



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 energy networks in the Netherlands, based on data up to the beginning of February 2008. 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 January 2008)	Yield on 10 year maturity – average over period
6 months	4.3%
1 year	4.3%
2 year	4.1%
3 year	3.8%
5 year	3.9%

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 a two year and a five year period. Applying this to the latest data gives a range of 3.9% to 4.1%.

Figure 1 shows that the government bond yield has increased since the start of 2007. However, the yield has fallen back from a high of 4.6% in June 2007 to a level of 4.1% in January 2008. This in part reflects investors moving into low risk assets following the ‘sub-prime’ crisis.

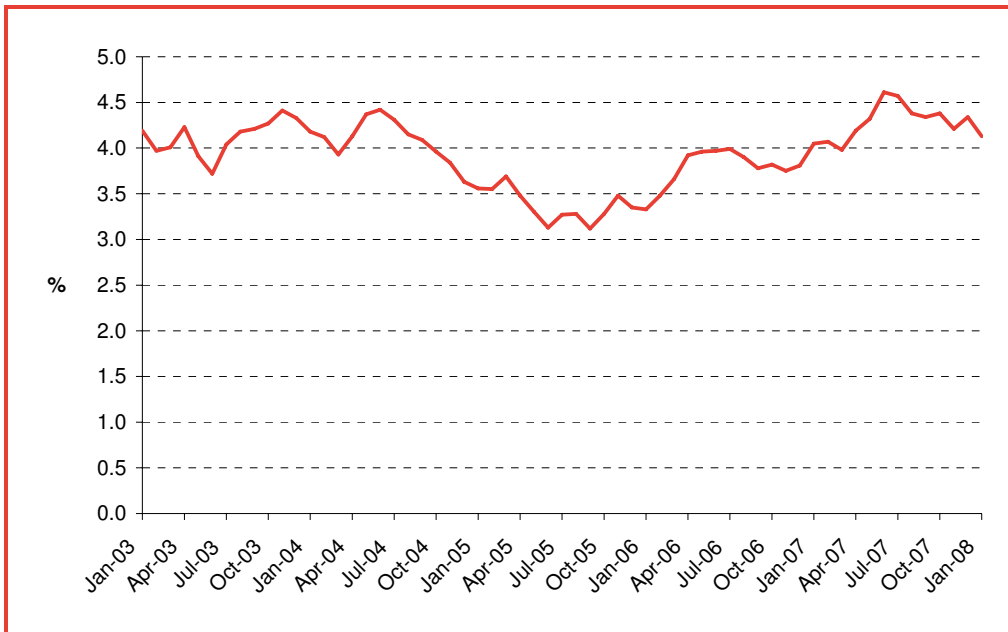


Figure 1: 10 year Netherlands Government bond yields

Source: Eurostat

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 2 shows how the debt premium has fluctuated over time, based on data for European corporate bonds.

