



# Updated cost of capital estimate for energy networks

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# 1 Introduction

This paper provides updated estimates of the cost of capital parameters for regulated energy networks in the Netherlands, based on data up to April 2007. The estimates are based on the methodology previously employed by Frontier in its analysis of the cost of the capital for DTe. This methodology is described in Frontier's report: "The cost of capital for Regional Distribution Networks: A Report for DTe" (December 2005).

## 2 Nominal risk free rate

Table 1 shows average nominal government bond yields for the Netherlands over periods from six months to five years.

Time period (to April 2007)	Yield on 10 year maturity – average over period
6 months	3.9%
1 year	3.9%
2 year	3.6%
3 year	3.7%
5 year	4.0%

Table 1: Yield on Netherlands Government debt  
*Source: Eurostat*

The methodology employed in our previous analysis used a range for the nominal risk-free rate based on the average yield over two years and the average yield over five years. Applying this to the latest data gives a range of 3.6% to 4.0%.

## 3 Debt premium

The previous analysis identified that the appropriate debt premium for the network utilities with a ‘single-A’ rating. A ‘single-A’ rating represents an appropriate benchmark for default risk of the regional networks under the proposed gearing assumption of 60%. The debt premium was based on a number of sources of evidence:

- data on A-rated European corporate bond spreads going back over a five year period;
- data on the spreads on a sample of energy company corporate bonds over a shorter period of time (2 years); and
- consideration of specific risk factors and issuance costs.

### 3.1 ‘SINGLE-A’ RATED CORPORATE BOND SPREADS OVER A FIVE YEAR PERIOD

Figure 1 shows how the debt premium has fluctuated over time, based on data for European corporate bonds<sup>1</sup>. Over the last five years the average debt premium has been around 0.5% for ‘single-A’ rated bonds.

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<sup>1</sup> ECB, Monthly Bulletin June 2007.

