period, using comparable forecasts of projected costs and asset values	n/a
Market weight	'The last factor is market weight. Increasing an industry's weight in the market proxy against which its beta is defined will draw its beta towards 1, although not necessarily in a monotonic fashion (Lally and Swidler, 2003). Gas pipeline businesses and possible comparators have very limited weights in market indexes. Consequently this point is not significant.'	Oxera agrees with Dr Lally that gas and electricity networks do not dominate the market indices used in estimating betas. Therefore, this point is not relevant in assessing the risk differential between gas and electricity networks	n/a

Note: [1] Specifically, Dr Lally notes his 'belief that there is likely to be a beta margin (of unknown degree) for price capping, because those subject to it bear an additional source of risk (volume) that would elevate beta'. See Lally, M. (2016), 'Review of WACC Issues', 25 February, p. 4.

Source: Lally, M. (2016), 'Review of WACC Issues', 25 February.

3.2 Gas networks face higher demand-side risks

In his 2008 report, Dr Lally identifies the nature of the industry as a key source of systematic risk for gas:

> The sensitivity of unlevered returns to real GNP shocks will be driven by a number of underlying factors. The first factor is industry, i.e. the nature of the product or service.[37]

In this section we present evidence that gas faces higher demand-side risk than electricity in the NZ energy market. Specifically, gas faces:

- **higher volume risk** than electricity, as depicted by an analysis of the relative volatility of gas and electricity consumption (section 3.2.1);
- **higher income elasticity of demand** than electricity, and is therefore more sensitive to systematic shocks (section 3.2.2).

Oxera notes that the higher volume volatility faced by gas pipeline businesses could be due to either systematic or idiosyncratic risks. Higher volatility does not necessarily indicate a higher asset beta. However, as outlined in this section, the gas market in New Zealand is not only characterised by higher volume volatility, but also subjected to higher income elasticity of demand. As higher income elasticity of demand implies greater sensitivity to systematic shocks, the higher volume risk faced by gas pipeline businesses in New Zealand, in comparison to electricity networks, points to a higher asset beta for gas.

3.2.1 Volume volatility is higher for gas networks

Aggregate demand for gas and electricity is driven by two factors:

- the number of consumers;
- usage per consumer.

These two factors are considered below.

The number of consumers

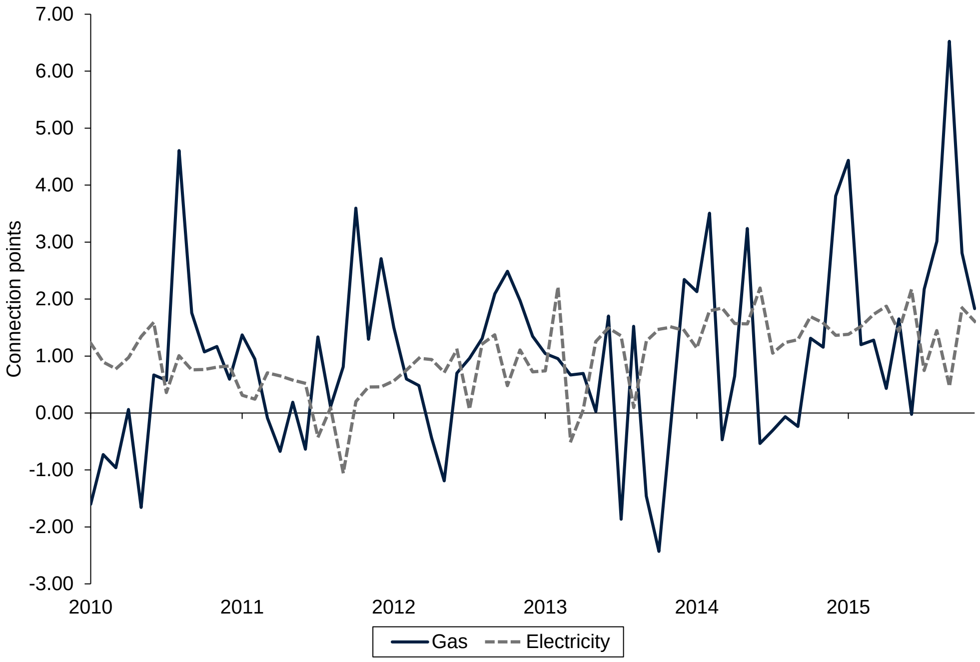
Unlike the electricity market in New Zealand, which is mature, the gas market is not yet fully saturated. In 2016, the proportion of connection points to the number of households in New Zealand was 16% for gas, compared with 121% for electricity (where the ratio exceeds 100% for electricity since there are also a number of connection points to non-households, e.g. industrial premises).[38] Therefore, it is likely that the number of consumers in the gas market is small and growing, whereas the number of consumers in the electricity market is stable, as most of the NZ population is already likely to have access to electricity. The number of gas consumers is likely to grow in a more volatile fashion than the number of electricity consumers. Whether consumers choose to connect to the gas pipelines is likely to vary with the state of the economy, i.e. consumers are more likely to connect to the gas pipelines in a period of economic growth rather than in a recession.

Although a proportion of connection points are to industrial premises, the variation in the number of gas connection points can provide a useful indication

[37] Lally, M. (2008), ‘The weighted average cost of capital for gas pipeline businesses’, 28 October, p. 49.
[38] Oxera calculation, based on data from Gas Industry, Electricity Authority, and Statistics New Zealand.

of the variation in the number of consumers. Figure 3.1 shows the mean-scaled monthly change in the number of connections (i.e. number of new connection points, net of disconnections).[39] Specifically, the monthly variation in the number of new gas connections is more than double that of electricity connections.[40] This shows that the electricity market in New Zealand is in a relative 'steady state' of maturity, with relatively constant growth in the number of connections over time. By contrast, there is marked volatility in the number of gas connections that have been achieved over time.

Figure 3.1 Monthly variations in the number of new gas and electricity connection points in New Zealand, 2010–16 (mean-scaled)



Note: The time series have been scaled (i.e. divided) by average growth (i.e. the average change in the number of connection points).

Source: Gas Industry, Electricity Authority and Oxera calculations.

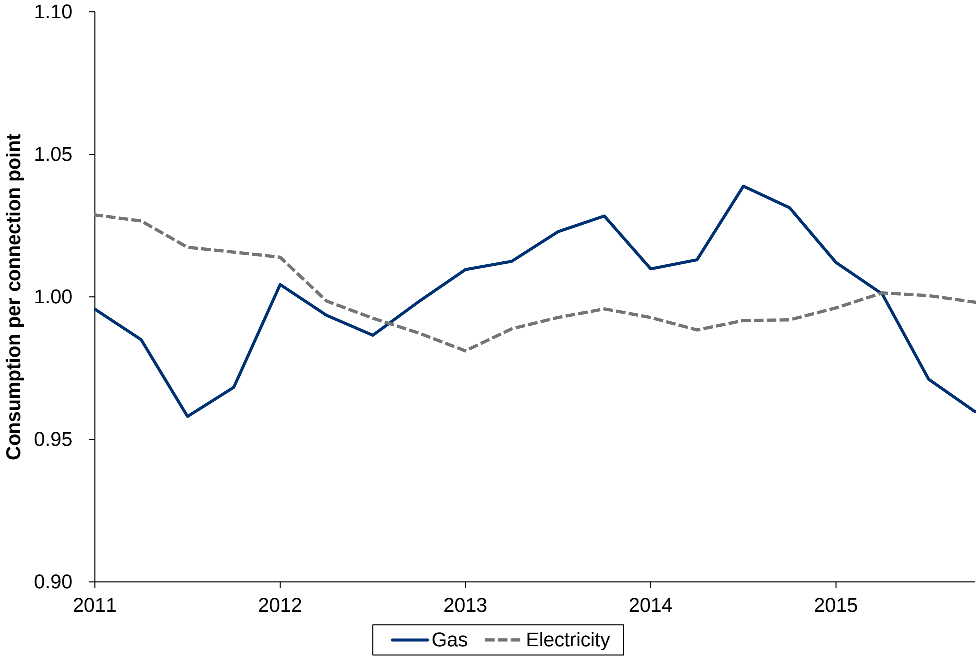
Usage per consumer

Even if the relative volatilities of gas and electricity usage per consumer were similar, the differences in the volatility of the number of consumers would indicate that gas is characterised by a higher relative volatility in demand than electricity. This would warrant a higher asset beta to the extent that this volatility is systematic in nature. However, as shown below, gas consumption per consumer is relatively more volatile than electricity consumption per consumer.

