GOVERNO DE PORTUGAL

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		Nº: 4112 **ENT.: 3814** **PROC. Nº:**	04/06/2012

ASSUNTO: **RESPOSTA AO REQUERIMENTO N.º 216/XII/1.ª**

Encarrega-me a Secretária de Estado dos Assuntos Parlamentares e da Igualdade de enviar cópia do ofício n.º 2857 de 04 de junho do Gabinete do Senhor Ministro da Economia e do Emprego, sobre o assunto supra mencionado.

Com os melhores cumprimentos,

A Chefe do Gabinete

Marina Resende

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04-06-2012

GOVERNO DE PORTUGAL | MINISTÉRIO DA ECONOMIA E DO EMPREGO

Gabinete da Secretária de Estado
dos Assuntos Parlamentares e da Igualdade
Entrada n.º 3814
Data: 04-06-2012

Exma. Senhora
Chefe do Gabinete da
Secretária de Estado dos Assuntos
Parlamentares e da Igualdade
Dra. Marina Resende

SUA REFERÊNCIA	SUA COMUNICAÇÃO DE	NOSSA REFERÊNCIA	DATA
Of. N.º 3375/SEAPI	03/05/2012	Nº: /2012 ENT.: /2012 PROC. Nº:	

ASSUNTO: **Resposta ao Requerimento n.º 216/XII/1.ª, de 3 de maio de 2012 «Rendas Excessivas»**

Na sequência do ofício acima identificado e em resposta ao requerimento n.º 216/XII/1.ª, de 3 de maio de 2012,formulada pelos Senhores Deputados Hortense Martins e Rui Paulo Figueiredo, do Grupo Parlamentar do Partido Socialista, encarrega-me Sua Excelência o Ministro da Economia e do Emprego de enviar em anexo os documentos solicitados.

Com os melhores cumprimentos,

A Chefe do Gabinete, em substituição

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BENCHMARK ON RATES OF RETURN FOR GENERATION ASSETS IN PORTUGAL

MAIN REPORT

January 2012

CONFIDENTIAL

Cambridge Economic Policy Associates Ltd

CEPA

OUTLINE

This report has been prepared by CEPA for the Government of Portugal. It provides an analysis of rates of return for particular generating assets in Portugal. The analytical study was carried out in an extremely compressed timeframe, which heavily influenced the approach taken and the scope of the work.

The focus of the analysis has been on the PPAs signed in 1993/4 with private developers and in 1996 with EDP, and the subsequent conversion of the EDP PPAs to the CMEC regime in 2007. Our analysis of the risk profile of these assets suggests that they are low risk generating assets which can be compared to European regulated network utility risk. At the request of the Government, we have focused on returns over the period 2000 - 2010.

We have also commented on returns to European renewables, but due to time restrictions this review has been based on a limited review of published sources and the outputs of our comparative analysis for Portuguese generators.

Our approach to calculating the return has been to calculate a generic integrated electricity/generation WACC to provide a benchmark against which the PPA/CMEC returns can be compared. The risk-free rate can be computed from government bond data, whilst the calculation of the Equity Market Premium is more complex, as there is no agreed approach – we have therefore relied on published works and regulatory decisions. Asset betas can be derived from observed equity betas and gearing for our data set. For the cost of debt, we have used the debt premium from our data set and combined that with the risk-free rate.

The results of our analysis show that risk-free rates in Portugal fell steadily until around 2007. Since then they have risen sharply, as is well reported. The Equity Market Premium was considered by many to be relatively high in the early 1990s, before becoming more commonly treated as around 5%. Corporate tax rates were also relatively high in the 1990s. These factors drove a relatively high real pre-tax WACC in the early 1990s which fell sharply such that by 2001 it was heading below 6% and it remained below that level for an extended period. Although increasing in 2007, it was at that time likely to have been in the 5.5%- 6% range. Headline rates have risen again since then, but a review of the appropriate return for generating assets located in Portugal at a time of sovereign stress has been outside of the scope of this work.

IMPORTANT NOTICE

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1. INTRODUCTION

Cambridge Economic Policy Associates Ltd (CEPA) has been engaged by the Government of Portugal to advise on efficient levels of cost of capital for regulated generators, with a particular focus on the Power Purchase Agreement (PPA)-backed generators and the subsequent Costs for the Maintenance of Contractual Equilibrium (CMEC) scheme. At the request of the Government, this advice focuses the time period from 2000 to the end of 2010.