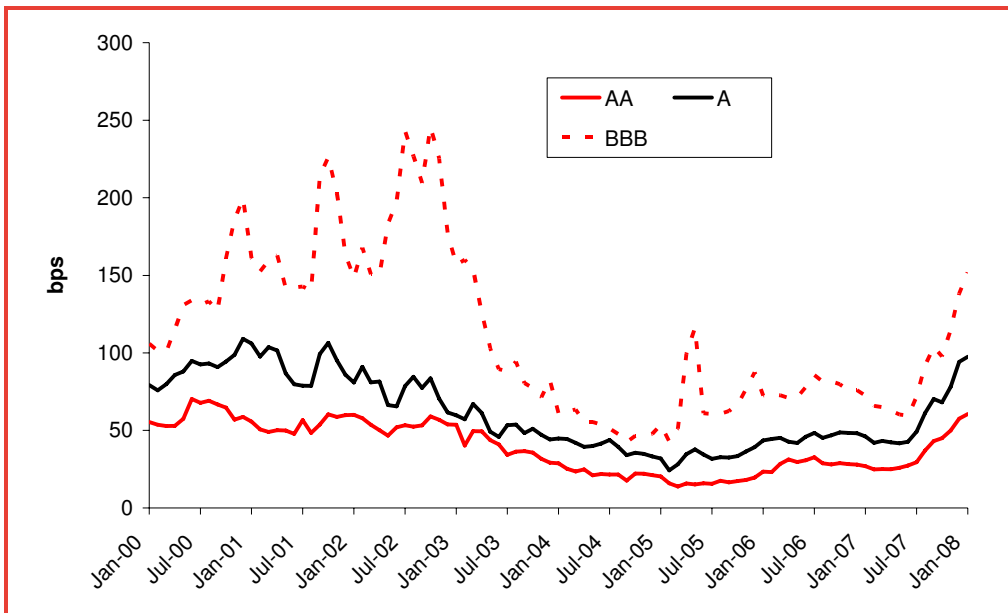


Figure 2: Spreads on European non-financial corporate bonds – to January 2008

Source: ECB Monthly Bulletin

Over the last five years the average debt premium has been around 0.5% for 'single-A' rated bonds. The average over the past two years is also 0.5%.

Figure 3 shows the 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%. The spreads shown in the Figure are calculated relative to a swappate. For

single A-rated debt this spread since 2003 has been between 30 and 40 basis points (i.e. 0.3% to 0.4%). The swaprate is typically 10-20 basis points above the government risk-free rate. Taking this into account the spread on single-A bonds relative to government rates has been around 0.5% over the past five years.

The evidence in Figures 2 and 3 shows a debt premium on 'single-A' rated European corporate bonds of around 0.5% in the last five years¹.

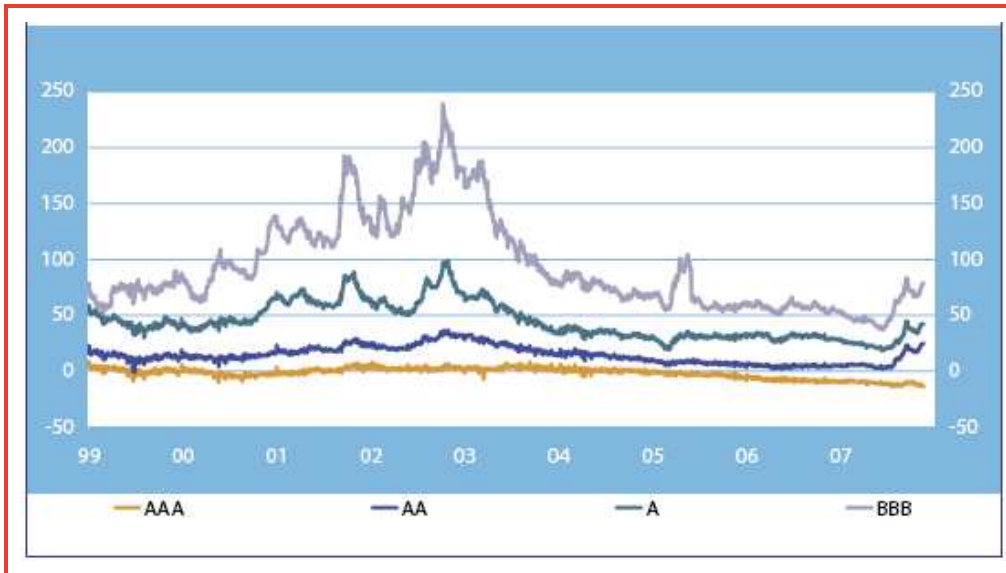


Figure 3: Corporate bond spreads by rating category (bps) – relative to swaprate
Source: Rabobank, Outlook 2008 (www.rabobankvisie.com)

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 (2-3 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 analysis undertaken in 2005. 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.

¹ The spreads relative in the Figure are calculated relative to a swaprate. The swaprate is typically 10-20 bps above the government risk-free rate. Taking this into account the spread on single-A bonds relative to government rates has been around 0.5% since the middle of 2003.

The results from this sample of utility bonds over the past two years are as follows.

- spreads range between 0.75% and 0.88%;
- the mean average spread is 0.83%; and
- the median spread is 0.85%.