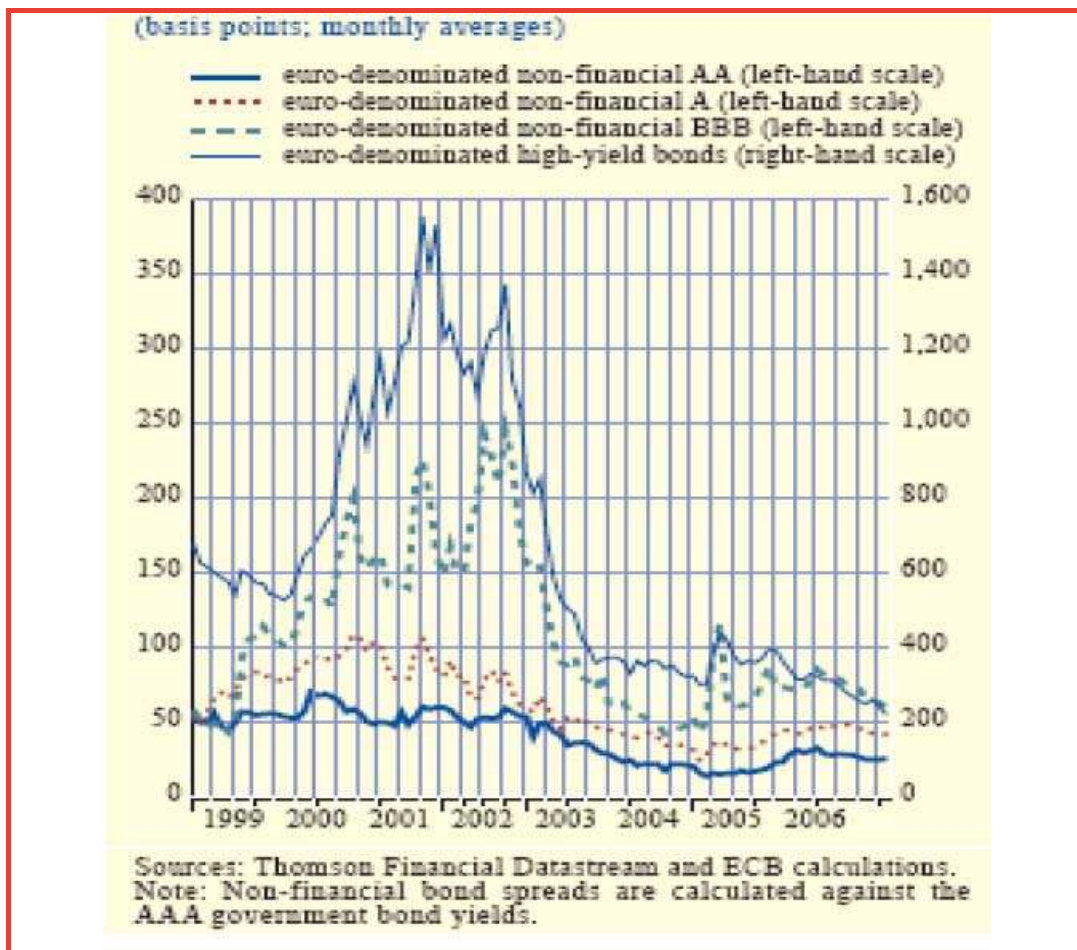


Figure 1: Spreads on European non-financial corporate bonds

Source: ECB Monthly Bulletin June 2007

Figure 2 shows the JP Morgan, Rabobank index for (amongst others) ‘single-A’ rated bonds. The spread on single A-rated debt over the last five years is on average around 0.5%<sup>2</sup>.

<sup>2</sup> Rabobank, Visie op 2007: internationaal (ww.rabobankvisie.com)



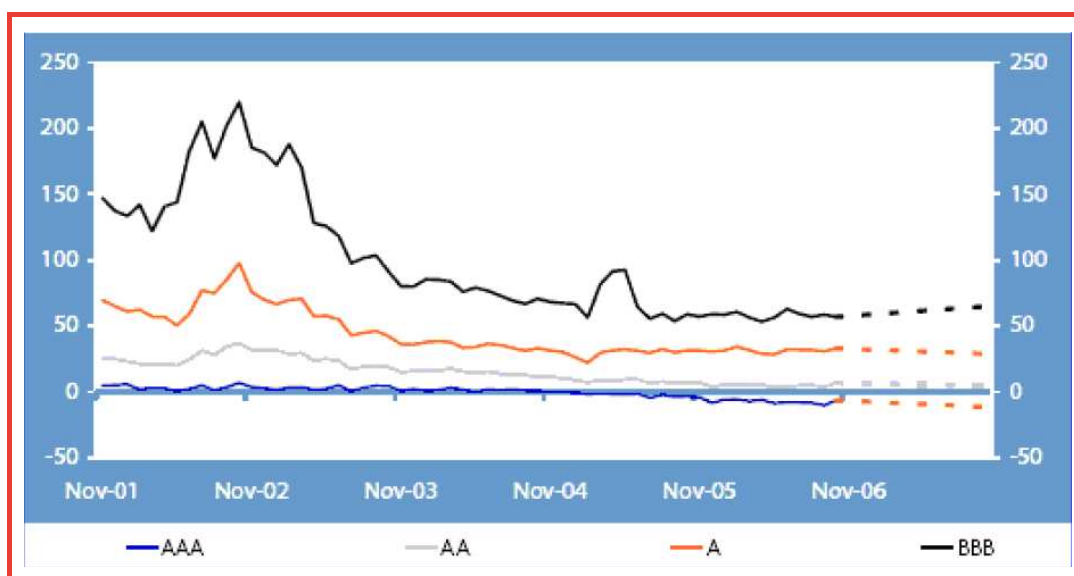


Figure 2: Corporate bond spreads by rating category (bps)

Source: Rabobank, *Visie op 2007: internationaal* ([www.rabobankvisie.com](http://www.rabobankvisie.com))

The evidence in Figures 1 and 2 shows a debt premium on ‘single-A’ rated European corporate bonds of around 0.5% in the last five years.