The timeframe for this analytical work has been extremely compressed – the project kicked-off on 6th January, a full draft report was produced for the 20th January and the final report on 27th January. Our understanding is that the timetable has in large part been driven by requests for information from the Troika (ECB, EU and IMF).

The compressed timetable has necessarily required an approach based on publicly available data, so for example there has been no real opportunity for discussions with the investment community (and those active in this community over the past decades) and limited opportunity to cross-check our approach with alternative approaches. Notwithstanding these limitations, we have, with the support of the Ministry of Economy and Employment and its advisers in our view been able to produce an analysis of returns that may be helpful to the Government in assessing the appropriate historic efficient returns for the generators in question.

The rest of this report is set out as follows:

- Section 2 provides some background on the relevant generating assets in Portugal and assesses the level of risk in those assets and the relevant comparators.
- Section 3 sets out our approach to building a benchmark for the Portuguese generating assets.
- Section 4 provides the results of our analysis of benchmark returns.
- Section 5 provides brief commentary on returns for renewables.

The report is supported by a number of Appendices, namely:

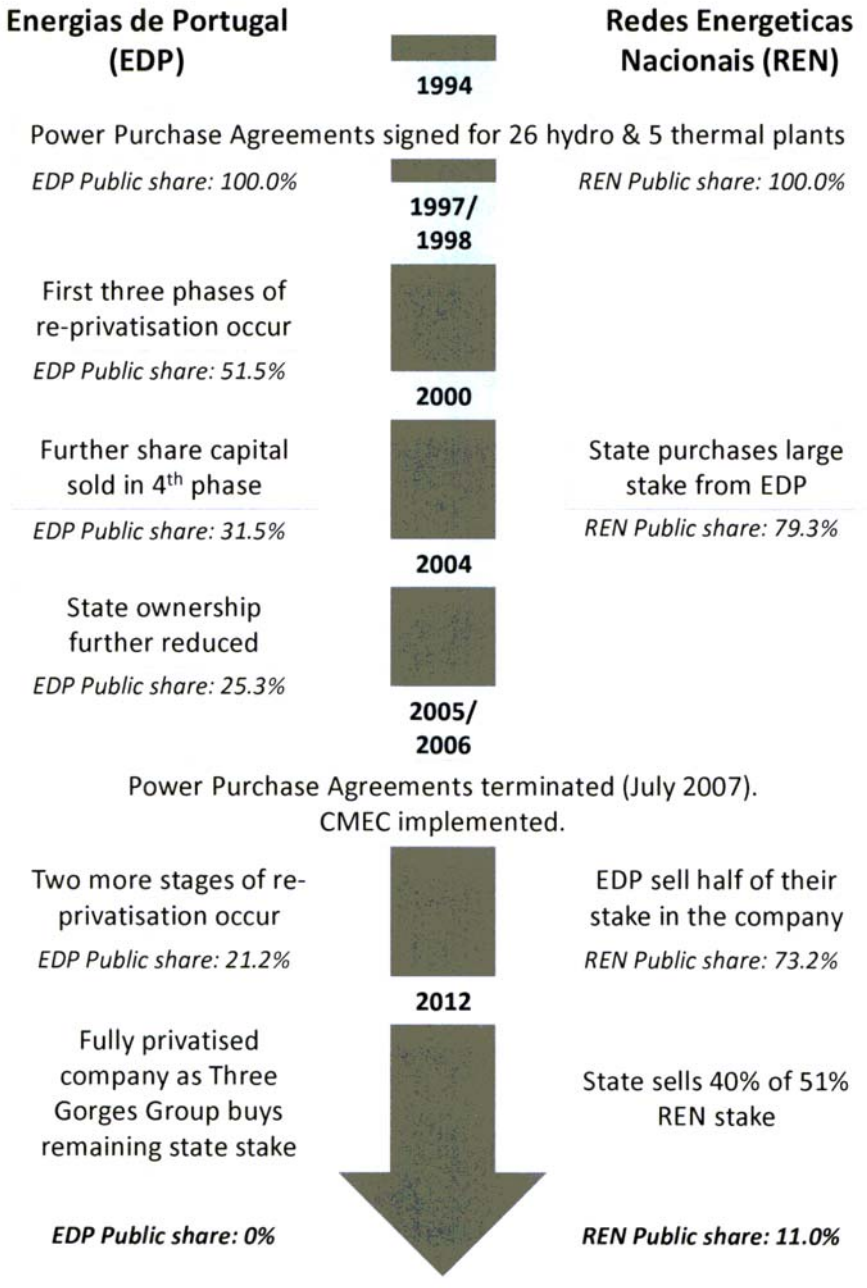
- Appendix 1: Details of Regulatory Decisions on Allowed Returns for Energy Networks in Portugal.
- Appendix 2: Comparator Companies.
- Appendix 3: WACC and Beta Estimates – Supporting Analysis.
- Appendix 4: Alternative Views on Risk-free Rate and ERP.