The usage per consumer can be proxied by the consumption per connection point. As shown in Figure 3.2 below, consumption of gas per connection point is around 70% more volatile than consumption of electricity per connection point.[41]

[39] The time series have been scaled (i.e. divided) by average growth (i.e. the change in the number of connection points).
[40] The coefficient of variation (i.e. the mean-adjusted standard deviation) of the monthly changes in gas connection is six times that of the monthly changes in electricity connections.
[41] Volatility in this context has been measured using the coefficient of variation, which is the mean-adjusted standard deviation.

Figure 3.2 Quarterly variation in gas and electricity consumption per connection point in New Zealand, 2011–16 (Gigajoules, mean-scaled)



Note: Both gas and electricity time series have been 'de-trended' in order to ensure comparability. Specifically, Oxera calculated an annual moving average to account for seasonal fluctuations in consumption. The time series were then scaled (i.e. divided) by the average consumption per connection point.

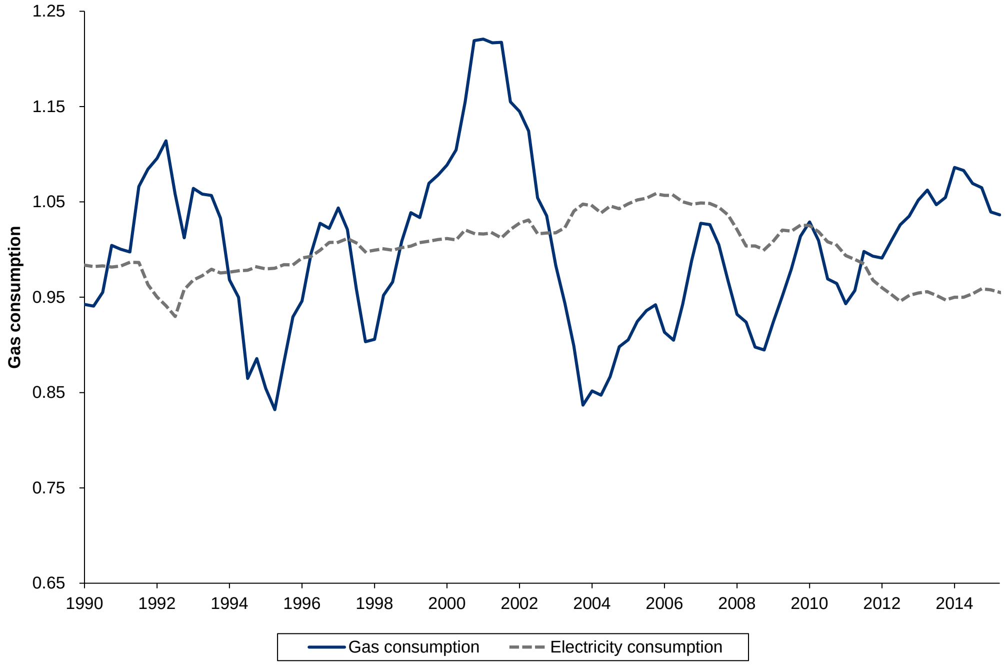
Source: Gas Industry, Electricity Authority and Oxera calculations.

Aggregate demand

The higher relative volatility of gas in terms of the number of consumers and usage per consumer leads to higher volatility in the overall demand for gas in comparison to electricity. Figure 3.3 below illustrates the de-trended variation in total quarterly consumption for both gas and electricity in New Zealand.[42] Here, the quarterly variation in electricity consumption is less than half that of gas.

[42] Both gas and electricity time series have been 'de-trended' in order to ensure comparability. Specifically, Oxera calculated an annual moving average to account for seasonal fluctuations in consumption, and fitted a linear trend for each time series. The time series were then scaled (i.e. divided) by the trend line.

Figure 3.3 Quarterly variations in gas and electricity consumption in New Zealand, 1990–2016 (petajoules, de-trended)



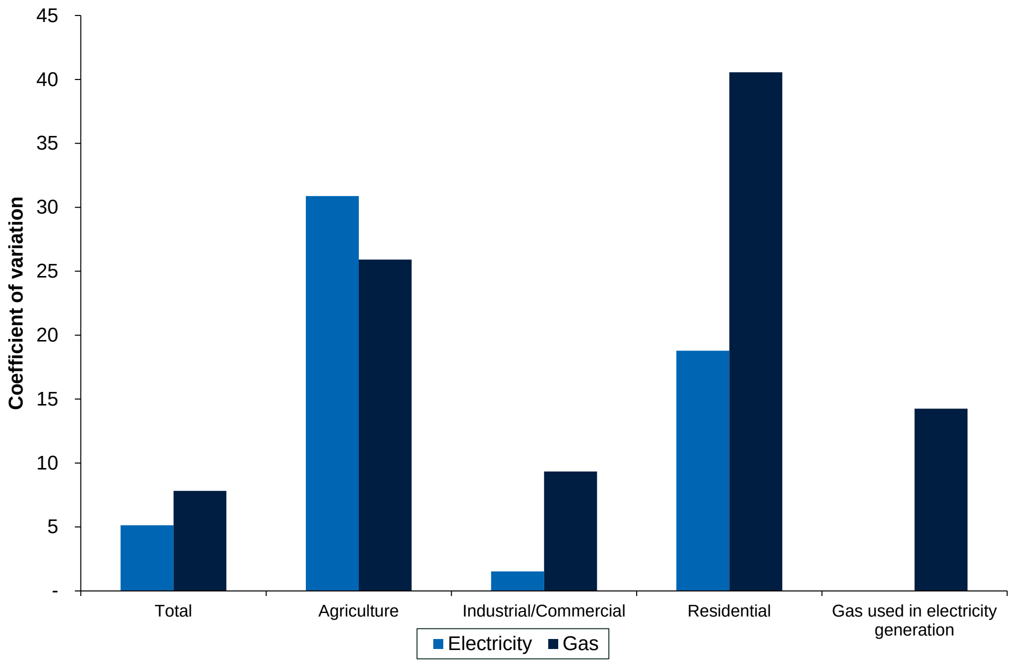
Note: Both gas and electricity time series have been 'de-trended' in order to ensure comparability. Specifically, Oxera calculated an annual moving average to account for seasonal fluctuations in consumption, and fitted a linear trend for each time series. The time series were then scaled (i.e. divided) by the trend line.

Source: MBIE and Oxera calculations.

Figure 3.4 below shows the volatility of gas and electricity consumption divided by residential, industrial/commercial and other sectors calculated with data compiled by the Ministry of Business, Innovation and Employment (MBIE).[43] The data shows that the volatility of electricity consumption exceeds that of gas consumption only in the agriculture sector, while the volatility of gas consumption exceeds that of electricity consumption in all other areas. In terms of total gas and electricity consumption, the usage of gas across the sectors is around 50% more variable than electricity.

[43] Volatility in this context has been measured using the coefficient of variation, which is the mean-adjusted standard deviation of a quarterly time series of levels of consumption in each sector.

Figure 3.4 Volatility of electricity and gas consumption, by sector, June 2013 to March 2016



Note: 'Coefficient of variation' is defined as the mean-adjusted standard deviation of a quarterly time series of levels of consumption in each sector. Breakdown of quarterly electricity consumption by sector is available only from June 2013 onwards.

Source: MBIE and Oxera calculations.

These findings are in line with the data presented earlier in this sub-section, demonstrating that gas consumption is more volatile than electricity consumption. The results of a volatility analysis undertaken by Oxera show that consumption of gas is considerably more variable than that of electricity. To the extent that this is an indicator of the volatility in the overall returns of the gas pipeline businesses and electricity networks, this might indicate that the systematic risk of gas pipeline businesses (whether transmission or distribution) is greater than that of electricity networks.