Company	Maturity of bond – as of Jan 2008	Credit rating	Spread over past two years
Eastern	5 years	A	0.75%
EON Int Fin	5 years	A	0.76%
Transco	10 years	A	0.80%
Yorkshire Electricity	12 years	BBB+	0.87%
Northern Electric	13 years	BBB+	0.87%
RWE	14 years	A+	0.79%
Scottish & Southern	15 years	A+	0.87%
RWE	16 years	A+	0.79%
Eastern	17 years	A	0.88%
Transco	17 years	A-	0.85%
National Grid	17 years	A	0.87%

Table 2: Utility bond spreads – energy networks – April 2005 - January 2008

Source: Thomson Financial, HSBC Bank plc

The estimated spreads from this sample are higher than those for the wider sample of single-A rated corporate bonds outlined above. This is partly explained by the fact that the average maturity of this sample of bonds is around 13 years, compared to 10 year maturity for the earlier evidence. The longer maturity will increase the credit spread, by the order of around 10 basis points.

3.3 IMPACT OF 'SUB-PRIME' CRISIS ON INVESTMENT GRADE YIELDS

Both Figure 2 and Figure 3 show that spreads on investment grade corporate bonds have increased since summer 2007, as a result of the crisis in sub-prime credit markets. For example, the data in Figure 2 shows that the spread on single-A rated debt has increased from around 0.4% between April and June 2007 to around 0.7% between September and November 2007.

In terms of assessing the impact of the credit crisis on the estimates of the regulated cost of debt for energy networks, there are a number of factors to take into account.

First, the recent increase in credit spreads has been relative to historically low rates in recent years. The methodology employed to estimate the cost of capital has focused on medium-term trends in order to reduce exposure to short-term volatility in financial markets. The current level of spreads is consistent with these medium-term trends.

Second, the increase in spreads is associated with a reduction in the risk-free rate, as investors switch from risky to risk-free assets. This point was identified by the Bank of England in December 2007². Figure 4, reproduced from the Bank of England publication, shows that the overall yield on US investment grade corporate bonds has not increased as a result of the crisis. The Bank stated that:

“The impact of wider credit spreads on firms’ cost of debt capital has to some extent been offset by falls in default-free government bond rates. Indeed, US investment grade and EME corporate bond yields are virtually unchanged”. [page 494]

As a result the modest increase in investment grade spreads shown in Figure 2 is associated with a reduction in the risk-free rate, as shown in Figure 1.

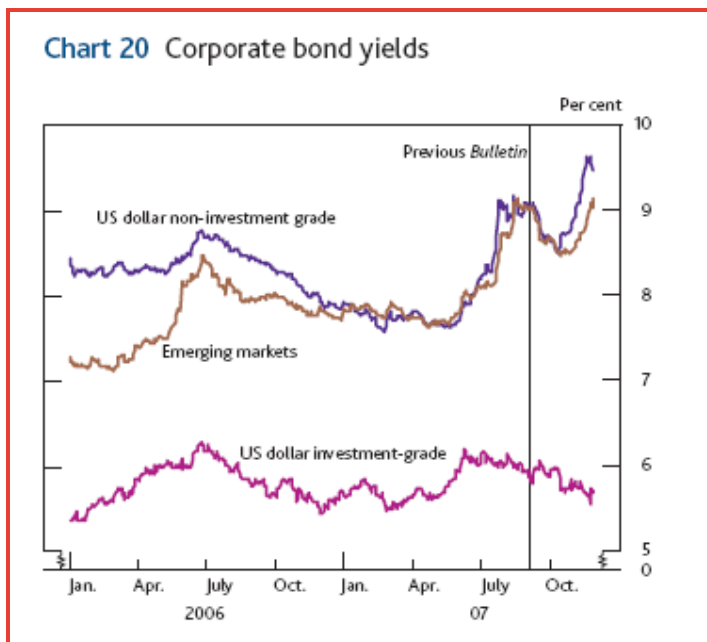


Figure 4: Corporate bond yields

Source: Bank of England Quarterly Bulletin, Q4 2007

Third, although the estimate of the cost of capital is based on historic data, the methodology should aim to be robust to possible future developments. The current financial market outlook is very uncertain and there is scope for further increase in spreads.

Figure 5 shows Rabobank’s forecast for credit spreads for the end of 2008. The forecast is for the spread on more riskier bonds to widen further but for the spreads on high credit quality bonds to stabilise. The spread on single-A bonds is forecast to be 0.45% relative to the swap-rate. Taking account of the 10-20 basis

² Bank of England Quarterly Bulletin Q4 2007.

point spread between the swap-rate and the government rate, this translates into a spread of 0.55% to 0.65% relative to the government rate.

