The Brattle Group

The WACC for Dutch Drink Water Companies

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1. INTRODUCTION AND SUMMARY

The Dutch Authority for Consumers and Markets (ACM)[1] has commissioned *The Brattle Group* to calculate the Weighted Average Cost of Capital (WACC) for drinking water distribution companies in the Netherlands. The purpose of the WACC calculation is to estimate an allowed return in the context of future price controls.

The ACM has instructed us to calculate the WACC using a methodology that complies with the relevant ministerial ruling and a ministerial decree.[2] In broad terms, the methodology we apply estimates the WACC by applying the Capital Asset Pricing Model (CAPM) to calculate the cost of equity. The risk-free rate is calculated based on the two-year and five-year average yield on 10-year Dutch government bonds. The ERP is calculated using long-term historical data on the excess return of shares over long-term bonds, using data from European markets. Specifically, the methodology specifies that the projected ERP should be based on the average of the arithmetic and geometric realised ERP. The methodology also takes note of other estimates of the ERP, from for example, dividend growth models, on deciding whether any adjustments need to be made to the final ERP.[3]

The Dutch water firms for which we are estimating the WACC are not publicly traded. Therefore we have selected a 'peer group' of publicly traded water distribution firms. We use the peer groups to estimate the beta for water distribution. The methodology specifies that the equity betas are estimated using daily betas taken over three years and tested for liquidity and statistical robustness.

We have examined the gearing and credit ratings of network industries in the peer groups and for Dutch network firms. We conclude that a 50% gearing level is a reasonable target for each of the three activities, and that for Dutch regulated firms an S&P 'A' credit rating would be consistent with a 50% gearing.[4]

The methodology specifies that the allowed cost of debt should be based on the average cost of debt for A-rated bonds, and the cost of debt for a group of bonds issued by firms engaged in similar activities to drinking water distribution that have a rating at or close to 'A' – so-called comparable bonds. We understand that 'similar activities' in this context means not only firms undertaking drinking water distribution but also firms engaged in activities such as the transport and/or distribution of gas and electricity. We identified a group of bonds that fit these criteria, but found that

[1] The work was actually commissioned by the NMa, but as of the date of publication the NMa has merged with the Dutch Consumer Authority and the Telecoms regulator to become the ACM.

[2] The '*Drinkwaterregeling*' and the '*Drinkwaterbesluit*'.

[3] Note that the methodology that we apply in this report to estimate the WACC for water distribution (the 'Water WACC methodology') is identical to the ACM's WACC methodology for electricity and gas distribution/transmission (the 'energy networks WACC methodology') *except* that a) the Water WACC methodology uses only Dutch government bonds for the risk-free rate, while the energy networks WACC methodology uses an average of German and Dutch government bonds. The period over which the yields on these bonds is calculated also differs and b) the Water WACC methodology estimates the cost of debt using yields from both specific bonds and generic bonds, while the energy networks WACC methodology uses only data from generic bonds.

[4] Leverage and gearing are usually used interchangeably. Both refer to the percentage of the firm value that is financed by debt, or the market value of debt divided by the sum of the market value of debt and the market value of equity.

the final sample of specific bonds did not include any water firms. Accordingly, we agreed with the ACM to calculate the spread for the comparable bonds using the yields for a group of utility firms published by Bloomberg, a data provider. This methodology results in a pre-tax cost of debt of 4.23%. The cost of debt includes 15 basis points for the cost of issuing debt.

Applying the methodology results in an after-tax cost of equity of 5.47% and a nominal pre-tax WACC of 4.85%. Because the Dutch drinking water firms do not corporation pay tax we apply an effective tax rate of 0%. Table 1 summarises the WACC for water distribution and of the inputs which led to the WACC.

Table 1: Summary WACC calculation

Risk Free Rate	[1]	2.78%	Section 4
Asset Beta	[2]	0.27	Section 6.4
Equity Beta	[3]	0.54	[2]x(1+(1-[9])x[11])
ERP	[4]	5.00%	Section 6.6
After-tax Cost of Equity	[5]	5.47%	[1]+[3]x[4]
Debt Premium	[6]	1.30%	Section 5
Non-interest Fees	[7]	0.15%	Section 5
Pre-tax Cost of Debt	[8]	4.23%	[1]+[6]+[7]
Tax Rate	[9]	0%	Effective Tax Rate
Gearing (D/A)	[10]	50%	Section 3
Gearing (D/E)	[11]	100%	[10]/(1-[10])
Nominal After-tax WACC	[12]	4.85%	(1-[10])x[5]+(1-[9])x[8]x[10]
Inflation	[13]	2.00%	Section 7
Nominal Pre-tax WACC	[14]	4.85%	[12]/(1-[9])
Real Pre-tax WACC	[15]	2.80%	(1+[14])/(1+[13])-1

2. SELECTION OF PEERS

The Dutch water distribution firms for which we are estimating the WACC are not publicly traded. Therefore we need to find publicly traded firms which derive the majority of their profits from water distribution. We call these firms 'comparables' or 'peers'. We use the peer groups for two key steps in the WACC calculation:

1. Estimating the beta;
2. Estimating the appropriate level of debt or gearing.

We first identify a group of potential peers. We then apply test to see if the firms' shares are sufficiently liquid before deciding on the final peer group.

In determining the number of peers that should be in each peer group, there is a trade-off. On the one hand, adding more peers to the group reduces the statistical error in the estimate of the beta. On the other hand, as more peers are added, there is a risk that they may have a different systematic risk than the regulated firm, which makes the beta estimate worse. In statistical terms, once we have 6-7 peers in the group the reduction in the error from adding another firm is relatively small. Therefore a peer group of around six firms should ensure an acceptable level of accuracy while avoiding adding firms which are not sufficiently similar to the activity in question.

To reach the required number of peers we first attempt to include companies involved in similar business lines in the EU. If this is not sufficient we use peers from for the US.[5] The only listed European comparators which could meet the criteria on sufficient revenue and liquidity are four UK water companies. To increase the group to six, and therefore reduced the error in the beta estimate, we add two water companies from the US.

We have not used water companies from outside of the US and the EU. This is because we are not confident that the relationship between the share prices of such firms and the local market index will be representative of the relationship for a water firm in the EU. Specifically, when estimating the beta for firms in, for example New Zealand and China, we would have to estimate beta by reference to the local market index. Our concern is that the relationship between, for example, the Chinese market index and a Chinese water firm's stock price might be very different from the equivalent relationship in Europe, because the Chinese economy is so different from Europe's. For example, the Chinese economy is more dependent on trade than the Eurozone economy, and has a different mix of activities such as service industries, manufacturing and agriculture. Hence the relationship between the share price of a Chinese water firm and the Chinese market index will be different to the relationship between a European water firm and the European market index. In our first report for ACM we described how the relevant market index is the Eurozone index, because a typical Dutch investor would be diversified across the Eurozone, not just in the Netherlands.[6] For this investor the relevant benchmark is the way that an individual firm's share price behaves relative to a Eurozone index, since this tells the investor about the degree of systematic risk he or she is bearing. The relationship between a Chinese water firm's share price and the Chinese index is not relevant for the

[5] However, we recognise that US firms have a different regulatory regime than EU firms.
[6] *Loc. Cit.* footnote 1.