2. STRUCTURE OF GENERATION IN PORTUGAL AND RISK

2.1. Background

Power Purchase Agreements (PPAs) were signed in 1993 and 1994 for one existing coal plant and one greenfield CCGT by private developers and then in 1996 for five thermal plants and 26 hydro plants belonging to EDP. We understand that most of the EDP plant was already operational in 1996. The offtaker was REN, at that time the wholly state owned transmission company belonging to EDP group, which was also wholly public at the time, but was on a path to floatation. This information can be seen in Figure 2.1 below.

Figure 2.1: Timeline for significant share sales in EDP & REN



Following the publication of Decree-Law n.º 240/2004 on January 27, 2005, agreements were signed for the early termination of the PPAs held by EDP's generation plants (the PPAs with the private developers remained in force). The Decree-Law established that in order to maintain the contractual equilibrium of the PPAs, the holders of such agreements, which included a significant portion of EDP's generation capacity in Portugal, had the right to receive compensation for the early termination of those agreements (CMEC). Termination depended on certain pre-conditions being fulfilled, including the launch of the spot electricity market at the Iberian level (MIBEL), which came into effect on July 1, 2007, although the relevant agreement for the EDP PPAs was signed on 15 June 2007. Generation plants operating under CMEC sell electricity directly on MIBEL i.e. are not dispatched by REN. However, plants have to match "Valoragua's" simulations in terms of (quantity of) energy placed on the market. For the two remaining PPAs, R.EN Trading makes offers for these plants' output.

We understand that the CMEC regulation set out the amount of initial compensation for the termination of the PPAs and at the same time it was established that EDP would pay an additional sum in relation to the extension of its rights to use public hydro resources for an average period of over 26 years.

Thus under the CMEC programme, each EDP generation plant that was under a PPA with REN was treated as follows:

- Intention was to keep each plant 'whole' as per its PPA with REN.
- The underlying remuneration of assets remained unchanged at 8.5% real pre-tax cost of capital and all operating costs (fuel, CO2, other variable and fixed) continue to be passed through to the consumer tariff.
- The incentive scheme to promote power availability remained unchanged: we understand that this incentive regime was a source of additional profit for the generators.
- We also understand that in order to calculate the termination payment, each plant was reviewed and the NPV of future cash streams computed, but that the NPV calculation and subsequent calculation of annuity payments gave a further and significant financial uplift to EDP.
- We also understand that EDP may have acquiring rights to extend the use of hydrological resources at a price which created a further financial gain for EDP, and that the use of correction factors in hydro and coal generation also mitigates the risk of EDP

Table 2.1 below summarises how individual items are dealt with under the PPAs/ CMEC. This summary is based on a review of a private developer's CCGT PPA and discussions with the Ministry.