	AAA	AA	A	BBB	HY
November 20th 2007	-13	25	42	79	256
End 2008	-10	22	45	100	320

Figure 5: Forecast credit spreads – relative to swaprates

Source: Rabobank Outlook 2008

In summary, to date the sub-prime crisis has not resulted in the cost of debt for single-A rated bonds to move out of line with our existing methodology. Nevertheless, there is greater uncertainty about the future outlook than there was previously.

3.4 SUMMARY ON DEBT PREMIUM

Our assessment is that the appropriate range for the debt premium is 0.6% to 1.0%. This represents an increase in the range compared to the previous analysis undertaken in 2005 and 2007, reflecting the current level of uncertainty in credit markets.

The range is based on the following evidence.

- The spread on single-A rated European corporate bonds has averaged 0.5% over the past five years and the past two years.
- A sample of utility bonds has an average premium of 0.83% over the past two years. This sample has an average maturity of around 13 years.
- The outlook for credit markets is uncertain and further increases in debt spreads are possible. The identified range includes a margin for this uncertainty and also to allow for issuance costs.

4 Equity risk premium

4.1 PREVIOUS ANALYSIS OF ERP

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%.

4.2 IMPACT OF SUB-PRIME CRISIS ON ERP

The sub-prime crisis may have resulted in an increase in the equity risk premium, as investors move away from risky assets into risk-free assets. The Bank of England Quarterly Bulletin, published in December 2007, considered this issue.

Figure 6 shows evidence, presented in the Bank of England report, that equity market volatility has increased since the summer of 2007.

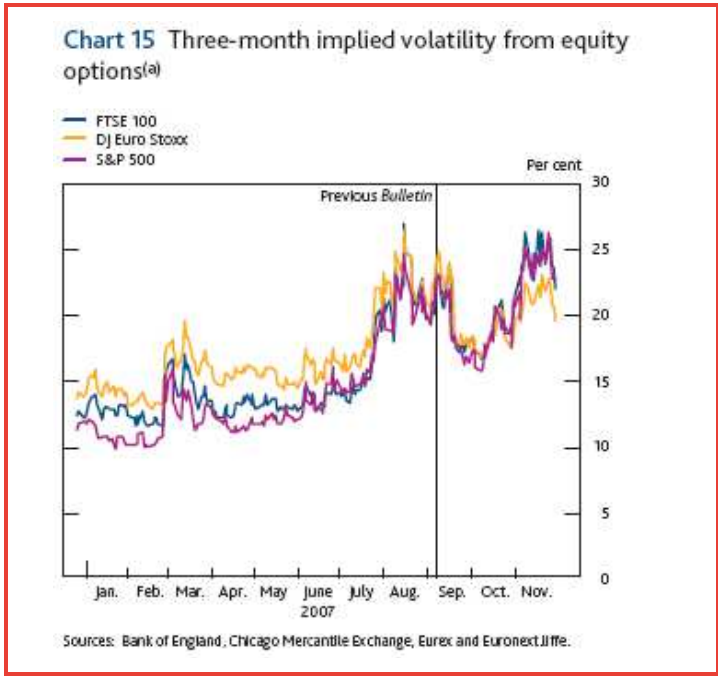


Figure 6: Equity market volatility

Source: Bank of England Quarterly Bulletin, Q4 2007

The increase in equity market volatility has been associated with an increase in the implied equity risk premium in the major equity markets. These estimates of the ERP are based on current dividend yields combined with a long-term view on dividend growth.