European investor, because it does not tell the Dutch investor about the risk of the water firm relative to the Eurozone market index which he or she is using to diversify risk. For this reason, we have not considered data from publicly traded water firms outside of the EU and the US.

Table 2: Firms Selected as Potential Peers for Water Distribution

Firm	Country
Severn Trent	UK
Pennon Group	UK
Northumbrian Water Group	UK
United Utilities Group PLC	UK
California Water Service	US
SJW Corp	US

2.1. LIQUIDITY TESTS

One of the things that we use the peer group for is estimating the beta for each activity. Illiquid stocks will tend to underestimate a beta, and so we first test each firm to see if its shares are sufficiently liquid.[7] There are several possible tests for the liquidity of a traded share. One test defines a share as being sufficiently liquid for the purposes of estimating beta using daily returns if it trades on more than 90% of days in which the index trades. We have applied this test to our prospective peers – Table 3 shows the results.

Table 3: Summary of liquidity tests

Company and currency	% of days that the company trades	Average daily value traded
Severn Trent PLC, €	97%	14,075,553
Pennon Group PLC, €	97%	8,018,467
Northumbrian Water Group PLC, €	97%	4,903,145
United Utilities Group PLC, €	97%	19,214,808
California Water Service, US$	100%	4,069,323
SJW Corp, US$	100%	783,476

Notes:
Average volume traded over 3 years of data used in analysis

All of the potential peers meet the threshold of 90% trading. We have also checked that all the peers have annual revenues of at least €100 million for the last three years. Table 4 illustrates.

[7] For example, suppose that the true beta of a firm was 1.0, so that every day the firm's true value moved exactly in line with the market. But the firm's shares only change price when they are traded. Suppose that the firm's shares are traded only every other day. In this case, the firm's actual share price will only react to news the day after the market reacts. This will give the impression that the firm's value is not well correlated with the market, and the beta will appear to be less than one. Using weekly returns to calculate beta mitigates this problem, since it is more likely that the firm's shares will be traded in the week. However, using weekly returns have other disadvantages, such as providing fewer 80% less data points over any given period.

Table 4: Annual Revenues of Peers

		2012	2011	2010	2009
Severn Trent PLC	UK (£)	1,770	1,711	1,703	
Pennon Group PLC	UK (£)	1,233	1,159	1,068	
Northumbrian Water Group PLC	UK (£)	789	738	704	
United Utilities Group PLC	UK (£)	1,154	1,513	1,573	
California Water Service Group	US ($)		501	460	449
SJW Corp	US ($)	261	238	215	216

Sources: Firm Annual reports

3. GEARING AND CREDIT RATING

Table 5 illustrates that the weighted average gearing of the peers for water distribution is 50%.

Table 5: Average gearing (D/A) of the peers

Firm	Country	Leverage
Severn Trent PLC	UK	53%
Pennon Group PLC	UK	50%
Northumbrian Water Group PLC	UK	57%
United Utilities Group PLC	UK	57%
California Water Service Group	US	41%
SJW Corp	US	41%
Minimum		41%
Maximum		57%
Average		50%

Source: Bloomberg
Gearing is as of the latest date used in the analysis period for each firm

The relevant decrees state that the financing structure used for calculating the WACC should be that which is considered reasonable for drinking water companies given the situation on the financial markets. The decrees also state that this value may deviate from the actual equity capital of the Dutch drinking water companies. Given that the cost of debt will be based on a firm with an A rating, we interpret this to mean that the assumed gearing should also be consistent with an A rating. To determine if the observed average gearing is consistent with an A rating we have investigated the relationship between gearing and credit rating for a number of network firms.

Figure 1 illustrates our findings.[8] From the sample, there is not a clear relationship between credit rating and gearing. The average gearing of the A rated firms is 46%, while the average gearing of firms rated BBB is 44%. This is because gearing is only one factor which drives credit ratings. Other

[8] Latest ratings given by S&P; latest gearing from Bloomberg.

factors include the sector in which the firm is active and the countries in which it operates. The latter has become particularly critical since the emergence of the sovereign debt crisis in the Eurozone. That there is no significant difference between the gearing of A rated and BBB rated companies confirms that factors other than gearing are driving the differences in credit ratings. In particular, the only regulated European BBB rated companies are Spanish. The BBB ratings reflect the weakening of the Spanish economy, and that Enagas and Red Electrica have been recently downgraded to match the rating of the Spanish Government. This also highlights that it is of limited use to compare the ratings of network firms operating in different European countries.

In contrast, The Dutch government has maintained its AAA rating. Gasunie, which is the parent company of GTS, had a long-term S&P credit rating of AA- with a negative outlook as of end February 2013.[9] Unfortunately deriving a gearing for GTS is difficult, since the debt is held by the parent, Gasunie, and is used to finance both regulated and non-regulated activities. TenneT notes on its website that it aims to maintain a credit rating of at least A. TenneT's 2011 gearing, based on net debt and book equity, was 48%.[10] Enexis and Alliander are two energy supply and network companies active in the Netherlands. Both have an S&P rating of A+ based on recent gearing of 41% and 37% respectively. Given the data above, we conclude that all the peer groups have a very similar gearing in the range of 45-50%.

In the past other EU regulators have allowed slightly higher gearing levels – up to around 65% – in their WACC calculations. However since 2008 firms have generally had to hold less debt to maintain an investment grade rating. Targeting an A grade rating – which is the last-but-one credit rating before debt loses its investment-grade status – seems prudent.

We note that the final WACC results are not sensitive to the choice of gearing, as long as the firms maintain an A credit rating. As gearing increases, the proportion of relatively cheap debt in the WACC formula increases. However, increased debt means more risk for equity holders, which results in a higher equity beta and a higher cost of equity. These two effects largely offset one another.[11] As long as the target level of debt and the credit rating assumed are consistent with one another, and the credit rating is reasonable given that the country in which the firms operate, then the resulting WACC should be reasonable.