### 3.2 SPREADS ON A SAMPLE OF ENERGY COMPANY CORPORATE BONDS OVER 2 YEARS PERIOD

The data on the spreads on a sample of energy company corporate bonds over a shorter period of time (2 years) are also taken into account. Table 2 shows the spread on utility bonds with rating around single ‘A’ and maturity between 5 and 17 years. This sample contains different bonds issues to those used in the previous analysis. This does not pose any methodological difficulties given that corporate bond spreads are determined by the credit rating and the maturity of the issue. The characteristics of this sample match the previous sample with respect to these factors. The spreads lie in the range 0.53% to 0.92% - with an average of 0.69% and a median of 0.67%.

Company	Maturity of bond – as of May 2007	Credit rating	Spread (%)
Eastern	5 years	A	0.53%
EON Int Fin	5 years	AA-	0.54%
Transco	10 years	A	0.67%
RWE	14 years	A+	0.76%
Scottish & Southern	15 years	A+	0.66%
Northern Electric	13 years	BBB+	0.92%
National Grid	17 years	A	0.78%

Table 2: Utility bond spreads – energy networks – April 2005 - May 2007

Source: Thomson Financial, HSBC Bank plc

Overall, this analysis confirms that the evidence on the corporate spreads lies in the range 0.5% to 0.7%. The results of this analysis do not take account of specific factors such as issuance costs. Taking into account issuance costs and a margin of uncertainty raises the estimated range for the debt premium to 0.6% to 0.8%.

## 4 Equity risk premium

The previous analysis of the equity risk premium, undertaken for DTe, identified an appropriate range of 4% to 6%. This range was based on a number of sources of evidence:

- historical equity returns data;
- survey evidence of equity returns data;
- models of equity returns and current market data.

The evidence base used to assess the equity risk premium is essentially unchanged since the previous analysis was undertaken in March 2006. Table 3 below shows the latest data on historical equity premia produced by Dimson, Marsh and Staunton, which has been updated to include data for 2006. The report's authors consider that an appropriate forward looking premia, on an arithmetic basis, is 5%. The evidence remains consistent with our range of 4% to 6%.

Market	Equity return over government bills (geometric)
Netherlands	4.7%
UK	4.5%
USA	5.6%
World index	4.8%

Table 3: ERP data 1900 - 2006

Source: *Global Investment Returns Yearbook 2007*, ABN-AMRO

We have reviewed any developments in the finance literature, survey evidence and regulatory decisions since the previous analysis was produced in March 2006. We are not aware of any developments in the evidence base and our view is that the appropriate range for the equity risk premium remains 4% to 6% with a central value of 5%.

## 5 Asset betas

Using the same methodology as in the previous cost of capital papers the appropriate value for the Beta is calculated based on the Betas of a set of comparable quoted companies. This involves two main issues:

- the choice of the set of comparators; and
- the choice of estimation method.

These issues are discussed in turn in the following sections.

### 5.1 CHOICE OF COMPARATORS

The choice of comparators is made on the basis of factors that would be expected to affect Beta<sup>3</sup>.

- **Network operations should be significant:** electricity or gas network activities should comprise a substantial, ideally dominant, part of companies' activities.
- **All company operations should be similar** in terms of their risk characteristics. This includes the following aspects:
  - diversification to other industries with markedly different risk profiles (e.g., financial investment industry, residential construction) should be minimised;
  - to the extent that a company is involved in non-energy operations, those should preferably fall within the utilities sector;
  - within the energy sector, diversification to other products (oil, propane etc) and other stages of the supply chain (upstream production, downstream energy services) should be minimised where possible.
- **Quoted companies should be large enough** to ensure that there is active trading and sufficient price variation for their stock. In general, delayed market reaction to events affecting infrequently trading stocks may cause Beta estimates calculated on daily data to be lower than Beta estimates calculated on a lower-frequency data. Delayed market reaction is more likely for small companies. As a result we limited the sample only to companies with an annual turnover of over \$100 million. In addition, for these companies we analysed the actual trading frequency of the stock. This was measured as the percentage of market trading days where the particular stock was traded.
- **Regulatory regimes should be comparable to the one in the Netherlands and choice of comparators should reflect a suitable mix of regimes.** The form of regulation can have an impact on the risk and Beta. We excluded countries for which information about the nature of their