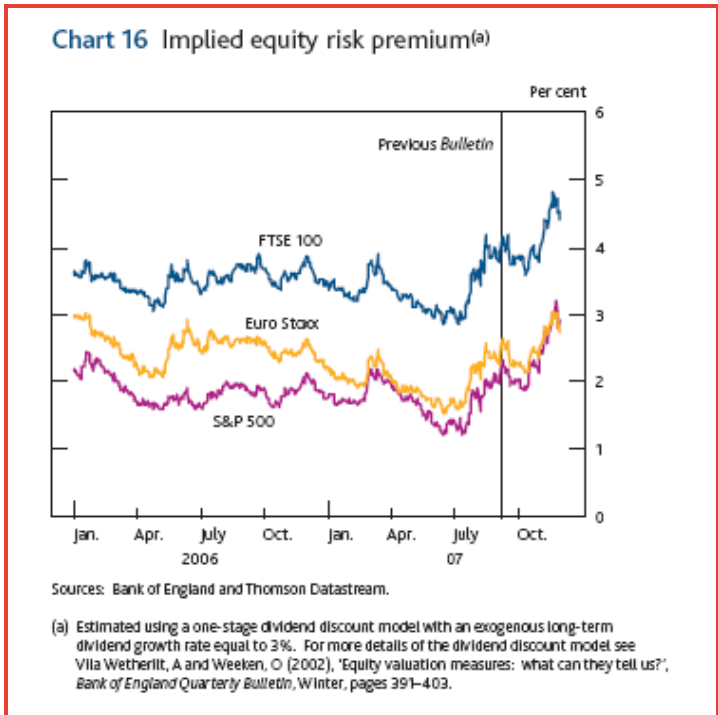


Figure 7: Implied equity risk premium

Source: Bank of England Quarterly Bulletin, Q4 2007

Although this evidence indicates that the ERP has increased in recent months, the estimated ERPs from this analysis lie within, or below, our estimated range of

Equity risk premium

4% to 6%. As a result, there is no indication that our range for the ERP is no longer appropriate.

Our methodology for estimating the ERP is to take account of a wide range of evidence over a long period of time. This reduces the sensitivity of the estimated cost of capital to short-term market volatility.

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 Beta³.

- **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

³ 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 chosen set of comparators. This sample of 15 regulated energy networks is based on that used in the analysis undertaken in July 2007. Three utilities have been dropped from the sample on the basis that

they are no longer quoted⁴. The remaining sample of 15 is sufficiently robust in terms of:

- Sample size. We consider that the sample size is important to providing robust beta estimates that will be consistent over time.
- The companies satisfy the criteria outlined above, ensuring that the sample remains representative.
- The sample maintains an appropriate geographical balance in the comparator set – providing results that are reasonably stable in the face of country specific factors.
- The sample 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.

As in previous analysis we have tested whether the Beta estimates are sensitive to autocorrelation in the estimated regression. In other words, there could be a concern that the returns are also affected by lagged market returns. The tests we have undertaken do not reveal any degree of autocorrelation.

This data provides a range of asset betas of 0.39 to 0.42 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.

⁴ These three utilities are Transcanada, Scottish Power and Duquesne.

Country	Company	Daily data	Weekly data
Argentina	Transener	0.32	0.35
Australia	Envestra	0.27	0.20
Australia	Australian Pipeline Trust	0.38	0.29
Canada	Emera	0.26	0.24
Canada	Canadian Utilities	0.37	0.43
Italy	Snam Rete Gas	0.42	0.35
Spain	Red Electrica	0.48	0.36
Spain	Enagas	0.56	0.48
UK	Transco	0.43	0.39
UK	United Utilities	0.49	0.40
USA	Atlanta Gas Light	0.49	0.51
USA	Kinder Morgan	0.31	0.33
USA	TC Pipelines	0.18	0.41
USA	Atmos Energy	0.42	0.47
USA	Exelon	0.85	0.64

Table 4: Asset betas for comparator firms, Vasicek adjustment

Source: Frontier calculations

Daily data over two years to 7th Feb 2008, weekly data over five years to 31 Jan–7th Feb 2008 (average across 5 possible start days); national indexes.

The Beta estimates have increased slightly during the past year. This is illustrated in Figure 8 and Figure 9 below.