Table 2.1: Risk and its treatment under the Portuguese PPAs

Risk	Treatment under Portuguese PPAs/ CMEC	'Standard' international treatment	Comment
Offtaker credit-worthiness	Offtaker is REN, which is state-backed regulated network and, at the time of PPA signature, belonged to EDP group.	Depends on credit quality – enhancements are sometimes needed e.g. guarantee/ letter of credit.	Currently some comments from analysts about Iberian system credit risk and pressure on tariffs.
Fuel	Water: notional charge but pass through. Pumping costs (for pump storage) passed through. Gas: 100% pass through of invoices for gas purchased under the Gas Agreement. REN/consumers carries take-or-pay risk. Coal: the generator is paid for 80% based on an annual contract for forecast consumption, which allows the generator to buy forward. 20% is required to match or beat the Platts API2 index. Train operator has take or pay agreement with the PPA coal plant, but for 50% of annual output. Some exchange risk as payments to generators based on average monthly currency values which might differ to spot price.	Index for thermal plants.	Coal: Portuguese generators import coal from the world market, so low fuel cost risk. Some notional take or pay risk with train operator. Coal typically runs baseload apart from very wet years.
Hydrological	No risk, as the CMEC 'revisibility mechanism' adjusts the generation of the power plants to the hydrological conditions.		
O&M	Fixed O&M: Based on pre-defined values, updated monthly using five indices (soft steel, diesel, labour cost, consumer prices, consumer prices other goods). Variable O&M: Based on pre-defined values, updated monthly by consumer price index excluding housing (CPI).	Often fixed ex ante with inflation index and / or periodic (3 – 5 year) re-openers for union contract renegotiation..	Some protection from changing operating regime as variable O&M based on unit values.

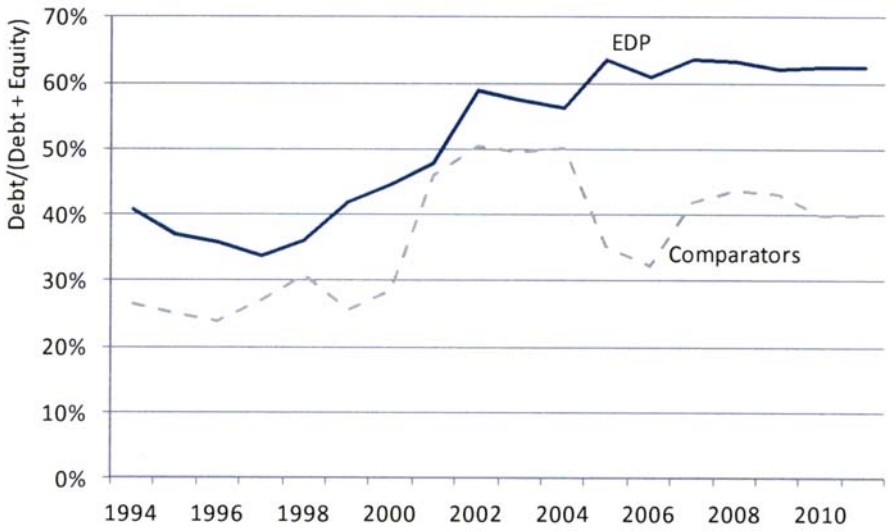
Risk	Treatment under Portuguese PPAs/ CMEC	'Standard' international treatment	Comment
Project costs	Capacity payments were fixed for most plants when post construction.	Owner usually negotiates EPC before signing PPA. Recovery of capital costs typically linked to availability targets. Also, in a "pre-financed" plants, typical to reflect actual debt financing.	
Debt costs	For existing plant, no gearing at project level, but we understand that EDP did gear up at corporate level. For new plant, some pass though / link to interest rate movements.	Owners' risk – owner would hedge to extent possible. See above.	
Availability	For existing plant, additional payments for outperformance and targets appear low (unchanged from original targets).	Straight leverage onto recovery of fixed costs.	
Currency	Original contracts in Esc converted into Euro at prevailing rate.	Hard currency capacity payments, or only portion in a 'soft' currency.	Portion of currency risk removed through treatment of fuel as effective pass through.
Carbon/ emissions	Generators granted a 'free' allowance for five years and emissions costs treated as pass through. Excess allowances are sold and go to the system. Allowances will be paid for from 2013 but costs passed through. There is an incentive to reduce cost with swaps of 10% of EUA allowances with CEER allowances (50% of the cost reduction). Any investment to meet emissions standards would be treated as pass through.	Unclear.	We understand that the additional income from these allowances is not significant.
Termination	In some of the thermal plants, REN is responsible for site remediation.		
Other	We understand that dispatch risk is effectively with REN.		

2.2. Summary of risk profile

Based on the above review of risks, it would seem that the PPAs are a low risk asset class, closer to a regulated utility/ regulated network return. The main residual risk would be in a failure to operate e.g. due to fire, against which insurance is available.

This low risk is further evidenced by the fact that it is understood that the private developers geared their coal plant at high levels, whilst EDP over time increased its gearing at the group rather than project level as would be expected. This is illustrated in Figure 2.2 below.