Given the observed gearing levels of between 45-50%, the need to maintain an A credit rating and the relative insensitivity of the WACC to the final choice of gearing (as long as it consistent with an A rating), a gearing level of 50% is consistent with an A credit rating for regulated firms operating in the Netherlands. This level of gearing and the target credit rating are consistent with actual

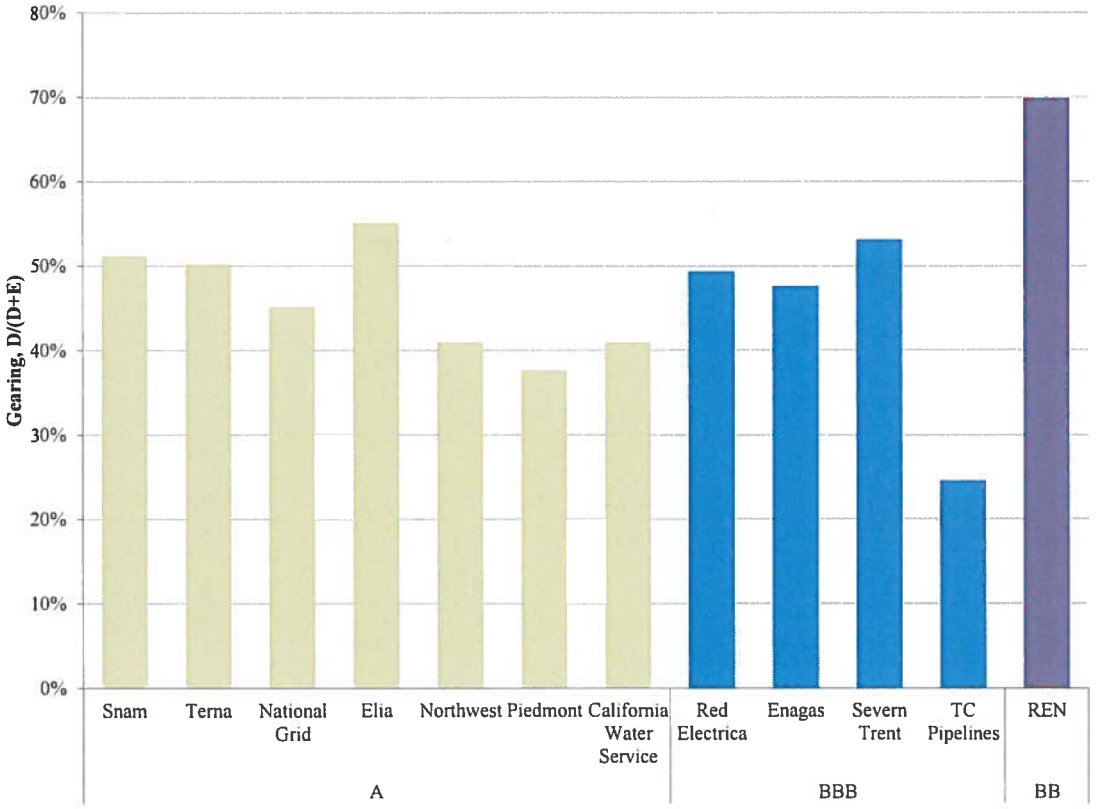
[9] http://www.gasunie.nl/en/about-gasunie/credit-ratings visited on February 27, 2013.

[10] Debt-to-RAB is a usually a good approximation for gearing for non-listed firms, since the RAB should approximate the value of debt plus the market value of equity.

[11] The insensitivity of the WACC to the financing choices under certain assumption is known as the Modigliani–Miller theorem.

practice of the Dutch network firms for which credit ratings are available. It is also consistent with Moody's requirement for gearing to be between 40% and 55% to qualify for an A-rating.[12]

Figure 1: Gearing vs S&P Credit Rating



4. RISK-FREE RATE

The methodology specifies that to calculate the risk-free rate, we must calculate the average yield on 10-year Dutch government bonds over the last five years, and the average over the last two years. The risk-free rate is then the average of the two-year and five-year average. Figure 2 below shows the movement of the yields on 10-year Dutch government bonds over the prior five years. We note that, as a result of the economic crisis and subsequent easing of monetary policy, the risk free rate has declined substantially over the five-year reference period, from around 4% to less than 2%.

The two-year average yield is 2.43%. The five-year average is higher at 3.14%, because this includes the pre-crisis period in 2008 and the period in 2009 before the easing of monetary policy took effect. The average of these two numbers gives a risk-free rate of 2.78%.

[12] Gearing is only one criteria that Moody's look at when assigning a rating. Hence a firm that scores an A rating on gearing may obtain a higher or lower rating than A depending on other rating criteria.

Figure 2: Yield on Dutch Government 10 Year Bonds

5. COST OF DEBT

The method prescribes that the cost of debt for water distribution be estimated by looking at two different sources of debt yields and spreads:

1. The five-year average yields on A-rated Euro bonds with a maturity of 10 years, where the bonds have been issued by firms active in multiple sectors. We refer to these yields and spreads as 'cross-sector, since they are issued by firms that are active in a wide range of sectors;[13]
2. The two-year average yields on bond issued by firms that engage in activities which are comparable to that of drinking water companies and which have a rating of A, A+ or A- and a maturity of around 10-years. We understand that 'activities which are comparable to that of drinking water companies' in this context means not only firms engaged in drinking water distribution but also firms engaged in activities such as the transport and/or distribution of gas and electricity. We refer to these as the 'comparable' bonds.

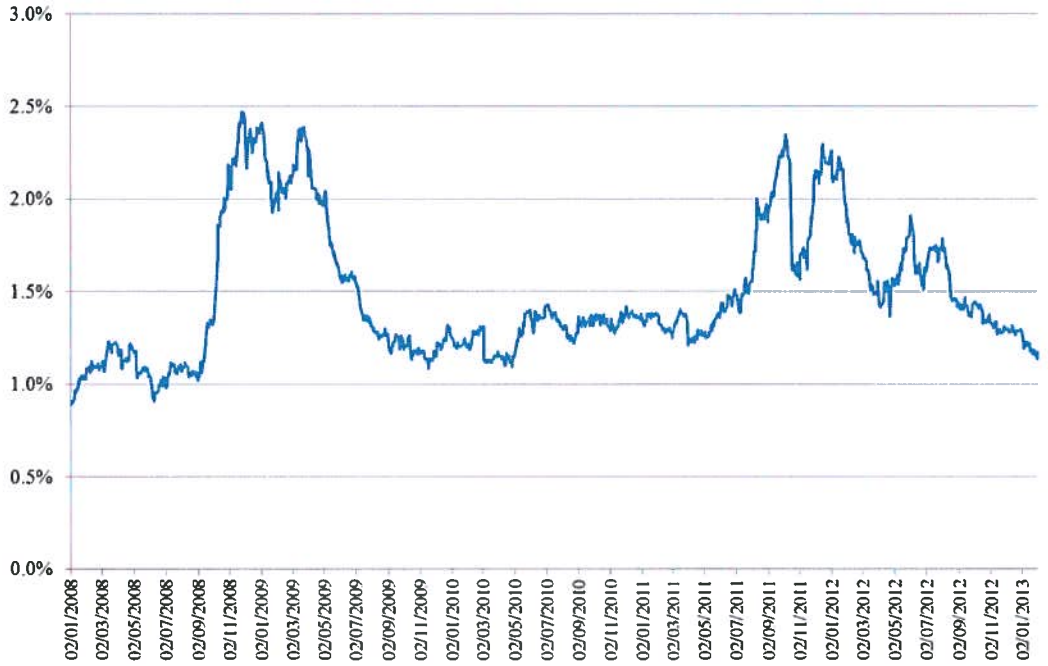
In both cases, we calculate the difference or spread of the bond yields relative to the relevant government bond rate. We describe the results below.