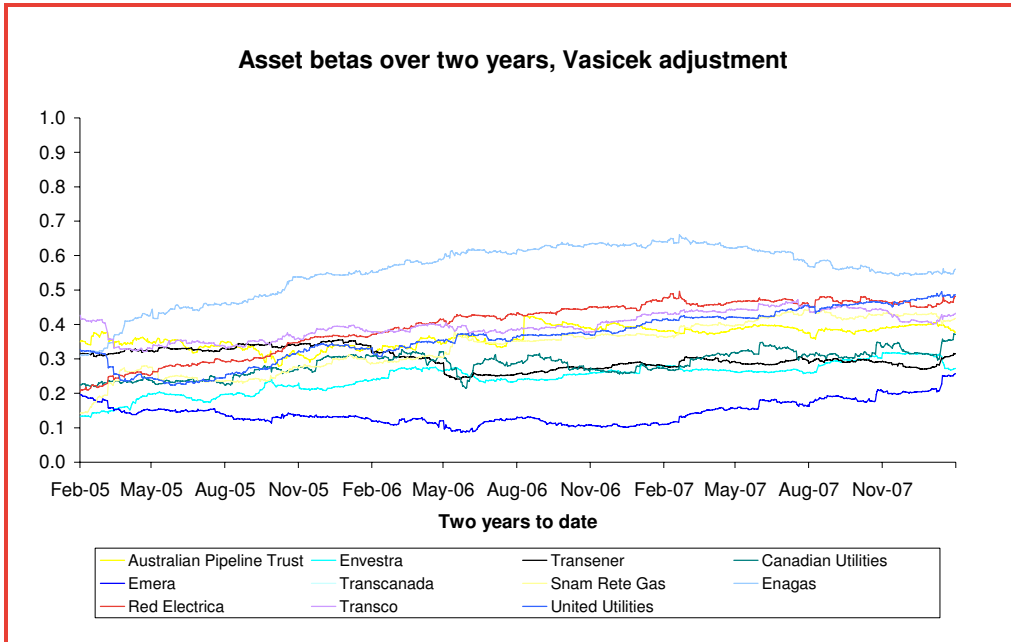


Figure 8: Beta estimates for non-US comparators

Source: Frontier calculations

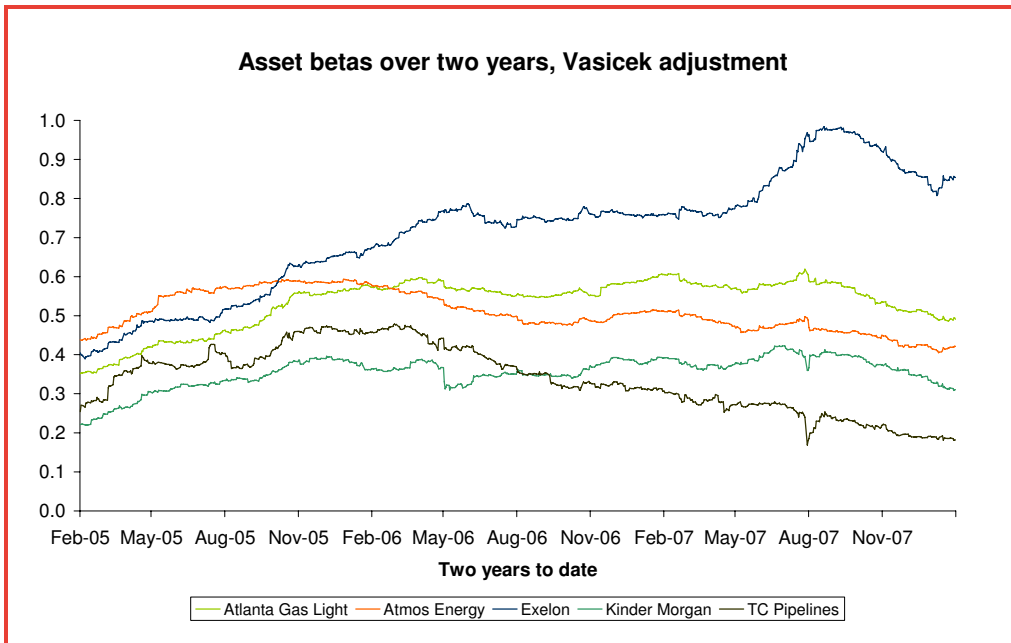


Figure 9: Beta estimates for US comparators

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 following sources of evidence.