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<sup>3</sup> The methodology applied is set out in Frontier's report: *"The cost of capital for Regional Distribution Networks: A Report for DTe"* (December 2005).

regulatory regime is not available. The companies in the sample are regulated under mix of regimes; price cap, rate of return and other cost of service regimes.

Gas and electricity networks are likely to share most of the characteristics that would affect their cost of capital, and therefore there is no apparent reason to expect their asset Beta values to be different. As a result, although we have identified a set of comparators for both gas and electricity, we have combined this into a single comparator set to apply to both sectors.

## 5.2 METHODOLOGY FOR ESTIMATING BETAS

Once the set of comparator companies has been selected, a number of decisions need to be made regarding the estimation methodology itself. These decisions are as follows.

- **Choice of data frequency and sample period.** Our preferred approach is to estimate Betas using returns with daily or weekly frequency. This approach is expected to provide the most precise Beta estimate (because of the larger sample), particularly as there is no difference in the degree of correlation of market returns when daily, monthly and annual data is used. We looked at periods from one to five years, and have chosen the period of two years for the daily data and five years for the weekly estimates. This period allows us to focus on the recent risk profiles of the comparator companies, and at the same time provides robust estimates (sample size of around 500 for the daily estimates and 250 for the weekly estimates).
- **Choice of market index.** We have analysed Beta estimates against national equity indices and a world equity index. We used the national indices for the final estimates to reflect any concern that national stock markets are not yet fully integrated.
- **Method of correcting raw Beta estimates.** We have applied a Bayesian adjustment to the raw Beta estimates, the Vasicek method. This method treats estimates for different comparators differently, applying a smaller adjustment to those estimates that were more robust to begin with (based on their statistical properties).
- **Method of converting from equity to asset Beta.** Equity Betas have been converted into asset Betas using the Modigliani-Miller formula and assuming a zero debt Beta. This approach takes account of corporation taxes, and we apply the debt premium later in the final WACC formula.

## 5.3 UPDATE OF BETA CALCULATIONS

Table 4 shows the beta estimates for the previous set of comparators. Two companies no longer exist in the same form as they were when the WACC was originally calculated and have therefore been removed from the sample:

- Australia Gas Light has now sold all its network assets and has therefore been removed from the sample, although it still exists as a company;

- Viridian was taken over by Arcapita, an investment company, and delisted in December 2006.

We have added additional companies to the comparator set – comprising six regulated network companies with extensive gas transmission activities<sup>4</sup>. These companies will in general face similar risks to those faced by companies with electricity networks and therefore satisfy the criteria set out above. The advantages of expanding the comparator set are as follows.

- It maintains (and in fact expands) the sample size. We consider that the sample size is important to providing robust beta estimates that will be consistent over time.
- The added companies satisfy the criteria outlined above, ensuring that the sample remains representative.
- The expanded dataset maintains an appropriate geographical balance in the comparator set – providing results that are reasonably stable in the face of country specific factors.
- The expanded dataset has a balanced proportion of gas and electricity network companies.

The annexe to this paper provides details on the characteristics of the comparator companies and additional data on the beta estimates.

This data provides a range of asset betas of 0.31 to 0.41 based on the median of the weekly estimates and the median of the daily estimates. The use of the median estimate prevents undue weight being applied to sample outliers, although in this case the difference between the median and the mean was very small.