[13] By 'generic', we mean these are yields for a group of A-rated utilities calculated by Bloomberg, where the individual firms used in the sample have not been identified.

5.1. SPREADS ON CROSS-SECTOR BONDS

The method requires the calculation of a spread over the risk-free rate. We take the risk-free rate to be the contemporaneous yield on a Dutch government 10-year bond. The spread is the difference between the yield on the generic A-rated Euro-denominated debt with 10 years maturity and the contemporaneous yield on a Dutch government 10-year bond. Figure 3 illustrates how this spread has developed over the last five years. Following the collapse of Lehman Brothers in September 2008 – which is generally regarded as the peak of the financial crisis – the spread on A-rated debt was over two per cent. Spreads also peaked during the Eurozone sovereign debt crisis, in particular in reaction to the risk of a Greek default. Between these periods the spread has remained between 1-1.5%. We find that the average spread over the last five years is 1.48%.

Figure 3: Spread of Cross-Sector 10-year A-rated European Debt over 10-year Dutch Government bonds



5.2. SPREAD ON THE COMPARABLE BONDS

We identified a 'long-list' of 115 firms that have traded debt and seemed to be engaged in similar activates to drinking water distribution. To increase the sample size we considered firms from around the world, and not only Europe. We then screened the long-list to find debt which was rated either A, A+ or A- by Standard & Poors (S&P), and had a maturity of between 8 to 12 years on 1 April 2013. We also eliminated so-called 'callable bonds', which can be redeemed by the issuer prior to maturity.[14] Applying these criteria reduced the number of possible firms to 34. From the list of 34,

[14] Callable bonds generally attract a higher yield than bonds that mature on a fixed date. Hence the two kinds of bonds are not comparable, and callable bonds cannot be compared on a like-for like basis with Government bonds that have a fixed maturity, which is why we do not use them in our analysis. Callable bonds generally

we then checked that the firms were really engaged in activities that could be considered similar to drinking water distribution. Specifically, we checked that most of the firms' revenues were derived from regulated activities in energy or water. Applying this criterion reduced the number of firms to 11, and the number of bond issues to 26, which had an average maturity of 9.8 years. Appendix II gives details of the firms considered.

However, there were no water firms which met all the criteria to be in the final sample. For example, we could only find one bond for York Water which matured in 2040. Golden State Water had issued a bond rated A+, but we discounted it as it was 'callable'. American Water's bonds were excluded because they are rated BBB+.

Accordingly, we agreed with the ACM that, given the company specific bonds we identified contained energy companies only, it would be more consistent with ACM's WACC calculations for other sectors to use a sample of utility bonds as published by Bloomberg to estimate the comparable bond spread. The firms included in the utility-bond group have activities similar to water distribution in the context of the decree, and hence are a suitable group for the estimate of the spread of the comparable bonds. The average spread of the utility bonds over the relevant two-year period is 1.12%.

Hence, in estimating the WACC of the water distribution firms, we use the simple average of the 1.48% spread for the generic bonds and the 1.12% spread for the utility bonds. Table 6 illustrates that this results in an average spread of 1.30%.[15]

Table 6: Spreads on the specific and generic bonds and the average spread

			Spread, %
All A-rated (5-year average)	[1]	See note	1.48
A-rated Utility Bonds (2-year average)	[2]	See note	1.12
Average spread	[3]	([1]+[2])/2	**1.30**

Notes and sources:
[1],[2]: Brattle analysis of Bloomberg data

6. COST OF EQUITY

The methodology specifies that the cost of equity will be estimated by applying the Capital Asset Pricing Model. The CAPM expresses the cost of equity for a business activity as the sum of a risk-

attract a higher yield because bonds are more valuable if interest rates fall, but in this scenario the callable bond may be re-deemed. Hence the bond holder has an asymmetric pay-off.

[15] Note that the 5-year average spread for the utility bonds is 1.08%, which is 40 basis points less than the spread for the generic index over the same period.

free rate and a risk premium. The size of the risk premium depends on the systematic risk of the underlying asset, or project, relative to the market as a whole.[16]

In the case of the regulated activities in the Netherlands, the systematic risk of each of the regulated businesses cannot be measured directly. The regulated Dutch firms are not listed on a stock exchange making it impossible to measure the covariance of firm value against the movement of the market as a whole. Accordingly, we for each activity we identify a peer group of firms which are publicly traded and derive the majority of their profits from the activity in question.

6.1. MARKET INDICES

The relative risk of each company must be measured against an index representing the overall market, defined as the covariance of returns between the company and the chosen market index. The methodology specifies a broad Eurozone index for the European companies, and a national index for the US companies. Our Phase I report for the ACM discusses the reasons for the use of a Europe wide index in more detail, but in essence the idea is that the typical investor in a Dutch utility would be diversified across Europe. Since the Phase I report, we have refined the methodology to say that the investor would be diversified in particular across the Eurozone, because this would eliminate exchange rate risk.[17] Therefore a Eurozone index is the correct reference point for measuring the systematic risks of the activity.

6.2. PEER GROUP EQUITY BETAS

The methodology specifies a three year daily sampling period for the beta. We note that of the previously identified firms, Northumbrian water was acquired in 2011 so we use the latest data before any announcement of takeover occurred.[18] The announcement of a take-over will cause stock movement which will not reflect the underlying asset and should be excluded.

When calculating betas using daily returns, there is a risk that the response of a firm's share price may appear to react to the market index the day before or the day after. This could occur because of differences in market opening times and trading hours, or differences in the liquidity of the firm's shares vs. the average liquidity of the market. If such an effect is present, it could affect a beta which is calculated using only the correlation between the return on the firm's share on day D and the return on the market index on the same day.

The "Dimson" adjustment is a standard test which deals with this effect. The Dimson adjustment estimates betas by performing the same regression against the market index as for a standard beta, but uses the company returns from either one day ahead or one day before that of the market.[19] If the market is perfectly efficient, then all information should be dealt with on the same day, so that a beta

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[16] Further information on assumptions and theory underlying the CAPM can be found in most financial textbooks; see Brealey, Myers, Allen, *"Principles of Corporate Finance"*.

[17] *Loc. Cit.* footnote 1.

[18] The takeover of Northumbrian Water was announced on the 27th of June 2011. All data after and including this date is excluded.

[19] More days of leads and lags can be applied, but in this case we look at only one.

measured using the company returns from either one day ahead or one day before that of the market index return should be uncorrelated, giving a beta of zero. A beta significantly different from zero[20] suggests that information about the true beta may be contained in trading the day before or after the day for which the market return is calculated.

The Dimson beta adjustment combines the beta estimates from the day ahead and day before with the original beta estimate to give an overall beta which includes the information provided in the adjacent days.

We have performed this test for the firms in our peer groups. The results are presented in Table 7, which shows both the 'raw' betas that come directly from the regression and the Dimson-adjusted betas. We note that the adjustment is significant for five firms out of the total sample, suggesting that information on systematic risk is contained within the adjacent days.