The impact of volatility on systematic risk differentials between energy networks is relevant because asset betas should be directly related to the degree of volatility in companies' returns. The implication is that greater volatility of returns would be expected to be accompanied by a higher asset beta.

3.2.2 Income elasticity of demand is higher for gas networks

As recognised by Dr Lally, higher income elasticity of demand of an industry would imply greater sensitivity to systematic shocks, and therefore a higher beta for that industry.

> […] differences in beta are driven by differences in sensitivity to GDP shocks, and GDP shocks affect the demand for a product in accordance with its income elasticity of demand.[44]
>
> Firms producing products with low income elasticity of demand (necessities) should have lower sensitivity to real GNP shocks than firms producing products with high income elasticity of demand (luxuries), because demand for their product will be less sensitive to real GNP shocks. Rosenberg and Guy (1976,

[44] Lally, M. (2008), 'The weighted average cost of capital for gas pipeline businesses', 28 October, p. 8.

Table 2) document statistically significant differences in industry betas after allowing for various firm specific characteristics, and these differences accord with intuition about the income elasticities of demand.[45]

As shown in Table 3.2, academic evidence suggests that income elasticity of demand for gas is higher than income elasticity of demand for electricity.

Table 3.2 Academic evidence on income elasticity of demand

Paper	Residential/ industrial	Gas	Electricity	Countries	Time period
Liu (2004)	Residential	0.14–0.49	0.06–0.30	23 OECD countries	1978–99
	Industrial	0.38–1.36	0.30–1.04		
Akmal and Stern (2001)	Residential	1.882	0.523	Australia	1969–98

Note: Income elasticity is defined as percentage change in quantity resulting from percentage change in income.

Source: Liu, G. (2004), 'Estimating energy demand elasticities for OECD countries', Discussion Paper No. 373, Statistics Norway; Akmal, A. and Stern, D. (2001), 'Residential energy demand in Australia – An application of dynamic OLS', October.

Houston Kemp has estimated the income elasticities of demand for gas and electricity in New Zealand over the period 1990–2016, and has shown that income elasticity of demand for gas is higher than that for electricity (see Table 3.3), which would imply a higher asset beta for gas than for electricity.

Table 3.3 Income elasticity of demand for electricity and gas in New Zealand

	Residential	Commercial
Electricity	0.80–0.82	1.37–1.42
Gas	3.61–4.18	1.38–1.62

Note: Income elasticity is defined as percentage change in quantity resulting from percentage change in income.

Source: Houston Kemp (2016), 'Asset beta for gas pipeline businesses', May, p. 9.

However, the Commission has raised some concerns in relation to Houston Kemp's analysis, as follows.[46]

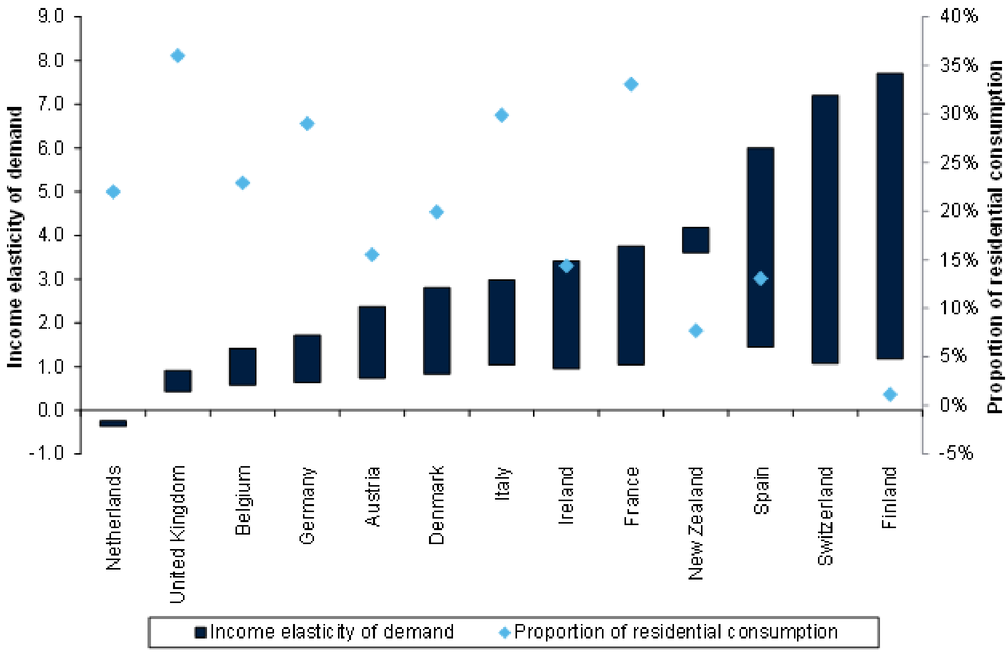
- Houston Kemp's income elasticities of demand estimates for both residential and commercial gas customers are very high, and differ significantly from alternative estimates.
- There is no evidence on whether income elasticities for NZ gas companies differ from those in other countries.
- It is not clear that the income elasticity of demand will have a material impact on the systematic risk faced by NZ electricity line and gas pipeline businesses because of the way they are regulated.

The Commission's concerns are considered below. First, there is wide variation in the range of estimates of income elasticity of demand for gas across countries. As shown in Figure 3.5, Asche, Nilsen and Tveteras (2008)

[45] Lally, M. (2008), 'The weighted average cost of capital for gas pipeline businesses', 28 October, p. 49.
[46] 'Under a revenue cap regulated businesses receive their revenue allowance each year, independent of changes to GDP or incomes. Under a weighted average price cap, regulated businesses are exposed to forecast risk, but it is not clear that this will be correlated with the market'. See Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, para. 335.

estimates that the income elasticity of demand for residential gas consumers ranges from -0.36 to 7.70; Houston Kemp's estimates for the income elasticity of demand for residential gas consumers fall within this range, as shown in Figure 3.5. Even if the Commission considers that Houston Kemp's point estimates for the income elasticity of demand for gas in New Zealand are high, the results indicate that the income elasticity of demand for gas is significantly higher than that for electricity.

Figure 3.5 Income elasticity of demand for residential gas consumers by country



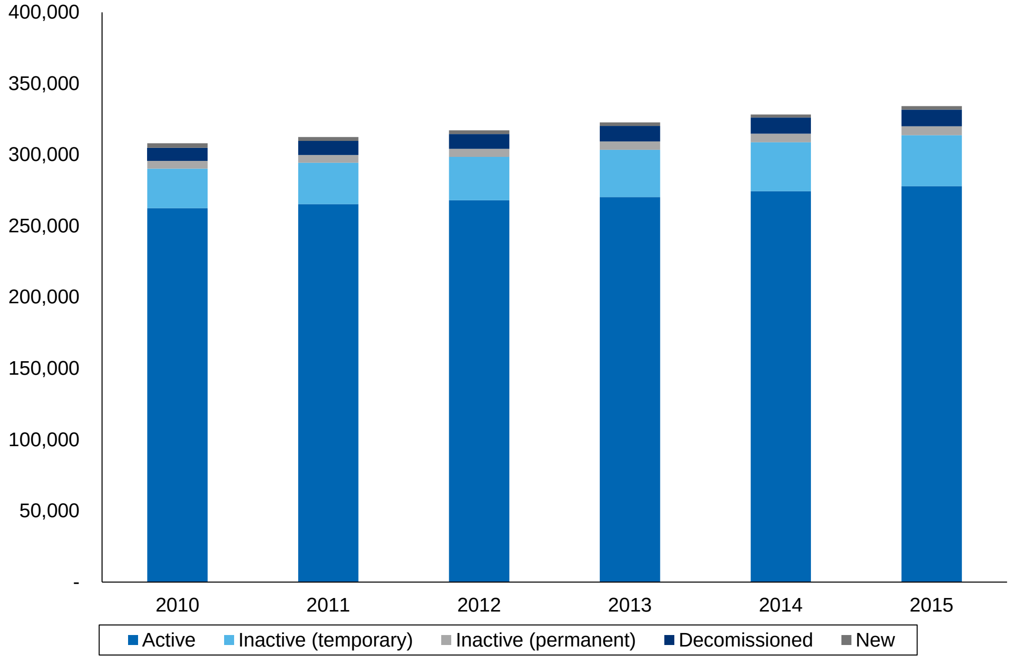
Note: Income elasticity is defined as percentage change in quantity resulting from percentage change in income. Income elasticity of demand for New Zealand was estimated by Houston Kemp over the period 1990–2016; the range estimated by Houston Kemp is narrower than the estimates provided y Asche et al. (2008). Income elasticity of demand for all other countries has been estimated using data over the period 1978–2002. Data on the proportion of residential consumption is not available for Switzerland.