Figure 2.2: EDP gearing



Source: Bloomberg. Chart also shows gearing for comparators, which will be examined further below.

2.3. Analyst views on risk

Much of the evidence we present below is quantitative evidence supporting the calculation of a reasonable cost of capital for the generation business enjoying the benefit of the long-term PPA agreements. However, it is also relevant to consider the market perceptions of EDP. As can be seen in Figure 2.1., EDP was not listed at the time of the signature of the PPAs in 1996 as the IPO was in 1997, so evidence of market perceptions relate to a later period, but we believe these are relevant. To obtain market views we have had conversations with a limited number of analysts covering the European utilities at that time.

European legislation forcing the opening of electricity markets came into force in February 1999, but by the time of the EDP flotation was already law. This placed threats to the earnings of the large liquid utility companies which were listed at that time. In Germany, the threat to prices appeared to be severe, with no recognition of the need to cut costs, putting pressure on the ratings of the utility conglomerates RWE, VEBA and VIAG. In Spain, the threat was less severe, but the government was overseeing a substantial reform of the sector with the introduction of a wholesale electricity market and new forms of regulation for the infrastructure segments. Valuation of generation assets in these markets required an estimate of a future wholesale market price in an unknown competitive environment.

The environment in Portugal was, and was seen to be, very different. EDP had not been restructured into smaller companies as was considered in the early 1990s, but was dominant in its market. The competitive threat would be low even without the PPAs. But the PPAs were seen to provide earnings security for many years for the generation assets. The attraction of EDP to investors was that the revenues were secure, and that value could be created for the shareholders from cost cutting. The continued role of the government in the shares was seen to provide added security.

As a result of these factors, EDP was seen as an integrated regulated utility, with correspondingly lower risks than the other countries where there were greater competitive threats.

The replacement of the PPA agreements with CMECs was intended to preserve the value of the generation assets (i.e. not change returns). However, issues about the passing on of the tariff deficit in Spain to consumers and potential risks of this in Portugal meant that the cost of capital for EDP was seen to be similar to those of Spanish companies.

3. APPROACH TO BUILDING A BENCHMARK

Establishing a benchmark required rate of return or weighted average cost of capital (WACC) for generation companies requires estimates of:

- The required rate of equity return/cost of equity (COE);
- The required rate of debt return/cost of debt (COD); and
- The mix of debt and equity in the capital structure – also referred to as the level of gearing.

It is also important to specify whether a post- or pre-tax estimate is being derived.

This section of the report provides an overview of the approach we have adopted to establishing our estimate of the benchmark WACC – a series of appendices provide more detailed information on the approach adopted and the data used in deriving the estimate. Our estimate is reported in the following section and includes a high-level discussion of the results.

3.1. Overall approach

When determining a benchmark for the WACC of the PPAs in the power sector in Portugal there are two choices of approach that could be used, specifically:

- a WACC based on the observed rates demanded for PPAs that had the same structure and risk as those in Portugal could be developed; or
- a generic WACC could be developed for (i) pure generators, (ii) good comparators, (iii) integrated utilities, (iv) transmission utilities, and (v) renewable energy companies only.

While the former approach would provide a clear benchmark against which the Portuguese PPAs could be measured the following problems arise:

- the level of information available on the WACC (both the headline rate and the true expected rate which incorporates additional returns) for each PPA is likely to be limited and also confidential;[1]
- even if the information is available, the number of PPAs signed in any one year is unlikely to be significant, so meaning that the pool of observations for any one year is limited; and
- within this pool, the PPAs which match the risk profile, maturity and overall structure of those against which the benchmark is being compared are likely to be even more limited.

Consequently, while this approach should yield a good benchmark against which the actual PPAs can be measured the reality is that implementing the approach would be, at best, difficult if not impossible.

[1] Additional returns refer to the types of payment that might be expected to arise from setting targets in the PPA at a level which any company would expect to beat – say a low availability target that should allow the company to earn abnormal returns without operating above normal levels of efficiency.

As an alternative, it is possible to consider the development of a more generic measure of the WACC for generation companies, based on those companies that are listed (for the equity measure) and raising bond finance (for the debt measure). Obviously this approach also has its limitations, namely:

- the comparability of listed companies which may be operating a portfolio of plant types, under a range of different contractual/ competitive arrangements in one or more countries;
- the majority of generating companies are likely to be part of larger entities that tend to be integrated energy companies; and
- a number of mergers and acquisitions have taken place in the energy sector since the late-1990s).