We perform a further series of standard diagnostic tests to assess if the beta estimates satisfy the standard conditions underlying ordinary least squares regression, which are outlined in Appendix I. Once we have applied the corrections the betas should be robust to autocorrelation and heteroskedasticity.

Table 7: Raw and Dimson Adjusted Equity Betas

Company	Raw Beta	Dimson Adjusted Beta	Difference
Severn Trent PLC	0.39	0.39	0.00
Pennon Group PLC	0.42	0.42	0.00
Northumbrian Water Group PLC	0.44	0.56	0.13
United Utilities Group PLC	0.36	0.36	0.00
California Water Service Group	0.78	0.58	-0.20
SJW Corp	1.09	0.86	-0.23

6.3. VASICEK CORRECTION

The methodology applies the Vasicek adjustments to the observed equity betas. This adjustment takes account of a prior expectation of the equity beta. In this case, we have used a prior expectation of the beta of 1.0, which is the market average. We considered applying the critique of Lally,[21] which among other things argues for using a prior expectation of the beta which is specific to the activity in question. However, we could find no objective way of determining the prior expectation of beta. Accordingly, we have adopted the more neutral assumption of the prior expectation of a prior expectation of beta of 1.0.

The Vasicek adjustment moves the observed beta closer to 1 by a weighting based on the standard error of the beta, such that values with lower errors will be given a higher weighting. The

[20] Significance is taken at the 5% level.
[21] Lally, Martin, *"An Examination of Blume and Vasicek Betas"*. Financial Review, August 1998.

prior expectation of the Beta given in other consultant reports is 1, which we apply here. For the prior expectation of the standard error we use the standard error on the overall market.[22] Table 8 illustrates the effect of the Vasicek adjustment.

Table 8: Effect of the Vasicek adjustment

Company	Country	Estimate of Beta	Standard Error	Vasicek Beta
Severn Trent PLC	UK	0.39	0.03	0.40
Pennon Group PLC	UK	0.42	0.03	0.43
Northumbrian Water Group PLC	UK	0.56	0.03	0.57
United Utilities Group PLC	UK	0.36	0.03	0.36
California Water Service Group	US	0.58	0.05	0.59
SJW Corp	US	0.86	0.07	0.86

Notes: The betas are adjusted to a prior estimate of 1. The prior estimate of Standard Error is assumed to be the market standard error. This is 0.36 for the European companies and 0.39 for the US companies.

6.4. PEER GROUP ASSET BETAS

The measured equity beta measures the relative risk of each company's equity, which will reflect the financing decisions specific to each company. As debt is added to the company the equity will become riskier as more cash from profits goes towards paying debt in each year before dividends can be distributed to equity. With more debt, increases or decreases in firm profit will have a larger effect on the value of equity. Hence if two firms engage in exactly the same activity but one firm has a more gearing, that firm will also have a higher beta than the firm with lower gearing.

To measure the relative risk of the underlying asset on a like-for-like basis it is necessary to 'unlever' the betas, imagining that the firm is funded entirely by equity. The resulting beta is referred to as an asset beta or an unlevered beta. To accomplish the un-levering, the methodology specifies the use of the Modigliani and Miller formula.[23] Table 9 illustrates both the equity beta and the asset betas for each firm. We calculate the asset beta for drink water distribution as the median asset beta for the water peer group.

[22] The standard error on the FTSE 100 index is used as a proxy for the European market, and is reported by the LBS. Valueline reports the standard deviation of all stocks in the US market.
As we are using the market average beta for our prior expectation, it is consistent to use the standard deviation of the distribution of the betas underlying the market population as the prior expectation of the standard error.

[23] The specific construction of this equation was suggested by Hamada (1972) and has three underlying assumptions: A constant value of debt; a debt beta of zero; that the tax shield has the same risk as the debt.

Table 9: Equity and Asset Betas

Firm	Gearing (D/E) [A] Bloomberg	Equity Beta [B] Section 6.3	Tax Rate [C] KPMG	Asset Beta [D] See Note
Severn Trent PLC	116%	0.40	28.0%	0.22
Pennon Group PLC	81%	0.43	28.0%	0.27
Northumbrian Water Group PLC	156%	0.57	28.0%	0.27
United Utilities Group PLC	129%	0.36	28.0%	0.19
California Water Service Group	60%	0.59	28.0%	0.41
SJW Corp	67%	0.86	28.0%	0.58
Median				0.27

Notes and Sources
[D]=[B]/(1+(1-[C])x[A])

6.5. Equity Beta for Water Distribution

We re-lever the asset beta derived for each activity in the previous section to the 50% gearing of the regulated asset described in Section 3. Table 10 shows that the resulting equity beta is 0.54. Note that the Dutch water distribution firms are publicly owned and do not pay corporation tax. Accordingly, we assign a zero tax rate when re-levering the beta.

Table 10: Equity beta

Asset Beta	[1]	0.27	Section 6.4
Gearing (D/A)	[2]	50%	Section 3
Gearing (D/E)	[3]	100%	[2]/(1-[2])
Tax Rate	[4]	0%	Effective Tax Rate
Equity Beta	[5]	0.54	[1]x(1+(1-[4])x[3])

6.6. The Equity Risk Premium

The methodology specifies a 'European' ERP. That is, it uses an ERP based on the excess return of stocks over bonds for the major economies of Europe, rather than the ERP based on only the excess return of shares in the Netherlands. More specifically, the ACM has determined to use the simple average of the long-term arithmetic and geometric ERP as the anchor for the ERP estimate. The ACM will then examine other sources of information on the ERP in particular evidence of the ERP from Dividend Growth Models, and use these results as a check on the validity of the historical data for the next regulatory period. In line with the ACM's methodology we present evidence on the long-term ERP in Europe using both the arithmetic and geometric realised ERP.

Table 11 below illustrates the realised ERP derived from DMS data in individual European countries taken from the February 2013 DMS report. This report contains ERP estimates using data up to and including 2012. Table 11 also shows the simple and weighted average ERP for the Eurozone. All the ERPs are calculated relative to long-term bonds and the weighting is based on current market-capitalisation of each country's stock market. Hence, the ERPs of larger markets are given more weight, assuming that a typical investor would have a larger share of their portfolio in countries with more investment opportunities.