Source: Asche, F., Nilsen, O.B. and Tveteras, R. (2008), 'Natural gas demand in the European household sector', *The Energy Journal*, **29**:3, pp. 27–46; Houston Kemp (2016), 'Asset beta for gas pipeline businesses', May, p. 9; residential gas consumption (as a proportion of total gas consumption) in various EU countries in 2014 has been calculated based on Eurostat data; the proportion of residential gas consumption in New Zealand was calculated based on data from MBIE.

Second, the specific characteristics of the gas market in New Zealand could explain why income elasticity of demand in New Zealand may differ from that in other countries. A possible explanation for the wide variation in income elasticities of demand in various countries is that demand may be less income elastic in countries where gas is widely used by households. It is possible that a higher proportion of residential consumption characterises markets in which gas is considered an essential service. As shown in Figure 3.5, countries that have low income elasticity of demand tend to have higher residential consumption of gas (as a proportion of total gas consumption in the country). Also, Liu (2004) argues that income elasticity of demand for residential consumers in OECD countries is low because energy markets in these countries are mature and, consequently, consumption of energy goods in the residential sector is likely to increase only to a moderate extent when income increases.[47] However, gas markets in New Zealand, unlike those in OECD countries, are not mature—for example, in 2010, only 15% of households in New Zealand had gas connections, compared with 56% in Australia and 86% in the UK.[48]

High income elasticity of demand for residential consumers could be explained by the fact that consumers in New Zealand have the choice of temporarily disconnecting from the network by turning off the gas valve while remaining physically connected to the network, which is a feature unique to the NZ market. As shown in Figure 3.6, around 9–11% of total gas connections in New Zealand were temporarily inactive over 2010–16. By contrast, it does not appear reasonable to assume that any customers would choose to 'switch off' their electricity connections on a temporary voluntary basis.

Figure 3.6 Number of gas connection points by activity status



Note: 'Active', gas is able to flow and the customer either has a contract with a retailer or the premises is vacant; 'Inactive (temporary)', gas is unable to flow due to a temporary disconnection; 'Inactive (permanent)', gas is unable to flow due to a permanent disconnection; 'Decommissioned', the connection point has been decommissioned; 'New', newly created connection points.

Source: Gas Industry.

Third, the Commission has noted that it is not clear whether the income elasticity of demand will have a material impact on the systematic risk faced by NZ electricity networks and gas pipeline businesses because of the way they are regulated. This criticism does not appear wholly justified in the context of the energy regulatory regimes in New Zealand. This is because gas distribution is expected to remain subject to price cap regulation while the other energy networks (i.e. gas transmission, and electricity transmission and distribution) will be subject to a revenue cap form of control from the next control. It is therefore expected that the gas distribution business within gas networks will be exposed to volume risk to a higher degree than other energy network businesses in New Zealand. Furthermore, as gas pipeline businesses are

[47] Liu, G. (2004), 'Estimating energy demand elasticities for OECD countries', Discussion Paper No. 373, Statistics Norway, p. 14.
[48] Economics Insight data provided by First Gas.

growing from a smaller base, they have greater reliance on new connections and, therefore, greater forecasting risk for future demand in comparison to electricity. Such risks are not fully compensated for under a price cap form of control.

Furthermore, to the extent that gas transmission is subject to higher volume volatility than electricity transmission, it is possible that gas will still retain higher asset risk than electricity under a similar revenue cap form of control. This is because the application of a revenue cap assumes a certain volume assumption, multiplied by a tariff estimate. If NZ gas transmission networks suffer a shortfall in volumes (e.g. due to low connections growth, or to low gas consumption by existing customers), the networks may not be able to price up to the level consistent with the revenue cap, since an increase in price would deter further connections. In short:

- gas distribution networks are expected to face higher risk than electricity distribution because of higher volume risk exposure within a price cap form of control;
- gas transmission networks are expected to face higher risk than their electricity counterparts due to potential difficulties in pricing up to the revenue cap if there is a significant shortfall in expected volumes (e.g. due to the higher volume volatility as analysed in this section).

3.3 Network growth

It is well recognised in the academic literature that the existence of growth options increases a firm's sensitivity to systematic shocks.[49] This is because values of growth options are more sensitive to systematic shocks than a firm's value exclusive of these options.

Dr Lally recognises that gas pipeline businesses face higher growth options and should therefore have a higher beta.

> Prima facie, gas pipeline businesses do not have significant growth options arising from new products. However their networks are incomplete and therefore the option to expand their existing networks may be significant.[50]
>
> First, unlike the lines businesses, which have largely exhausted the opportunity to expand their networks, the gas businesses have significant options to expand their networks. This may raise their asset betas relative to the lines businesses.[51]

This is supported by theoretical and empirical academic evidence, as shown in Box 3.1.

[49] Academic evidence includes Black, F. and Scholes, M. (1973), 'The Pricing of Options and Corporate Liabilities', *Journal of Political Economy*, **81**, pp. 637–54; Chung, K. and Chareonwong, C. (1991), 'Investment Options, Assets in Place and the Risk of Stocks', *Financial Management*, **20**:3, pp. 21–33; Myers, S. and Turnbull, S. (1977), 'Capital Budgeting and the Capital Asset Pricing Model: Good News and Bad News', *Journal of Finance*, **32**, pp. 321–32.
[50] Lally, M. (2008), 'The weighted average cost of capital for gas pipeline businesses', 28 October, p. 52.
[51] Lally, M. (2008), 'The weighted average cost of capital for gas pipeline businesses', 28 October, p. 62.

Box 3.1 Academic evidence on the effect of growth options on beta

- Chung and Chareonwong (1991) estimate how changes in growth opportunities and existing assets affect the beta of a firm, using the earnings-price ratio and the market over book value of equity as proxies. The authors' findings support the hypothesis that higher growth options lead to a higher overall equity beta.
- Bernardo Chowdhry and Goyal (2007) demonstrate that the beta of growth opportunities is greater than the beta of assets-in-place. The authors find that firms with above-average growth opportunities have higher firm unlevered betas than firms with below-average growth opportunities. Using the computer industry as an example, the authors show that a firm with high growth options has a beta that is 0.355 higher than a firm with low growth options. This difference in beta accounts for approximately 2% higher cost of capital for high growth option firms.
- Pindyck (1986) shows that for a typical firm, growth options should account for more than half of the market value. Pindyck's theoretical findings are consistent with Kester (1984), who estimates that the value of existing capital constitutes less than half of the market value of the firms in most cases. Furthermore, the author estimates that around 70–80% of the market value of equity comprises the value of growth opportunities in industries with high demand volatility.

Source: Bernardo, A.E., Chowdhry, B. and Goyal, A. (2007), 'Growth Options, Beta, and the Cost of Capital', *Financial Management*, **36**:2, June; Chung, K. and Chareonwong, C. (1991), 'Investment Options, Assets in Place and the Risk of Stocks', *Financial Management*, **20**:3; Kester, C. (1984), 'Today's Options for Tomorrow's Growth', *Harvard Business Review* (March-April), pp. 153–60; Pindyck, R. (1986), 'Irreversible Investment, Capacity Choice, and the Value of the Firm', NBER Working paper No. 1980, *National Bureau of Economic Research*, July.

3.3.1 Growth options exist despite gas networks being regulated

Dr Lally argues that given that gas pipeline businesses are subject to regulation, they no longer have growth options available.