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<sup>4</sup> These companies are: Australian Pipeline Trust, Transcanada, Snam Rete Gas (Italy), Enagas (Spain) and Kinder Morgan and TC Pipelines (USA).

Country	Company	Daily data	Weekly data
Argentina	Transener	0.30	0.41
Australia	Envestra	0.26	0.16
Australia	Australian Pipeline Trust	0.41	0.28
Canada	Emera	0.16	0.17
Canada	Transcanada	0.44	0.30
Canada	Canadian Utilities	0.32	0.41
Italy	Snam Rete Gas	0.41	0.25
Spain	Red Electrica	0.46	0.24
Spain	Enagas	0.63	0.32
UK	Transco	0.42	0.34
UK	Scottish Power	0.57	0.51
UK	United Utilities	0.41	0.31
USA	Atlanta Gas Light	0.58	0.50
USA	Kinder Morgan	0.37	0.35
USA	TC Pipelines	0.29	0.30
USA	Atmos Energy	0.48	0.42
USA	Duquesne Light Holdings	0.52	0.47
USA	Exelon	0.77	0.50

Table 4: Asset betas for comparator firms, Vasicek adjustment

Source: Frontier calculations

Daily data over two years to 24 April 2007, weekly data over five years to 19-25 April 2007 (average across 5 possible start days); national indexes.

The Beta estimates have generally increased during the past year. The increase is particularly marked for the US comparators in the sample. This is illustrated in Figure 3 and Figure 4 below.