Table 11: Historic Equity Risk Premium Relative to Bonds: 1900 - 2012

	Geometric Mean [1]	Arithmetic Mean [2]	Average [3]	Standard Error [4]	Current Market Cap ($mm) [5]
Belgium	2.3%	4.3%	3.3%	2.0%	312,551
Denmark	1.8%	3.3%	2.6%	1.6%	265,105
Finland	5.3%	8.9%	7.1%	2.8%	173,907
France	3.0%	5.3%	4.2%	2.1%	1,723,289
Germany	5.2%	8.6%	6.9%	2.7%	1,599,659
Ireland	2.6%	4.6%	3.6%	1.9%	124,002
Italy	3.4%	6.8%	5.1%	2.8%	502,150
The Netherlands	3.3%	5.6%	4.5%	2.1%	306,803
Norway	2.2%	5.2%	3.7%	2.6%	295,767
Spain	2.1%	4.1%	3.1%	1.9%	583,333
Sweden	2.9%	5.1%	4.0%	2.0%	644,287
Switzerland	2.0%	3.5%	2.8%	1.7%	1,328,124
United Kingdom	3.7%	5.0%	4.4%	1.6%	3,449,459
Europe	3.4%	4.8%	4.1%	1.5%	n/a
World	3.2%	4.4%	3.8%	1.4%	n/a
Average Eurozone	3.4%	6.0%	4.7%		
Value-Weighted Average Eurozone	3.6%	6.4%	5.0%		

Sources and Notes:

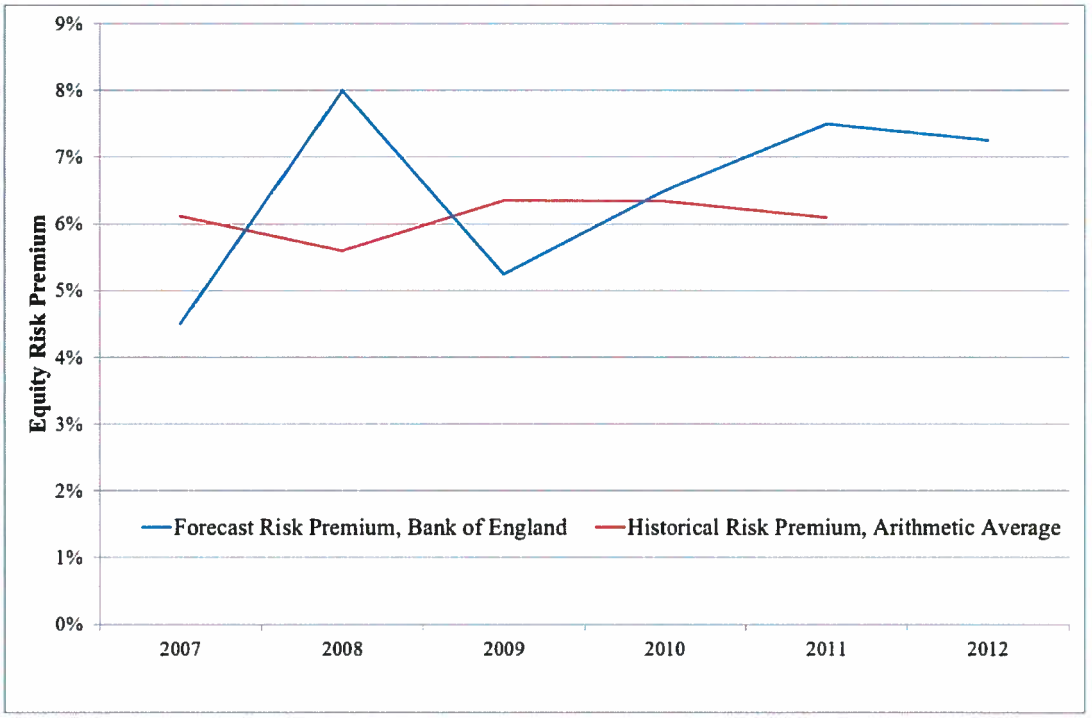
[1] - [4]: Credit Suisse Global Investment Returns Sourcebook 2013, Table 9.

[5]: Bloomberg LP as of 3/1/2013.

Looking at Table 11 the simple average of the arithmetic and geometric ERP for the period 1900 to 2012 was 4.1% if all of Europe is included, and 4.7% if only Eurozone countries are included. The very low ERP in Denmark and Switzerland in particular lower the simple average ERP for all of Europe. Using the market size to weight the averages for all of Europe, the ERP for the Eurozone is 5.0%. These figures reflect the very long run and notably exclude countries in former Eastern Europe. As discussed in section 6.1, we use the ERP for the Eurozone, since a Dutch investor is more likely to be diversified over the same currency zone, rather than to incur additional currency risks by diversifying within Europe but outside of the Euro zone.

ERPs forecasted on the basis of Dividend Growth Models are currently above the historically realised ERP. For example, the Bank of England produces ERP forecasts based on Dividend Growth Models, and forecasts the Euro Stoxx ERP at a little over 7%.[24] As illustrated in Figure 4, 7% is above the historically realized simple average ERP for the Eurozone, which is 3.4% and 6.0% for the geometric and arithmetic average respectively.

Figure 4: Eurozone Historical and Forecast Risk Premiums by Year



Accordingly, forecast ERP estimates based on Dividend Growth Models are above the long-term average of the arithmetic and geometric ERP for Europe. Therefore, it seems reasonable not to make any of the downward adjustments that are sometimes applied to the historical average ERP, such as adjustments for the increase in price-dividend ratios over the last 50 years, and instead take the 'raw' historical ERP estimates. Accordingly, we apply a Eurozone average ERP of 5.0%.

7. INFLATION

To convert a nominal WACC to a real WACC requires an adjustment for inflation. The methodology requires that inflation consider both historic and forecast rates of inflation in the Netherlands and Germany.

[24] Bank of England, "Financial Stability Report," June 2012, Issue 31, Chart 1.11 p. 10. The next issue of the Bank of England's Financial Stability Report is due in mid-December 2012.

Historical inflation over the prior three years amounts to 2.06% for Germany and 2.57% for the Netherlands.[25] This period matches the time horizon used for the risk free rate, which may be useful as the bond yields will have inherent assumptions on the inflation expectations of the market.

Euro-area inflation predictions are provided by the ECB, which are based on a survey of professional forecasters. The short term prediction for the upcoming calendar year is 1.9%, and the five-year prediction is 2%.[26]

The CPB also provides a short term forecast of inflation rates for the Netherlands: the predicted inflation for 2013 is 2.75%. The Bundesbank provides a forecast for Germany of 1.5% in 2013 and 1.6% in 2014.[27] Based on the considerations above, we use an inflation rate of 2%.

8. WEIGHTED AVERAGE COST OF CAPITAL

Table 12 illustrates the overall calculation of the real and nominal WACC for drinking water distribution in the Netherlands.[28]

Table 12: WACC for drinking water distribution

Risk Free Rate	[1]	2.78%	Section 4
Asset Beta	[2]	0.27	Section 6.4
Equity Beta	[3]	0.54	[2]x(1+(1-[9])x[11])
ERP	[4]	5.00%	Section 6.6
After-tax Cost of Equity	[5]	5.47%	[1]+[3]x[4]
Debt Premium	[6]	1.30%	Section 5
Non-interest Fees	[7]	0.15%	Section 5
Pre-tax Cost of Debt	[8]	4.23%	[1]+[6]+[7]
Tax Rate	[9]	0%	Effective Tax Rate
Gearing (D/A)	[10]	50%	Section 3
Gearing (D/E)	[11]	100%	[10]/(1-[10])
Nominal After-tax WACC	[12]	4.85%	(1-[10])x[5]+(1-[9])x[8]x[10]
Inflation	[13]	2.00%	Section 7
Nominal Pre-tax WACC	[14]	4.85%	[12]/(1-[9])
Real Pre-tax WACC	[15]	2.80%	(1+[14])/(1+[13])-1

[25] Data from Eurostat

[26] Data from the ECB

[27] Bundesbank, Summary of December Monthly Report, *"Outlook for the German economy –macroeconomic projections for 2013 and 2014"*, December 2012.