> In particular, the option to expand a network affects beta to the extent that the option is valuable, and it is valuable to the extent that the expansion is expected to produce revenues in excess of costs. Furthermore, such excess revenues are more likely in the earlier scenario without formal regulation (to which Lally's analysis applied) than the current price or revenue control scenario because these controls constrain expected revenues to merely cover costs.[52]

However, for the reasons outlined below, an expectation or presumption of growth exists in gas pipeline businesses in New Zealand despite the businesses being subject to regulation.

- The gas market in New Zealand has low maturity compared with the electricity market. As natural gas is reticulated only on the North Island, about one-third of the population of New Zealand (i.e. those living on the South Island) do not have access to the gas network. Market penetration is also low on the North Island, as gas has only recently been reticulated. Although in the short run expected revenues are constrained for the duration of the five-year price control period, the gas networks still have growth options available in the long run. In particular, investors in gas pipeline businesses are able to have a dialogue with the regulator about potential expansion of the network, and whether to exercise these growth options.

- Gas distribution is subject to a price cap, presumably so that it has an incentive to grow the network. This suggests that there is still both an incentive and the ability to grow the gas network, which should support the notion of network growth options and higher systematic risk. Indeed, both the Commission and Dr Lally recognise that there are reasons to adjust the allowed beta in line with the regulatory form of control, even though the

[52] Lally, M. (2016), 'Review of WACC Issues', 25 February, p.6.

differential in risks under a price or revenue cap form of control is not easily quantified.[53] In this respect, Dr Lally has stated:

> Although this matches the Commerce Commission's 2010 view, my recommendation arises in spite of my belief that there is very likely to be a beta margin (of unknown degree) for price-capping over revenue-capping, because those subject to it bear an additional source of risk (volume) that would elevate beta.[54]

Oxera considers that the lack of such evidence does not mean that the issue should be disregarded. Where there is a clear *a priori* reason to believe that demand risk is higher under a price cap form of control, and that this risk is at least partly systematic, this should support the regulatory judgement of a higher beta for gas networks. This is in the context that gas pipeline businesses are partially subject to a price cap, compared with electricity networks which are fully subject to a revenue cap, in the forthcoming control period.

- All of the risks associated with the expected future shape of gas pipeline businesses in New Zealand are observed and reflected in the volatility of today's market value (price). However, the observed market value, ahead of associated investments actually being undertaken or committed, will only reflect the value of today's existing physical infrastructure and the (smaller) net present value of growth expectations. Thus, the beta observed today by reference to today's market value and experienced by investors at the present time is amplified relative to the long-run steady-state level observed for more mature networks. Gas in New Zealand is notably different from electricity in New Zealand in this regard, as recognised in the academic literature:

> […] the firm should be considered as a portfolio of tangible and intangible assets. The tangible assets are units of productive capacity in place-real assets-and the intangible assets are options to purchase additional units of productive capacity in future periods. The market value of the firm is (1) the present value of the tangible assets, plus (2) the sum of the option values, which corresponds to the "present value of growth." The risk (P) of an option is not the same as the risk of the asset the option is written on. Usually it is greater. If so, the larger the option value, relative to the value of assets in place, the greater is the systematic risk of the firm's stock. Thus, the systematic risk of the firm's stock is an over-estimate of the beta for tangible assets, and a rate of return derived from observed common stock p's will be an overestimate of the appropriate hurdle rate for capital investment whenever firms have valuable growth options.[55]
>
> The bad news is that the right asset beta depends on project life, the growth trend of expected cash flows, and other variables which are not usually considered important in assessing business risk. Moreover, for growth firms the right discount rate cannot be inferred from the observed systematic risk of the firm's stock, even if the firm invests only in projects of a single risk class. The reason is that growth opportunities affect observed systematic risk.[56]

- While Oxera has not undertaken a comprehensive review of gas networks in other jurisdictions that are captured in the Commission's beta comparator sample, such as US networks, we consider it likely that the gas networks in

[53] Commerce Commission New Zealand (2016), 'Input methodologies review draft decisions', Topic paper 4: Cost of capital issues, 16 June, para. 321.
[54] Lally, M. (2016), 'Review of WACC Issues', 25 February, p. 25.
[55] Myers, S. and Turnbull, S. (1977), 'Capital Budgeting and the Capital Asset Pricing Model: Good News and Bad News', *Journal of Finance*, **32**, pp. 331–32.
[56] Myers, S. and Turnbull, S. (1977), 'Capital Budgeting and the Capital Asset Pricing Model: Good News and Bad News', *Journal of Finance*, **32**, pp. 331.

other jurisdictions are more mature. Therefore, betas estimated based on comparators from mature markets may underestimate the betas of gas pipeline businesses in New Zealand, as the volatility faced by gas companies in New Zealand from growth options would not be captured within the market betas of comparators.

3.3.2 Greenfield investments and asset stranding risks

In the specific context of regulation of a greenfield infrastructure asset, utility investors are exposed to asymmetry due to capped upside returns but unlimited downside returns. Since gas pipeline businesses are growing from a smaller base (compared with the customer base for mature electricity networks), they have greater reliance on new connections and, therefore, greater forecasting risk for future demand in comparison to electricity. Risks related to uptake, such as the potential that not enough consumers connect to a newly built network, can lead to investments in gas pipelines becoming stranded. In general, greenfield network expansion by gas pipeline businesses is expected to be risky, compared with network maintenance activities undertaken by mature electricity networks. To grow its network, a gas pipeline business would need to undertake sunk cost investments, which may or may not be remunerated eventually by uptake of new connections. The demand for new connections is at least partially dependent on housing growth, which in turn is affected by the economic cycle (i.e. a systematic risk). If sufficient growth cannot be achieved, the sunk cost of investment in network assets will be stranded.

There are regulatory precedents in which regulators have looked at uplifting the weighted average cost of capital for greenfield networks in order to account for risks with uptake, which can lead to investments becoming stranded.

- In the context of regulated access to next generation access networks in the telecommunications sector, the European Commission has allowed for an exceptional premium above the cost of capital, to reflect investment risk related to asset stranding such as uncertainty regarding technological progress.[57]
- In the UK, the Competition Commission (now the CMA) suggested that higher ex post returns for Phoenix Natural Gas Ltd (PNGL), a natural gas distribution and gas service business in Northern Ireland, were appropriate given the high level of ex ante risks faced in constructing a greenfield gas distribution network in Northern Ireland:

> Specifically, PNGL had significant volume risk exposure due to the uncertainty of gas connections uptake and usage. At the same time, PNGL's original licence envisaged the recovery of high upfront capex and opex towards the end of a 20-year period with a risk of under-recovery due to the uncertain demand for gas connections.[58]

The Commission has considered whether to allow gas pipeline businesses the option of shortening asset lives to mitigate stranding risk. However, as gas networks are still growing, the burden on each consumer of shortening asset lives to permit accelerated recovery of sunk investment costs would be high. The regulated asset base (RAB) of gas pipeline businesses per connection

[57] European Commission (2010), 'Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA)', *Official Journal of the European Union*, L 251/45.
[58] Competition Commission (2012), 'Phoenix Natural Gas Limited price determination', 28 November, para. 7.32.

point is NZ$7,720, compared with NZ$4,384 for electricity networks.[59] This suggests that attempting to recover the RAB over a shorter period of time would imply a disproportionate increase in gas tariffs (relative to electricity tariffs). An increase in gas tariffs might deter future connections growth and/or hamper gas networks' ability to price up to their cap if customers perceive the tariff increase to be untenable and switch off their gas connection.

3.4 Concluding remarks

As discussed in this section, the gas market in New Zealand has low maturity, since natural gas is reticulated only on the North Island. In 2016, the proportion of connection points to the number of households in New Zealand was only 16% for gas. The low maturity of the gas market in New Zealand, coupled with the potential to grow the network over time, indicates that gas networks are likely to have greater exposure to systematic risks than electricity networks in New Zealand, which are relatively mature.

Moreover, the comparator analysis presented in section 2 estimates the asset beta for gas in New Zealand based on a sample that comprises predominantly US networks, as per the Commission's energy market sample. The nature of regulation in the USA is different from that in New Zealand—for example, due to a greater use of rate of return regulation, firms are less likely to suffer from cost shocks. Other things being equal, US betas are therefore likely to be lower than in New Zealand, not only due to their relative maturity but also due to the regulatory form of control.