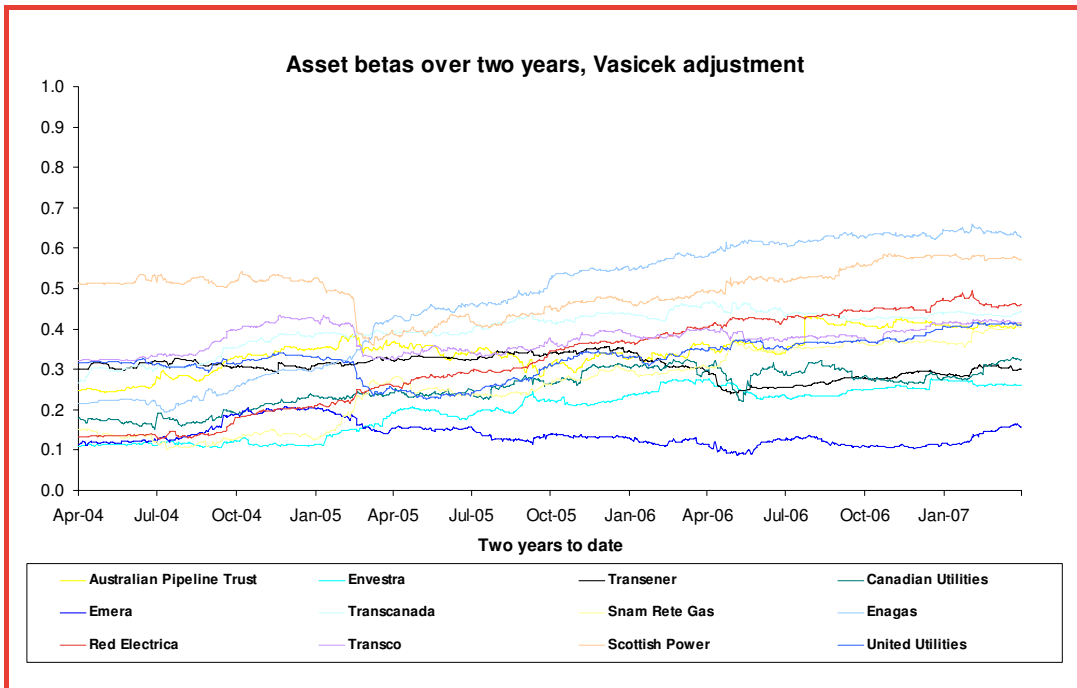


Figure 3: Beta estimates for non-US comparators

Source: Frontier calculations

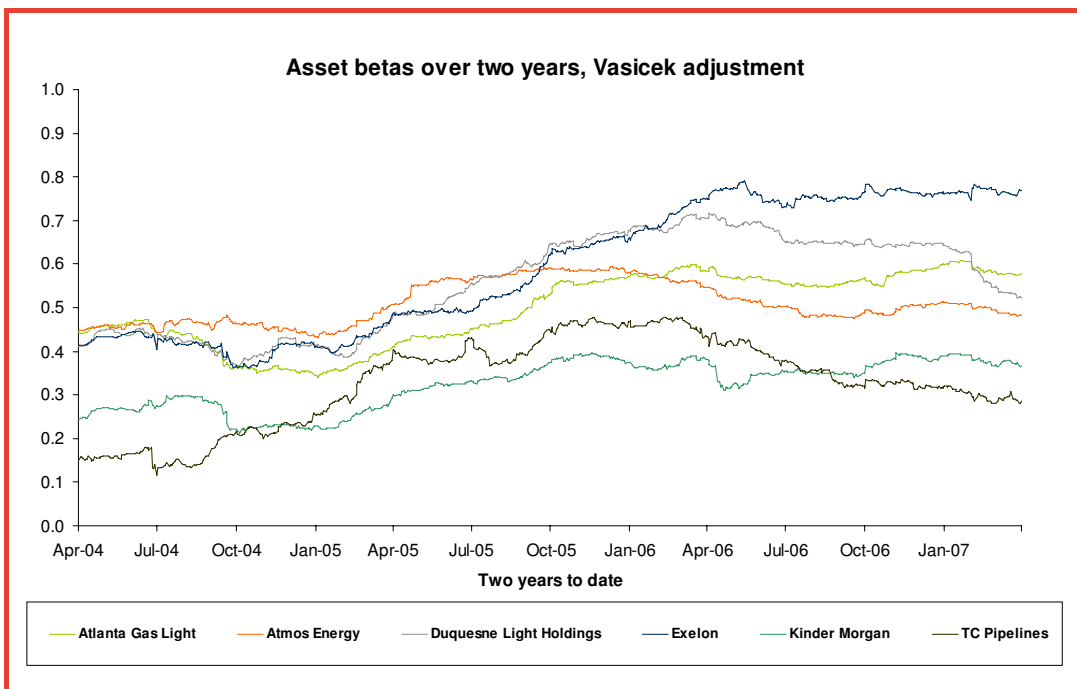


Figure 4: Beta estimates for US comparators

Source: Frontier calculations



## 6 Tax rate and inflation

### 6.1 TAX RATE

The corporate tax rate has been reduced to 25.5%. This has been reflected in the calculations.

### 6.2 INFLATION

The inflation rate used in the analysis is based on the medium-term forecast for CPI inflation published by the Netherlands Bureau for Economic Policy Analysis (the CPB). The latest medium-term inflation projection from the CPB is 1.5%.

The inflation projection of 1.5% represents an increase compared to the figure of 1.25% used in the previous analysis. In addition to being the CPB's medium-term projection, the value of 1.5% is consistent with the following evidence.

- The CPB projection for core inflation (that excludes items such as energy prices) is projected to be 1.5% in 2007, 2.0% in 2008 and subsequently 1.5% upto 2011.<sup>5</sup>
- The value of 1.5% for inflation is broadly consistent with the out-turn inflation experienced over the 2 year and 5 year periods used for the risk-free rate.

The inflation figure of 1.5% is based on the latest information and is consistent with the methodology employed at the previous analysis. In addition, the choice of the appropriate value for the real risk-free rate should aim to be consistent between the inflation assumption and the value for the nominal risk-free rate.

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<sup>5</sup> CPB (2007), Nieuwsbrief June 2007. And: CPB (2006), Economische Verkenning 2008-2011. Source: [www.cpb.nl](http://www.cpb.nl)



## Annexe 1: Data underlying beta estimates

This annexe provides details of the data used in estimating betas for the comparator group of companies.