Clearly these concerns are limitations to the approach, but the practical reality is that this approach is at least implementable. However, as discussed later in this report, the way in which the results are interpreted will be important owing to the differences in the average risk of the generation portfolio and the specific Portuguese PPAs.

3.2. The basic benchmark

Given the general approach outlined above, we have adopted a standard approach to estimating the benchmark and its constituent elements. Each of these are discussed in turn.

3.2.1. The cost of equity (COE)

Our approach to estimating the required COE is based on the Capital Asset Pricing Model (CAPM), a standard corporate finance approach to addressing this question. The CAPM links the required rate of return to three factors:

- the general risk-free rate in the economy;
- the level of additional return required for holding the entire "risky" portfolio of assets in the country (the equity or market risk premium – ERP or MRP); and
- the relative risk exposure of the specific asset or asset class compared to the whole portfolio (the equity beta).

These elements are combined as:[2]

$$R_e = R_f + \beta_e(R_m - R_f)$$

Where: R_e is the return on equity;

R_f is the risk-free rate;

$ß_e$ is the equity beta;

R_m is the market return.

[2] These should be presented as expected values but for simplicity the equation has been simplified.

Each of these elements is now discussed in turn.

Risk-free rate

The risk-free rate is an estimate of the underlying cost of riskless borrowing in an economy. It is normal to proxy this rate through the use of government borrowing rates. Of course, government borrowing rates are not riskless – apart from the general risk of the government there is risk of unexpected inflation affecting nominal bonds. Whilst index-linked bonds are a partial solution to this there use is limited across Europe. Government bonds are, however, normally the least risky asset in an economy and, as such, typically the relevant benchmark against which riskier assets are measured.

The choice of the appropriate government security to act as the risk-free rate depends on:

- the availability of different maturities;
- the frequency of trades and size of the bonds;
- whether nominal or index-linked bonds are issued; and
- the time horizon of the investment.

For countries with a significant number of government bonds there are indices of specific maturity developed – say a constant five year or 10 year maturity. With these indices individual bonds are included while their maturity is within the band of the constant maturity and then dropped once it is outside the band (so the five year bond may include bonds with remaining maturities between three and a half and six and a half years). We have focused on these sort of Bloomberg index but also considered some individual bonds.

As discussed later, we use several different maturities to provide a range of time horizons for the WACC calculation.