In summary, using the fundamental risk analysis in this section to interpret the market evidence presented earlier supports the continued use of a point estimate for the gas beta that is higher than that for electricity networks in New Zealand.

[59] RAB per connection point was calculated using 2017 RAB projected figures and the number of connection points in March 2016.

4 Regulatory precedents

Oxera understands that the Commission has already considered evidence in relation to regulatory precedents from European jurisdictions;[60] however, this evidence is mixed in relation to whether the allowed asset beta for gas is higher than the asset beta for electricity. In the European countries where regulators made determinations for gas and electricity in the same year,[61] a number of regulators assumed either that there was no differentiation for gas and electricity betas or that electricity betas were higher than in the gas sector. The French energy regulator allowed a gas beta that was higher than the allowed electricity beta.

It is difficult to draw an inference for the NZ market based on the European precedents. This is because, as assessed in the preceding section:

- the NZ gas market is considerably less mature than European markets—e.g. in 2010, only 15% of households in New Zealand had gas connections compared with 86% in the UK.[62] Therefore, if there are systematic greenfield risks related to the relative immaturity (e.g. growth options or asset stranding risk), this would not be reflected in European regulatory decisions as a differential in gas and electricity betas;
- the market for fuel in New Zealand allows for a high degree of discretion relating to customer uptake of gas connections and usage of gas (e.g. the ability to switch off the connection to the gas network to avoid daily connection charges). To the extent that this promotes high demand volatility in New Zealand, this would reduce the comparability between the regulatory allowed beta in New Zealand and more mature markets where relatively 'steady-state' demand might reasonably be expected. The intended form of the control in New Zealand will allow gas pipeline businesses to remain exposed to such volume risk within a price control (for gas distribution).

Oxera has not assessed evidence on differentials in US gas and electricity beta precedents. This is because although the US regulatory environment is comparable to the European market in aiming to achieve financial viability of a regulated company while protecting consumers from excessive prices, the regulatory methodologies used differ considerably. Specifically, the system of US regulation is more ex post in nature, with a greater reliance on cost pass-through and 'rate of return' regulation. For example, 19 state-based regulatory bodies have stated that they exclusively use rate of return regulatory approaches.[63] Due to such a reliance on ex post cost pass-through, there is less emphasis than in European regulation on determining regulatory allowed betas for energy networks, taking into account systematic risk characteristics on a forward-looking basis. Instead, companies may be asked to submit views on what the backward-looking cost of capital has been, to determine the financing cost pass-through level, possibly on an annual basis.[64] With such survey-based or ad hoc cost-pass-through mechanisms, it is difficult to systematically compare the beta allowances for gas pipeline businesses and electricity networks.

[60] NERA (2016), 'The Beta Differential between Gas and Electricity Networks – A Review of the International Regulatory Precedent', A Report for Colonial First State, 22 March.
[61] These jurisdictions are: Germany (2008); Slovenia (2009); Luxembourg (2011); Austria (2012); Great Britain (2012); France (2013); Finland (2015) and Poland (2015).
[62] Economics Insight data provided by First Gas.
[63] Kwoka, J. (2009) 'Investment adequacy under incentive regulation', Northeastern University, pp. 24–25, as described in Competition Economists Group (2013), 'Information on equity beta from US companies', p. 25.
[64] Castalia (2014), 'Estimating WACC for Regulated Utilities in the United States', 30 April, p. 7.

Oxera has also considered available regulatory precedents from Australia. There is some evidence of allowing different betas for gas and electricity companies in Australia. In 2013, the Australian Energy Regulator (AER) set a single equity beta of 0.7[65] that applied to both gas and electricity businesses.[66] On the other hand, the Economic Regulation Authority (ERA), responsible for economic regulation in Western Australia, allowed different asset betas for electricity and gas companies in the period between 2010 and 2012.[67] In particular, the equity beta for the Western Power Network—the only regulated electricity business in Western Australia—was set at 0.65[68] compared with the allowed equity beta of 0.8 for the gas network companies.[69] Note that these regulatory allowed equity betas are directly comparable once they have been re-levered, since the ERA assumed the same level of notional gearing across the companies.

[65] Australian Energy Regulator (2013),' Better Regulation Explanatory Statement Rate of Return Guideline', December, p. 82.

[66] Australian Energy Regulator (2013), 'Better Regulation Explanatory Statement Rate of Return Guideline (Appendices)', December, p. 128.

[67] Oxera has also considered the 2016 decision by ERA in relation to the Dampier Bunbury gas pipeline. However, this decision only related to the gas pipeline and no comparable decision in relation to electricity was taken at a similar time. It has therefore not been possible to assess a more recent differential in allowed betas for gas and electricity networks in Western Australia.

[68] Economic Regulation Authority (2012), 'Further Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network', 29 November, p. 21.

[69] Economic Regulation Authority (2011), 'Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline', 31 October, p. 158; Economic Regulation Authority (2010), 'Final Decision on GGT's Proposed Revisions to the Access Arrangement for the Goldfields Gas Pipeline', 13 May, p. 38; Economic Regulation Authority (2011), 'Final decision on WA Gas Networks Pty Ltd proposed revised access arrangement for the Mid-West and South-West Gas Distribution Systems, 28 February, p. 52.

5 Concluding remarks

The Commission's intended 0.1 reduction in the asset beta for gas pipeline businesses is an abrupt and significant change that is brought on by a revised approach. Within regulated settings it is desirable to have stable, predictable and consistent tariff-setting policies, by avoiding abrupt changes in regulatory allowed parameters, including the beta. Therefore, even if the Commission is minded to remove an uplift for the gas industry, it would be helpful to do so only if the evidence shows that there is a marked change in the evidence base, including in capital market conditions that warrant this methodological change. As shown by the evidence presented in this report, the proposed reduction is not underpinned or supported by a movement in capital market data.

There are a number of theoretical reasons why gas pipeline businesses in New Zealand would face higher systematic risk exposure than electricity networks in New Zealand. Specifically, there are higher demand-side risks for gas pipeline businesses in New Zealand than for electricity networks (i.e. higher volume volatility of consumption and higher income elasticity of demand). Also, NZ gas networks are characterised by higher asset risk relating to their relative immaturity compared with NZ electricity networks. This includes consideration of the following factors: gas networks have higher levels of long-run growth options, and relatively low penetration rates for the greenfield gas network implying higher asset stranding risk.

The marked divergence in betas of comparator gas and electricity companies over the whole period since the publication of the 2010 Input Methodologies supports the view that for statistical analysis, it is inappropriate to rely on the estimates based on the 'energy' sample in order to estimate a regulatory allowed asset beta. Instead, the Commission's own 'gas' sub-sample (18 companies) and 'electricity' sub-sample (16 companies) are more relevant for setting the betas for gas pipeline businesses and electricity networks, respectively. The current market evidence supports an asset beta for gas pipeline businesses of 0.44–0.50. If a point estimate for the gas beta was derived based on the Commission's methodology using data over a longer period (i.e. 2006–16), the beta for gas companies would be around 0.42. [70]

Table 5.1 Asset beta estimates of the Commission's sample

Sample	Four-weekly results	Weekly results	Daily results	*Commission's beta estimate for 2006-16*[1]
Gas	0.44 (0.17)	0.45 (0.17)	0.50 (0.13)	*0.42*
Electricity	0.26 (0.08)	0.29 (0.09)	0.33 (0.12)	*0.32*
Integrated	0.26 (0.08)	0.30 (0.08)	0.37 (0.10)	*0.30*
Energy	**0.30 (0.13)**	**0.34 (0.13)**	**0.39 (0.12)**	***0.34***
Difference between gas and whole 'energy' sample	*0.14*	*0.12*	*0.11*	*0.09*
Difference between 'gas' and 'electricity' sample	*0.18*	*0.17*	*0.16*	*0.10*

[70] Oxera understands that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Note: Standard errors are reported in brackets. The cut-off date is set to 31 March 2016, consistent with the Commission's analysis. [1] Oxera understands from a discussion between First Gas and the Commission that the Commission's reported point estimate for the beta is based on a simple average of four-weekly and weekly results for the two most recent five-year periods (i.e. 2006–11 and 2011–16).