### Unadjusted asset betas

Country	Company	Daily data	Weekly data
Argentina	Transener	0.28	0.38
Australia	Australian Pipeline Trust	0.38	0.22
Australia	Envestra	0.25	0.14
Canada	Canadian Utilities	0.25	0.25
Canada	Emera	0.13	0.14
Canada	Transcanada	0.43	0.27
Italy	Snam Rete Gas	0.37	0.22
Spain	Enagas	0.61	0.29
Spain	Red Electrica	0.44	0.21
UK	Scottish Power	0.54	0.48
UK	Transco	0.40	0.32
UK	United Utilities	0.40	0.29
USA	Atlanta Gas Light	0.57	0.49
USA	Atmos Energy	0.48	0.41
USA	Duquesne Light Holdings	0.52	0.44
USA	Exelon	0.76	0.47
USA	Kinder Morgan	0.34	0.32
USA	TC Pipelines	0.22	0.24

Table 5: Unadjusted asset betas for comparator firms

Source: Frontier calculations

Daily data over two years to 24 April 2007, weekly data over five years to 19-25 April 2007 (average across 5 possible start days); national indexes.

### Unadjusted equity betas

Country	Company	Daily data	Weekly data
Argentina	Transener	0.44	0.81
Australia	Australian Pipeline Trust	0.65	0.37
Australia	Envestra	0.61	0.36
Canada	Canadian Utilities	0.31	0.32
Canada	Emera	0.19	0.21
Canada	Transcanada	0.61	0.40
Italy	Snam Rete Gas	0.54	0.30
Spain	Enagas	0.78	0.37
Spain	Red Electrica	0.63	0.32
UK	Scottish Power	0.56	0.59
UK	Transco	0.60	0.51
UK	United Utilities	0.59	0.45
USA	Atlanta Gas Light	0.82	0.71
USA	Atmos Energy	0.75	0.61
USA	Duquesne Light Holdings	0.76	0.65
USA	Exelon	0.90	0.60
USA	Kinder Morgan	0.45	0.41
USA	TC Pipelines	0.29	0.28

Table 6: Unadjusted equity betas for comparator firms

Source: Frontier calculations

Daily data over two years to 24 April 2007, weekly data over five years to 19-25 April 2007 (average across 5 possible start days); national indexes.

## Standard errors of equity betas

Table 7 shows the standard errors of the beta estimates. This data is used in the calculation of the Vasicek adjustment. The lower the standard error, the smaller the adjustment to the raw beta value.

Country	Company	Daily data	Weekly data
Argentina	Transener	0.05	0.17
Australia	Australian Pipeline Trust	0.09	0.11
Australia	Envestra	0.07	0.08
Canada	Canadian Utilities	0.09	0.09
Canada	Emera	0.06	0.07
Canada	Transcanada	0.05	0.07
Italy	Snam Rete Gas	0.08	0.07
Spain	Enagas	0.07	0.07
Spain	Red Electrica	0.06	0.06
UK	Scottish Power	0.07	0.07
UK	Transco	0.06	0.06
UK	United Utilities	0.05	0.06
USA	Atlanta Gas Light	0.06	0.06
USA	Atmos Energy	0.05	0.06
USA	Duquesne Light Holdings	0.05	0.09
USA	Exelon	0.08	0.08
USA	Kinder Morgan	0.06	0.07
USA	TC Pipelines	0.08	0.08

Table 7: Standard errors of equity betas for comparator firms

Source: Frontier calculations

Daily data over two years to 24 April 2007, weekly data over five years to 19-25 April 2007 (average across 5 possible start days); national indexes.

## Market gearing

Table 7 shows the data on gearing used to convert from equity to asset beta values.