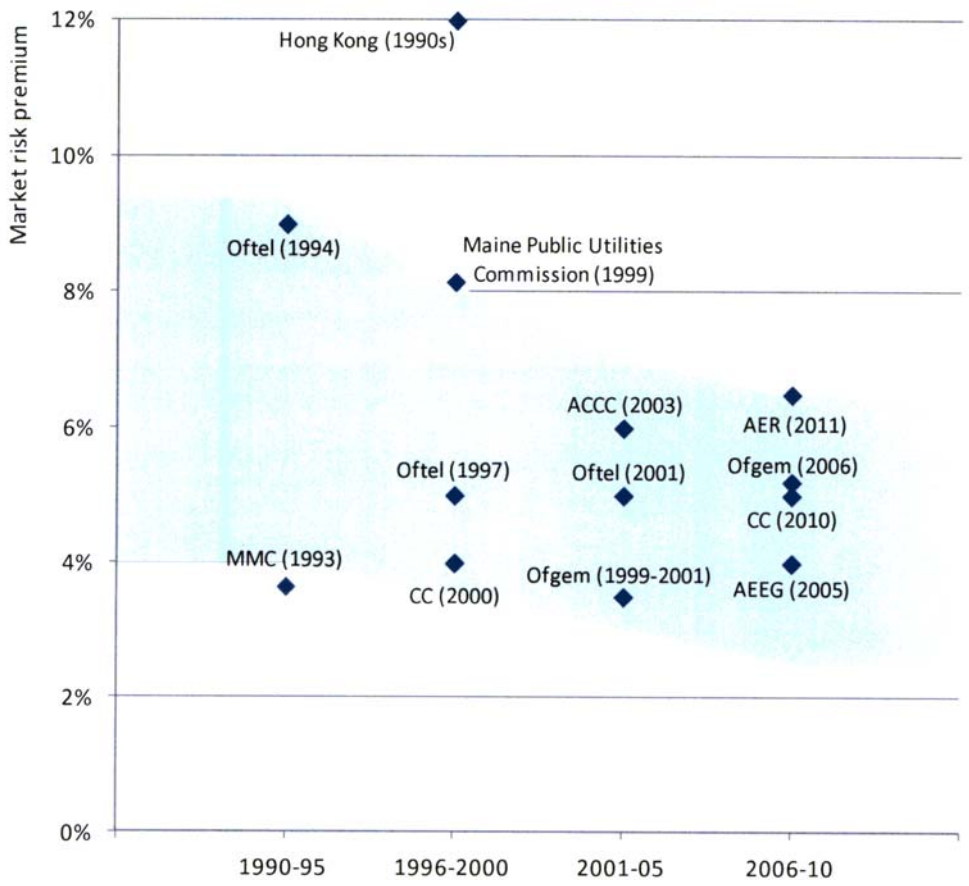
Equity/market risk premium

While the principle behind the ERP or MRP (henceforth referred to solely as the MRP) is simple – as noted above, it is the additional return demanded by investors to hold the whole "risky" portfolio in a country – the measurement has proven a subject of intense academic debate. The basic problem arises from the observed values for the MRP, which are measured by comparing the returns on the market with returns on risk-free assets.

Figure 3.1 below summarises selected regulatory decisions and our view of the broad consensus regarding the MRP over time. In the 1990s, worldwide evidence pointed to a MRP in the broad range of c4% to 7%, or even as high as 9%. Many regulatory decisions on the WACC in the late 1980s and early 1990s used these figures.[3]

[3] While there are some differences between the situation faced by generators to standard regulated utilities, regulatory determinations are a useful public source of views on elements of the WACC.

Figure 3.1: Consensus range and regulatory decisions on MRP



Source: CEPA research. The shaded area represents the approximate range of the consensus view on the MRP. We recognise that alternative views have existed outside this range – as demonstrated by regulatory decisions in Hong Kong in the 1990s. The selected regulatory decisions are intended to indicate the range of views taken by worldwide regulators and are not intended to be comprehensive.

Several academics posed the question of how an MRP as high as 9% could be justified from a theoretical perspective when other approaches justified much lower values. This led to an intense debate about why using observed values to estimate the MRP provided misleading values. This focused specifically on the:

- use of out-turn values rather than expected values;
- problems of survival bias in equity indices;
- problems of unstable ratings periods such that like-for-like calculations are not being undertaken; and
- relative impact of unanticipated inflation on equities and bonds.

This analysis has led to alternative values for the MRP being developed. The consensus view is now arguably lower (and narrower), as reflected in Figure 3.1.

Equity beta

The final element of the CAPM calculation is the relative risk of the asset/company, as captured by the equity beta. When measuring the equity beta the risk that matters is referred to as market or non-diversifiable risk. This is because investors are assumed to have an efficient portfolio of assets which allow some risk to be mitigated through the ownership of assets that benefit from the risk that is negatively affecting another asset. As such, the only risk that matters is that which cannot be diversified away through the creation of an efficient portfolio.

The market as a whole has an equity beta value of 1 and if a company has an equity beta of less than 1 then it is less risky than the market as a whole and if the value is greater than 1 then the company is more risky. Two factors drive the equity beta value for a company:

- underlying business risk reflecting the non-diversifiable risks of the business relative to the market as a whole (measured through the asset beta); and
- financial risk which magnifies the underlying business risk's effects on equity caused by the increasing use of debt. In principle this should be measured against the average gearing (financial structure) of the market as a whole, however, this is normally assumed to be constant and it is just the actual level of gearing for the asset that is considered.[4]

3.2.2. The cost of debt (COD)

The COD is traditionally measured as two separate elements:

- the risk-free rate (described earlier); and
- the debt premium.

The debt premium is a measure of the additional risk faced by investors for lending money to a company rather than the government. It is estimated by comparing the yield to maturity of the corporate bond with the yield to maturity of the appropriate government bond. This spread is then the debt premium.

When choosing government comparator bonds it is important to consider:

- the maturity of the bond; and
- the coupon.