Source: The Commission's asset beta spreadsheet based on the Commission's comparator sample.

This evidence suggests that if the Commission were to use its own 'gas' and 'electricity' comparator sub-samples to set separate betas for gas and electricity, respectively, the evidence would justify a beta that is higher for gas pipeline businesses by up to 0.10–0.18.[71]

If the Commission's prior methodology—i.e. applying an uplift for gas pipeline businesses relative to betas for electricity networks (that are derived from the 'energy' whole sample)—were retained, the market evidence would support an uplift of 0.09–0.14.

[71] Similar results are obtained from Oxera's refined comparator sample of 67 companies (rather than the Commission's sample of 74 companies). Specifically, if the Commission were to use the refined gas and electricity comparator sub-samples to set separate betas for gas and electricity, respectively, the evidence would justify a beta that is higher for gas networks by up to 0.10–0.16.

A1 Asset beta estimation results

Table A1.1 Five-year asset betas based on a refined sample of companies

Bloomberg ticker	Four-weekly asset beta	Weekly asset beta	Daily asset beta
Gas sub-sample (15 companies)			
GAS US Equity	0.12	0.24	0.31
ATO US Equity	0.31	0.36	0.44
CPK US Equity	0.27	0.31	0.54
SR US Equity	0.30	0.32	0.44
NFG US Equity	0.79	0.81	0.80
NJR US Equity	0.35	0.43	0.59
NWN US Equity	0.24	0.28	0.39
PNY US Equity	0.45	0.41	0.50
STR US Equity	0.32	0.46	0.52
SWX US Equity	0.38	0.37	0.50
TCP US Equity	0.60	0.54	0.45
KMI US EQUITY	0.56	0.55	0.53
EEP US Equity	0.62	0.52	0.49
OKE US Equity	0.58	0.66	0.66
SE US Equity	0.45	0.51	0.56
Simple average	**0.42**	**0.45**	**0.51**
Weighted average	0.47	0.49	0.52
Electricity sub-sample (14 companies)			
ALE US Equity	0.40	0.37	0.43
AEP US Equity	0.21	0.27	0.32
EIX US Equity	0.26	0.27	0.32
EE US Equity	0.27	0.31	0.37
ETR US Equity	0.22	0.23	0.28
GXP US Equity	0.30	0.30	0.32
HE US Equity	0.37	0.43	0.50
IDA US Equity	0.38	0.37	0.45
ITC US Equity	0.19	0.26	0.32
NEE US Equity	0.25	0.29	0.33
PNW US Equity	0.29	0.33	0.39
PNM US Equity	0.28	0.29	0.38
SO US Equity	0.09	0.18	0.23
WR US Equity	0.26	0.28	0.33
Simple average	**0.27**	**0.30**	**0.36**
Weighted average	0.22	0.26	0.31
Integrated sub-sample (38 companies)			
LNT US Equity	0.31	0.35	0.42
AEE US Equity	0.26	0.30	0.36
APA AU Equity	0.33	0.32	0.39
AVA US Equity	0.30	0.32	0.39
BKH US Equity	0.46	0.40	0.49
CNP US Equity	0.30	0.36	0.41
CNL US Equity	0.28	0.36	0.41
CMS US Equity	0.18	0.24	0.30

Bloomberg ticker	Four-weekly asset beta	Weekly asset beta	Daily asset beta
ED US Equity	0.06	0.16	0.24
D US Equity	0.17	0.27	0.33
DTE US Equity	0.23	0.30	0.36
DUE AU Equity	0.13	0.12	0.14
DUK US Equity	0.13	0.19	0.26
EDE US Equity	0.22	0.28	0.38
ES US Equity	0.25	0.30	0.36
EXC US Equity	0.18	0.27	0.35
FE US Equity	0.12	0.21	0.27
MGEE US Equity	0.31	0.37	0.59
NG/ LN Equity	0.26	0.27	0.31
NI US Equity	0.22	0.33	0.37
NWE US Equity	0.30	0.31	0.40
OGE US Equity	0.46	0.51	0.54
POM US Equity	0.19	0.21	0.24
PCG US Equity	0.27	0.23	0.30
PPL US Equity	0.19	0.23	0.26
PEG US Equity	0.23	0.36	0.44
SCG US Equity	0.25	0.26	0.32
SRE US Equity	0.38	0.38	0.43
SJI US Equity	0.43	0.41	0.53
SKI AU Equity	0.19	0.30	0.39
SSE LN Equity	0.42	0.43	0.45
TE US Equity	0.21	0.35	0.39
UGI US Equity	0.44	0.45	0.47
UTL US Equity	0.15	0.20	0.34
VVC US Equity	0.39	0.37	0.43
WEC US Equity	0.15	0.26	0.35
WGL US Equity	0.39	0.42	0.56
XEL US Equity	0.17	0.23	0.30
Simple average	**0.26**	**0.31**	**0.37**
Weighted average	0.23	0.28	0.34
Energy sample (67 companies)			
Simple average	**0.30**	**0.34**	**0.40**
Weighted average	0.26	0.30	0.36

Note: The calculation of the weighted average beta for the sample is based on market capitalisation as at 31 December 2015. The cut-off date is set to 31 March 2016, consistent with the Commission's analysis.

Source: Commission's asset beta spreadsheet based on the Commission's comparator sample after applying liquidity and gearing filters.

A2 Commission's sample refinement

Table A2.1 Quantitative filters applied to the Commission's comparator sample

Bloomberg ticker	Company name	Comparator sub-sample	Asset beta (five-year daily)	Standard error	Liquidity filters passed?
AEE US Equity	Ameren Corp	Integrated	0.36	0.02	Yes
AEP US Equity	American Electric Power Co Inc	Electricity	0.32	0.01	Yes
AES US Equity	AES Corp/VA	Electricity	0.37	0.01	**No (average gearing)**
ALE US Equity	ALLETE Inc	Electricity	0.43	0.02	Yes
APA AU Equity	APA Group	Integrated	0.39	0.02	Yes
AST AU Equity	AusNet Services	Integrated	0.24	0.02	**No (free float)**
ATO US Equity	Atmos Energy Corp	Gas	0.44	0.02	Yes
AVA US Equity	Avista Corp	Integrated	0.39	0.01	Yes
BKH US Equity	Black Hills Corp	Integrated	0.49	0.02	Yes
BWP US Equity	Boardwalk Pipeline Partners LP	Gas	0.42	0.03	**No (free float)**
CMS US Equity	CMS Energy Corp	Integrated	0.30	0.01	Yes
CNL US Equity	Cleco Corporate Holdings LLC	Integrated	0.41	0.02	Yes
CNP US Equity	CenterPoint Energy Inc	Integrated	0.41	0.02	Yes
CPK US Equity	Chesapeake Utilities Corp	Gas	0.54	0.03	Yes
D US Equity	Dominion Resources Inc/VA	Integrated	0.33	0.01	Yes
DGAS US Equity	Delta Natural Gas Co Inc	Gas	0.25	0.03	**No (bid–ask spread)**
DTE US Equity	DTE Energy Co	Integrated	0.36	0.01	Yes
DUE AU Equity	DUET Group	Integrated	0.14	0.01	Yes
DUK US Equity	Duke Energy Corp	Integrated	0.26	0.01	Yes
ED US Equity	Consolidated Edison Inc	Integrated	0.24	0.01	Yes
EDE US Equity	Empire District Electric Co/Th	Integrated	0.38	0.02	Yes
EE US Equity	El Paso Electric Co	Electricity	0.37	0.02	Yes
EEP US Equity	Enbridge Energy Partners LP	Gas	0.49	0.03	Yes
EIX US Equity	Edison International	Electricity	0.32	0.02	Yes
ES US Equity	Eversource Energy	Integrated	0.36	0.02	Yes
ETR US Equity	Entergy Corp	Electricity	0.28	0.01	Yes
EXC US Equity	Exelon Corp	Integrated	0.35	0.02	Yes
FE US Equity	FirstEnergy Corp	Integrated	0.27	0.02	Yes
GAS US Equity	AGL Resources Inc	Gas	0.31	0.02	Yes
GXP US Equity	Great Plains Energy Inc	Electricity	0.32	0.01	Yes