[28] The method assumes that since the water companies are publicly held and do not pay taxes, a tax rate of zero should be applied.

Appendix I – Statistical Reliability

We detail the standard diagnostic tests to assess if the beta estimates satisfy the standard conditions underlying ordinary least squares regression, which are: that the error terms in the regression follow a normal distribution and that they do not suffer from heteroskedasticity[29] or auto-correlation.[30] Failure to meet these conditions would not invalidate the beta estimates, but would have the following consequences:

1. Although OLS is still an unbiased procedure in the presence of heteroskedasticity and/or autocorrelation, it is no longer the best or least variance estimator.
2. In the presence of heteroskedasticity and/or autocorrelation, the standard error calculated in the normal way may understate the true uncertainty of the beta estimate.
3. Heteroskedasticity and/or auto-correlation may indicate that the underlying regression is mis-specified (i.e. we have left out some explanatory variable).

Heteroskedasticity

We apply White's test for heteroskedasticity. Table 13 illustrates the results.

Table 13: White's test for Heteroskedasticity

	3 yr		
	White Stat	p-value	Heterosk-edascity
Severn Trent	0.12	0.94	No
Pennon Group	5.14	0.08	No
Northumbrian Water Group	12.68	0.00	Yes
United Utilities Group	0.65	0.72	No
California Water Service	22.77	0.00	Yes
SJW Corp	14.94	0.00	Yes

The results indicate the presence of some heteroskedasticity in the sample. This most likely relates to the significant increase in market volatility around the heart of the crisis at the start of the sample period, and a subsequent decrease, changing the variance of the population over the sampling period.

Autocorrelation

We also apply the Durbin-Watson test for auto-correlation. Unsurprisingly, this test indicates a degree of autocorrelation in most of the regressions, also likely reflecting the development of the credit crisis and the changing extent of market volatility. The effect of this auto-correlation is that

[29] Heteroskedasticity means that there exists sub-populations in the sample which have different variance from others.

[30] Auto-correlation means that the error terms between periods are correlated.

standard errors will over-estimate the precision of the regression. The results are presented in Table 14:

Table 14: Durbin–Watson Test for Auto-correlation

	3 yr	
	DW Stat	Serial Correlation
Severn Trent	1.581	Yes
Pennon Group	1.503	Yes
Northumbrian Water Group	1.489	Yes
United Utilities Group	1.484	Yes
California Water Service	1.894	No
SJW Corp	1.581	Yes

Prais-Winsten Regressions

To account for the inclusion of auto-correlation in the sample a standard statistical technique is to apply a regression using the Prais–Winsten estimation tests. We also control for heteroskedasticity. The results are presented in Table 15.

Table 15: Prais-Winsten Regressions Results

	OLS Beta		Prais-Winsten Regression	
	Beta	Standard Error	Beta	Standard Error
Severn Trent	0.39	0.03	0.39	0.03
Pennon Group	0.42	0.03	0.42	0.04
Northumbrian Water Group	0.44	0.03	0.43	0.04
United Utilities Group	0.36	0.03	0.36	0.03
California Water Service	0.78	0.03	0.76	0.05
SJW Corp	1.09	0.04	1.09	0.08

The corrections for auto-correlation and heteroskedasticity do not have a significant impact on the results.

Appendix II – Details of Firms for Debt Peer Group

Table 16: Risk-free rates for debt spreads

		Currency	Two-year average yield
US 10y Treasury	[1]	USD	2.28
UK 10y Gilt	[2]	GBP	2.49
Dutch 10y Bond	[3]	EUR	2.43
Canadian 10y Bond	[4]	CAD	2.28

Notes and sources:
[1]: average on 2011-2013 yields - Federal Reserve Board of Directors
[2]: average on 2011-2013 yields - Bank of England, Data and Statistics
[3]: average on 2011-2013 yields - De Nederlandsche Bank
[4]: aligned to the US 10y Treasury as the exchange rate with USD is constant

Table 17: Long-list of companies considered for debt peer group

Ticker	Company Name	Most Recent S&P Bond Rating
GAS US	AGL Resources Inc	BBB+
AQN CN	Algonquin Power & Utilities Corp	BBB-
ALE US	ALLETE Inc	BBB+
LNT US	Alliant Energy Corp	A-
ALA CN	AltaGas Ltd	BBB
AEE US	Ameren Corp	BBB
AEP US	American Electric Power Co Inc	BBB
AWR US	American States Water Co	A+
AWK US	American Water	BBB+
ACO/X CN	Atco Ltd/Canada	A
ATO US	Atmos Energy Corp	BBB+
AVA US	Avista Corp	BBB
BKH US	Black Hills Corp	BBB-
BWP US	Boardwalk Pipeline Partners LP	BBB
BPL US	Buckeye Partners LP	BBB-
CWT US	California Water Service Group	A+
CU CN	Canadian Utilities Ltd	A
CNP US	CenterPoint Energy Inc	BBB+
CNL US	Cleco Corp	BBB
CMS US	CMS Energy Corp	BBB
CTWS US	Connecticut Water Service Inc	A
ED US	Consolidated Edison Inc	A-
DPM US	DCP Midstream Partners LP	BBB-

Ticker	Company Name	Most Recent S&P Bond Rating
DVN US	Devon Energy Corp	BBB+
D US	Dominion Resources Inc/VA	A-
DTE US	DTE Energy Co	BBB+
DUK US	Duke Energy Corp	BBB+
EOAN GY	E.ON	A-
EIX US	Edison International	BBB-
EE US	El Paso Electric Co	BBB
EPB US	El Paso Pipeline Partners LP	BBB-
ELI BB	Elia System Operator	A-
EMA CN	Emera Inc	BBB+
EDE US	Empire District Electric Co/The	BBB
ENG SM	Enagas	BBB
EEP US	Enbridge Energy Partners LP	BBB
ENB CN	Enbridge Inc	A-
ECA US	Encana Corp	BBB
EGN US	Energen Corp	BBB
ETP US	Energy Transfer Partners LP	BBB-
ETR US	Entergy Corp	BBB
EPD US	Enterprise Products Partners LP	BBB+
ENV AU	Envestra	BBB-
EOG US	EOG Resources Inc	A-
EQT US	EQT Corp	BBB
EXC US	Exelon Corp	BBB