- Out-turn inflation experienced over the 5 year period used for the risk-free rate. Over the past 5 years CPI inflation in the Netherlands has averaged just over 1.5%. Over the past 2 years CPI inflation has averaged just over 1.6%.
- The latest forecast from the central bank (De Nederlandsche Bank, Quarterly Bulletin, December 2007) predicts that consumer price inflation will increase from 1.6% in 2007 to 2.6% in 2008 and 3.1% in 2009.
- 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 1.75%.⁵

Taking account of this evidence we conclude that the appropriate inflation projection is 1.75%. This represents an increase compared to the figure of 1.5% used in the previous analysis of July 2007. The inflation assumption should be based on a forward looking view of inflation and should also reflect the fact that the nominal risk-free rate is based on data over the past 2 years and the past 5 years. Our assessment is that the current inflation projection of 1.75% is consistent with the estimates of the nominal risk-free rate.

⁵ CPB, Actualisatie Economische Verkenning 2008-2011, September 2007. Source: 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	0.30	0.33
Australia	Australian Pipeline Trust	0.36	0.26
Australia	Envestra	0.26	0.19
Canada	Canadian Utilities	0.31	0.38
Canada	Emera	0.23	0.21
Italy	Snam Rete Gas	0.40	0.33
Spain	Enagas	0.54	0.46
Spain	Red Electrica	0.46	0.34
UK	Transco	0.42	0.37
UK	United Utilities	0.48	0.38
USA	Atlanta Gas Light	0.48	0.50
USA	Atmos Energy	0.41	0.46
USA	Exelon	0.85	0.61
USA	Kinder Morgan	0.29	0.29
USA	TC Pipelines	0.14	0.35

Table 5: Unadjusted asset betas for comparator firms

Source: Frontier calculations

Daily data over two years to 7th Feb 2008, weekly data over five years to 31 Jan–7th Feb 2008 (average across 5 possible start days); national indexes.

Unadjusted equity betas

Country	Company	Daily data	Weekly data
Argentina	Transener	0.46	0.62
Australia	Australian Pipeline Trust	0.70	0.47
Australia	Envestra	0.62	0.48
Canada	Canadian Utilities	0.39	0.49
Canada	Emera	0.34	0.32
Italy	Snam Rete Gas	0.58	0.46
Spain	Enagas	0.69	0.59
Spain	Red Electrica	0.65	0.50
UK	Transco	0.58	0.55
UK	United Utilities	0.67	0.57
USA	Atlanta Gas Light	0.68	0.72
USA	Atmos Energy	0.64	0.70
USA	Exelon	0.99	0.75
USA	Kinder Morgan	0.38	0.38
USA	TC Pipelines	0.20	0.42

Table 6: Unadjusted equity betas for comparator firms

Source: Frontier calculations

Daily data over two years to 7th Feb 2008, weekly data over five years to 31 Jan–7th Feb 2008 (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	0.04	0.09
Australia	Australian Pipeline Trust	0.07	0.10
Australia	Envestra	0.06	0.07
Canada	Canadian Utilities	0.07	0.09
Canada	Emera	0.05	0.07
Italy	Snam Rete Gas	0.04	0.06
Spain	Enagas	0.05	0.07
Spain	Red Electrica	0.05	0.07
UK	Transco	0.05	0.07
UK	United Utilities	0.04	0.07
USA	Atlanta Gas Light	0.05	0.07
USA	Atmos Energy	0.04	0.06
USA	Exelon	0.07	0.10
USA	Kinder Morgan	0.04	0.08
USA	TC Pipelines	0.06	0.10

Table 7: Standard errors of equity betas for comparator firms

Source: Frontier calculations

Daily data over two years to 7th Feb 2008, weekly data over five years to 31 Jan–7th Feb 2008 (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	45%	58%
Australia	Australian Pipeline Trust	57%	54%
Australia	Envestra	67%	69%
Canada	Canadian Utilities	28%	31%
Canada	Emera	41%	44%
Italy	Snam Rete Gas	40%	36%
Spain	Enagas	30%	31%
Spain	Red Electrica	38%	42%
UK	Transco	36%	42%
UK	United Utilities	37%	42%
USA	Atlanta Gas Light	41%	42%
USA	Atmos Energy	47%	46%
USA	Exelon	21%	27%
USA	Kinder Morgan	35%	34%
USA	TC Pipelines	42%	25%

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

Source: Frontier calculations

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

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
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	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	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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