Bloomberg ticker	Company name	Comparator sub-sample	Asset beta (five-year daily)	Standard error	Liquidity filters passed?
HE US Equity	Hawaiian Electric Industries I	Electricity	0.50	0.02	Yes
IDA US Equity	IDACORP Inc	Electricity	0.45	0.02	Yes
ITC US Equity	ITC Holdings Corp	Electricity	0.32	0.02	Yes
JEL LN Equity	Jersey Electricity PLC	Electricity	0.01	0.01	**No (days traded)**
KMI US Equity	Kinder Morgan Inc/DE	Gas	0.53	0.03	Yes
SR US Equity	Spire Inc	Gas	0.44	0.02	Yes
LNT US Equity	Alliant Energy Corp	Integrated	0.42	0.02	Yes
MGEE US Equity	MGE Energy Inc	Integrated	0.59	0.02	Yes
NEE US Equity	NextEra Energy Inc	Electricity	0.33	0.01	Yes
NFG US Equity	National Fuel Gas Co	Gas	0.80	0.03	Yes
NG/ LN Equity	National Grid PLC	Integrated	0.31	0.01	Yes
NI US Equity	NiSource Inc	Integrated	0.37	0.01	Yes
NJR US Equity	New Jersey Resources Corp	Gas	0.59	0.02	Yes
NWE US Equity	NorthWestern Corp	Integrated	0.40	0.02	Yes
NWN US Equity	Northwest Natural Gas Co	Gas	0.39	0.02	Yes
OGE US Equity	OGE Energy Corp	Integrated	0.54	0.02	Yes
OKE US Equity	ONEOK Inc	Gas	0.66	0.03	Yes
PCG US Equity	PG&E Corp	Integrated	0.30	0.02	Yes
PEG US Equity	Public Service Enterprise Grou	Integrated	0.44	0.02	Yes
PNM US Equity	PNM Resources Inc	Electricity	0.38	0.02	Yes
PNW US Equity	Pinnacle West Capital Corp	Electricity	0.39	0.02	Yes
PNY US Equity	Piedmont Natural Gas Co Inc	Gas	0.50	0.03	Yes
POM US Equity	Pepco Holdings LLC	Integrated	0.24	0.02	Yes
PPL US Equity	PPL Corp	Integrated	0.26	0.01	Yes
SCG US Equity	SCANA Corp	Integrated	0.32	0.01	Yes
SE US Equity	Spectra Energy Corp	Gas	0.56	0.02	Yes
SJI US Equity	South Jersey Industries Inc	Integrated	0.53	0.02	Yes
SKI AU Equity	Spark Infrastructure Group	Integrated	0.39	0.02	Yes
SO US Equity	Southern Co/The	Electricity	0.23	0.01	Yes
SRE US Equity	Sempra Energy	Integrated	0.43	0.02	Yes
SSE LN Equity	SSE PLC	Integrated	0.45	0.02	Yes
STR US Equity	Questar Corp	Gas	0.52	0.02	Yes

Bloomberg ticker	Company name	Comparator sub-sample	Asset beta (five-year daily)	Standard error	Liquidity filters passed?
SWX US Equity	Southwest Gas Corp	Gas	0.50	0.02	Yes
TCP US Equity	TC PipeLines LP	Gas	0.45	0.04	Yes
TE US Equity	TECO Energy Inc	Integrated	0.39	0.02	Yes
UGI US Equity	UGI Corp	Integrated	0.47	0.02	Yes
UTL US Equity	Unitil Corp	Integrated	0.34	0.02	Yes
VCT NZ Equity	Vector Ltd	Integrated	0.25	0.03	**No (free float)**
VVC US Equity	Vectren Corp	Integrated	0.43	0.02	Yes
WEC US Equity	WEC Energy Group Inc	Integrated	0.35	0.02	Yes
WGL US Equity	WGL Holdings Inc	Integrated	0.56	0.02	Yes
WPZ US Equity	Williams Partners LP	Gas	0.60	0.05	**No (free float)**
WR US Equity	Westar Energy Inc	Electricity	0.33	0.01	Yes
XEL US Equity	Xcel Energy Inc	Integrated	0.30	0.01	Yes

Note: The cut-off date is set to 31 March 2016, consistent with the Commission's analysis.

Source: Oxera analysis based on data from Bloomberg, Datastream and the Commission's asset beta spreadsheet.

A3 Gas sub-sample qualitative filters

Table A3.1 Gas sub-sample qualitative description

Bloomberg ticker	BICS	BICS percentage of revenues	Description
GAS US Equity	Utility Networks – Gas Utilities	74%	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
ATO US Equity	Utility Networks – Gas Utilities	69%	Atmos Energy Corporation distributes natural gas to utility customers in several states. The Company's non-utility operations span various states and provide natural gas marketing and procurement services to large customers. Atmos Energy also manages company-owned natural gas storage and pipeline assets, including an intrastate natural gas pipeline in Texas
CPK US Equity	Utility Networks	101%	Chesapeake Utilities Corporation is a utility company that provides natural gas transmission and distribution, propane distribution, and information technology services. The Company distributes natural gas to residential, commercial, and industrial customers in Delaware, Maryland, and Florida. Chesapeake Utilities' propane is distributed to customers in Delaware, Maryland and Virginia
SR US Equity	Utility Networks – Gas Utilities	96%	Spire Inc. is a public utility company involved in the retail distribution of natural gas. The Company serves an area in eastern Missouri and parts of several other counties. Spire also operates underground natural gas storage fields and transports and stores liquid propane
NFG US Equity	Utility Networks – Gas Utilities	51%	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 USA
NJR US Equity	Utility Networks – Gas Utilities	99%	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
NWN US Equity	Utility Networks – Gas Utilities	100%	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

Bloomberg ticker	BICS	BICS percentage of revenues	Description
PNY US Equity	Utility Networks – Gas Utilities	90%	Piedmont Natural Gas Company, Inc. is an energy and services company that primarily transports, distributes and sells natural gas. The Company serves residential, commercial and industrial customers in North Carolina, South Carolina and Tennessee. Piedmont also, through subsidiaries, markets natural gas to customers in Georgia
STR US Equity	Utility Networks – Gas Utilities	46%	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
SWX US Equity	Utility Networks – Gas Utilities	59%	Southwest Gas Corporation purchases, transports and distributes natural gas to residential, commercial and industrial customers. The Company also provides underground piping contracting services to utility companies, including trenching and installation, replacement and maintenance services for energy distribution systems. Southwest Gas serves customers in the USA
TCP US Equity	Midstream - Oil & Gas – Dry Natural Gas Pipelines	100%	TC Pipelines, LP acquires, owns and participates in the management of US-based pipeline assets. The Company owns interest in the Northern Border Pipeline Company, the owner of an interstate pipeline system that transports natural gas from the Montana–Saskatchewan border to natural gas markets in the Midwestern USA
KMI US EQUITY	Midstream - Oil & Gas – Dry Natural Gas Pipelines	60%	Kinder Morgan Inc. is a pipeline transportation and energy storage company. The Company owns and operates pipelines that transport natural gas, gasoline, crude oil, carbon dioxide and other products; and terminals that store petroleum products and chemicals, and handle bulk materials like coal and petroleum coke
EEP US Equity	Midstream - Oil & Gas – Dry Natural Gas Pipelines	55%	Enbridge Energy Partners, L.P. transports and stores hydrocarbon energy. The Company offers crude oil and natural gas liquids to refineries in Midwestern USA and Eastern Canada
OKE US Equity	Midstream - Oil & Gas	100%	ONEOK, Inc. is a diversified energy company. The Company is involved in the natural gas and natural gas liquids business across the USA
SE US Equity	Midstream - Oil & Gas – Dry Natural Gas Pipelines	71%	Spectra Energy Corporation transmits, stores, distributes, gathers and processes natural gas. The Company provides transportation and storage of natural gas to customers in various regions of the northeastern and southeastern USA, the Maritime Provinces in Canada and the Pacific Northwest in the USA and Canada, and the province of Ontario, Canada.

Source: Oxera analysis and data from Bloomberg.

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