Ticker	Company Name	Most Recent S&P Bond Rating
FE US	FirstEnergy Corp	BBB-
FTS CN	Fortis Inc/Canada	A-
Gas SM	Gas Natural	BBB
GXP US	Great Plains Energy Inc	BBB
HE US	Hawaiian Electric Industries Inc	BBB-
HSE CN	Husky Energy Inc	BBB+
IBE SM	Iberdrola	BBB
IDA US	IDACORP Inc	BBB
IMO CN	Imperial Oil Ltd	AAA
TEG US	Integrys Energy Group Inc	A-
ITC US	ITC Holdings Corp	BBB+
KMP US	Kinder Morgan Energy Partners LP	BBB
LG US	Laclede Group Inc/The	A
MMP US	Magellan Midstream Partners LP	BBB
MDU US	MDU Resources Group Inc	BBB+
MGEE US	MGE Energy Inc	AA-
MSEX US	Middlesex Water Co	A-
NFG US	National Fuel Gas Co	BBB
NG/ LN	National Grid	A-
NFX US	Newfield Exploration Co	BBB-
NEE US	NextEra Energy Inc	A-
NI US	NiSource Inc	BBB-
NWN US	Northwest Natural Gas Co	A+

Ticker	Company Name	Most Recent S&P Bond Rating
NVE US	NV Energy Inc	BBB-
OGE US	OGE Energy Corp	BBB+
OKS US	ONEOK Partners LP	BBB
OTTR US	Otter Tail Corp	BBB-
PPL CN	Pembina Pipeline Corp	BBB
POM US	Pepco Holdings Inc	BBB+
PCG US	PG&E Corp	BBB
PNY US	Piedmont Natural Gas Co Inc	A
PNW US	Pinnacle West Capital Corp	BBB+
PAA US	Plains All American Pipeline LP	BBB
PNM US	PNM Resources Inc	BBB-
POR US	Portland General Electric Co	BBB
PPL US	PPL Corp	BBB
PEG US	Public Service Enterprise Group Inc	BBB
STR US	Questar Corp	A
REE SM	Red Electrica	BBB
RWE GY	RWE	BBB+
SCG US	SCANA Corp	BBB+
SSE LN	Scottish & Southern	A-
SPW LN	Scottish Power	BBB
SRE US	Sempra Energy	BBB+
SVT LN	Severn Trent	BBB-
SRG IM	Snam Rete Gas	A-

Ticker	Company Name	Most Recent S&P Bond Rating
SJI US	South Jersey Industries Inc	BBB+
SO US	Southern Co/The	A
SWX US	Southwest Gas Corp	A-
SWN US	Southwestern Energy Co	BBB-
SPN AU	SP Ausnet	A-
SE US	Spectra Energy Corp	BBB+
SEP US	Spectra Energy Partners LP	BBB
SU CN	Suncor Energy	BBB+
SXL US	Sunoco Logistics Partners LP	BBB-
TLM US	Talisman Energy Inc	BBB
TCP US	TC Pipelines LP	BBB
TE US	TECO Energy Inc	BBB+
TA CN	TransAlta Corp	BBB-
TRP CN	TransCanada Corp	A-
UIL US	UIL Holdings Corp	BBB
VVC US	Vectren Corp	A-
VSN CN	Veresen Inc	BBB
WR US	Westar Energy Inc	BBB
WGL US	WGL Holdings Inc	A+
WPZ US	Williams Partners LP	BBB
WEC US	Wisconsin Energy Corp	A-
XEL US	Xcel Energy Inc	A-
YORW US	York Water Co	A-

Table 18: Short-list of companies considered for debt peer group

Name of firm	Majority of revenues from network activities or water?	Comments
Ameren Corp	Yes	This is Ameren Illinois, which is a distribution and transmission entity
American Electric Power Co Inc	Mixed	Yes, only pertains to Southwestern Electric Power, which is a distribution and transmission entity
Avista Corp	Yes	Most of the revenues come from the power generation, transmission and distribution of electricity
American States Water Co	Yes	Almost 100% regulated
CMS Energy Corp	Yes	Consumers Energy is almost 100% regulated, gas distribution
CenterPoint Energy Inc	Yes	CenterPoint Houston is a distribution entity
Canadian Utilities Ltd	Yes	About 80% regulated: gas distribution, pipelines, integrated electric utility, IPP
Dominion Resources Inc/VA	Mixed	Virginia Electric and Power, Yes - Dominion Resources - No, Viginia Power is an integrated electric utility
DTE Energy Co	No	Data released pertain just on a gas distributor, with no disclosure whether this may be the majority of the revenues
Duke Energy Corp	Mixed	The entities listed are integrated electric utilities and mostly regulated; Duke Energ Corp. has lots of IPP
Edison International	Yes	Southern California Edison is primarily a distribution and transmission entity; Edison International is not
Enbridge Inc	Yes	Probably about 60% regulated; more for Enbridge Gas Distribution and Enbridge Pipelines
E.ON	No	
EOG Resources Inc	No	Oil drilling company. No trasmission activity according to the annual report
Entergy Corp	Mixed	All but "System Energy Resources" are regulated, Entergy Corp has lots of IPP but the named entities are either distribution & transmision, or integrated electric utilities
Exelon Corp	Yes	Peco is a electric and gas distribution entity, Exeelon Corp. has lots of IPP
IDACORP Inc	Mixed	Idaho Power is an integrated electric utility; almost 100% regulated

Name of firm	Majority of revenues from network activities or water?	Comments
NextEra Energy Inc	Mixed	Florida Power and Light is an integrated electric utility - almost fully regulated; NextEra is involved in other activities
National Grid	Mixed	Almost 100% regulated except for Niagra Mohawk Power Corp.
Public Service Enterprise Group Inc	Yes	More than 70% of the revenues from regulated business of distributing gas and electricity
Piedmont Natural Gas Co Inc	Yes	Almost 100% regulated revenues
Pepco Holdings Inc	Yes	The entities listed are 100% regulated; distribution and transmission activities
Portland General Electric Co	No	Minimal network activity
PPL Corp	No	Regulated revenues less than 50% of the total revenues from operations
Southern Co/The	Mixed	The entities listed are fully regulated electric utilities
Sempra Energy	Yes	San Diego Gas & Electric is a regulated electric and gas distribution and transmisison entity; Sempra has other activities
Snam Rete Gas	Yes	
Questar Corp	Yes	Questar Gas Co is a gas distribution company and fully regulated. Questar Corp owns pipelines, exploration and production
Southwest Gas Corp	Yes	Southwest gas is a regulated gas distribution company
Integrys Energy Group Inc	Mixed	Wisconsin Public Service is an integrated electric utility, Integrys has IPPs
TransCanada Corp	Yes	The pipelines listed are 100% regulated natural gas pipelines; TransCanada Corp is involved in IPP
Wisconsin Energy Corp	Mixed	Wisconsin Electric Power is an integrated electric utility
Xcel Energy Inc	Mixed	Public Service of Colorado and Northern States Power are fully regulated; integrated electric utilities - Xcel Corp deals with IPP business

Sources: Determined by The Brattle Group