Country	Company	Daily data	Weekly data
Argentina	Transener	46%	63%
Australia	Australian Pipeline Trust	50%	50%
Australia	Envestra	68%	70%
Canada	Canadian Utilities	28%	33%
Canada	Emera	42%	46%
Canada	Transcanada	40%	43%
Italy	Snam Rete Gas	40%	36%
Spain	Enagas	29%	32%
Spain	Red Electrica	40%	44%
UK	Scottish Power	4%	23%
UK	Transco	42%	47%
UK	United Utilities	40%	45%
USA	Atlanta Gas Light	42%	43%
USA	Atmos Energy	49%	46%
USA	Duquesne Light Holdings	44%	44%
USA	Exelon	24%	31%
USA	Kinder Morgan	34%	34%
USA	TC Pipelines	34%	19%

Table 8: Market gearing levels for comparator firms applied in asset beta calculations

Source: Frontier calculations

Daily data over two years to April 2007, weekly data over five years to April 2007. Market gearing is defined as the average total debt (net of cash and equivalents) divided by the sum of the average market cap and the total debt (net of cash and equivalents).

## Tax rate assumptions

Table 9 shows the tax rates used in calculating the comparator beta values.

Country	Daily data	Weekly data
Argentina	35%	35%
Australia	30%	30%
Canada	36%	37%
Italy	33%	34%
Spain	35%	35%
UK	30%	30%
USA	39%	39%

Table 9: Country tax rate assumptions applied in asset beta calculations

Source: OECD

Daily data over two years to April 2007, weekly data over five years April 2007.





## Annexe 2: Comparator characteristics

Table 10 and Table 11 contain information on the comparators used to estimate betas.

Country	Company	Electricity transmission share	Electricity distribution share	Gas transmission share	Gas distribution share	Other activities	Regulation	Turnover, mln EUR	Assets, mln EUR
Argentina	Transener	100%					Revenue cap; 5 years	83	650
Australia	Australian Pipeline Trust			95%		Trade	Price; 5 years, regulator must insert safeguards if longer	144	842
Australia	Envestra			15%	85%		Price; 5 years, regulator must insert safeguards if longer	177	1,479
Canada	Canadian Utilities	10%	20%	10%	10%	Upstream activities, water, other	Rate of return	1,928	3,998
Canada	Emera	15%	30%	10%		Upstream activities	Rate of return	777	2,417
Canada	Transcanada			75%		Upstream activities	Rate of return	3,159	13,688
Italy	Snam Rete Gas			95%		Trade	Price cap, but to recover costs plus inflation, expected productivity, quality improvements etc; annual	1,780	9,894
Spain	Enagas			100%			Ex-ante cost plus; annual	1,295	3,472
Spain	Red Electrica	100%					Ex-ante cost plus; annual	961	3,476
UK	Scottish Power	25%	65%			Upstream activities	Hybrid price cap to limit incentives to oversell volume; 5 years	8,542	20,344
UK	Transco	25%	20%	15%	35%	Other	Hybrid price cap to limit incentives to oversell volume; 5 years	13,077	34,475
UK	United Utilities		40%			Water, other	Hybrid price cap to limit incentives to oversell volume; 5 years	3,035	14,027

Table 10: Comparator characteristics – based on information collected in November 2005

Source: Frontier calculations based on annual reports, financial statements, company websites.

Country	Company	Electricity transmission share	Electricity distribution share	Gas transmission share	Gas distribution share	Other activities	Regulation	Turnover, mln EUR	Assets, mln EUR
USA	Atlanta Gas Light				80%	Supply, trade	Rate of return	1,473	4,534
USA	Atmos Energy				75%	Supply, trade	Rate of return	2,347	2,307
USA	Duquesne Light Holdings	10%	70%			Other	Rate of return	721	2,117
USA	Exelon	10%			65%	Upstream activities	Rate of return	11,669	33,820
USA	Kinder Morgan			100%			Rate of return	6,377	8,484
USA	TC Pipelines			100%			Rate of return		267

Table 11: Comparator characteristics – based on information collected in November 2005

Source: Frontier calculations based on annual reports, financial statements, company websites.



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