Maturity is the most important determinant of the yield and so ensuring comparator bonds have as close a maturity to the corporate bond as possible is key. However, if there is then a choice concerning coupon it is better to find a coupon similar to that of the corporate bond since tax clientele effects might lead to different levels of demand and so yield.

[4] Clearly this assumption is not appropriate when considering long time series of data. However, we have continued to use the standard assumption for this work given the limitations faced with respect to time, data etc.

3.2.3. Gearing

When calculating the WACC it is important to establish the capital structure of the business, i.e. the mix of debt and equity (referred to as the gearing). This plays several roles in the WACC calculation as it is used to:

- de-lever equity betas into asset betas (and then re-lever them); and
- weight the COE and COD in the WACC calculation.

The standard approach to measuring the level of gearing is:

$$Gearing = \frac{Debt}{Debt + Equity}$$

Whilst there are preferred ways of measuring the debt and equity values, given the scale of the analytical work and the compressed timetables for the project we have relied upon the value that Bloomberg provides in order to de-lever the equity betas. We have re-levered the resulting asset betas based on our assumption regarding the appropriate notional capital structure.

3.2.4. Taxation

Both corporate and individual taxes can have an influence on the WACC:

- corporate as differential treatment of debt and equity returns often exist, with debt interest being tax deductible; and
- personal since dividend and interest payments received by investors are treated as taxable income.

Consequently it is important to be clear as to the pre- or post-tax status of the estimate. It is normal to estimate values that are either pre- or post-corporate tax while assuming the values are pre-personal taxes. The standard approach to doing this is to:

- estimate a post-corporate tax value from observable information; and
- make an adjustment based on the corporate tax rate to determine the pre-tax rate.

Whether the tax adjustment should be made to just the COE or the whole WACC is a point of disagreement. Our approach allows for any of the options to be considered.

3.3. Additional aspects of the approach

In the sub-sections above we have considered the overall approach that we will adopt to estimating the benchmark. There are two further issues that need to be considered when determining an estimate.

3.3.1. Time

The time horizon for an estimate of the WACC is important. In principle the WACC should be calculated for the life of the asset under consideration. In the case of the PPAs in the Portuguese power sector there are different lives arising because of:

- the commissioning date of the various plant which already existed; and
- the differences in lives dependent on the technology/ fuel source employed by the plant.

Given this it is important to consider what elements of the estimate might change as the time horizon changes. There are two key elements:

- the risk-free rate; and
- the debt premium.

It is normally expected that there is an upward sloping yield curve, i.e. borrowing longer maturity funds is more expensive than short. This is because of the time value of money, risk etc. As such, we would expect the long maturity WACC to be higher than a short maturity one, ceteris paribus. Of course, there may be periods when short-term money is more expensive than long maturity money, owing to short-term risks – the current financial crisis is an example of this. That can change the slope of the yield curve.

The debt premium is also expected to increase the longer the maturity of the bond owing to the greater risk compared to the government bond. As such, a long maturity WACC should be higher than a short-maturity one, ceteris paribus. Anecdotal evidence in the 1990s suggested that every additional year of maturity added 2 basis points (0.02%) to the debt premium. However, it is also possible that if the maturity impact on the risk-free rate is significant then the debt premium may adjust for this and be lower for long dated debt (but still having an overall long dated COD greater than a short dated one).

To take account of the possible impact of maturity we calculate three maturities of WACC:

- Short-dated (under 10 years);
- Medium-dated (between 10 and 30 years); and
- Long-dated (above 30 years).

In our main conclusions we match the maturity of each PPA or CMEC agreement to the maturity categories above.

3.3.2. Fuel type

It is possible that the choice of fuel type will affect more than just the maturity of the plant, especially if the exposure to risk is different. The most obvious example of this would be the comparison of thermal plant and hydro-electric ones. The latter are unlikely to face fuel cost risk while this can be important for thermal plant. Of course, whether the thermal plant faces a different level of risk will depend on the structure of the contract under which the power is being sold. For the PPA-backed generators in Portugal, our analysis indicates that you would not expect to see significant differential pricing according to fuel type.

Unfortunately, given the time and data limitations no meaningful information on the impact of technology has been discernible from our analysis.

4. OUR BENCHMARK

Having outlined our approach, this section reports the results of the data analysis that was undertaken. The length of the time series of WACC estimates required has created some specific data issues that are discussed in the appendices that support the section.

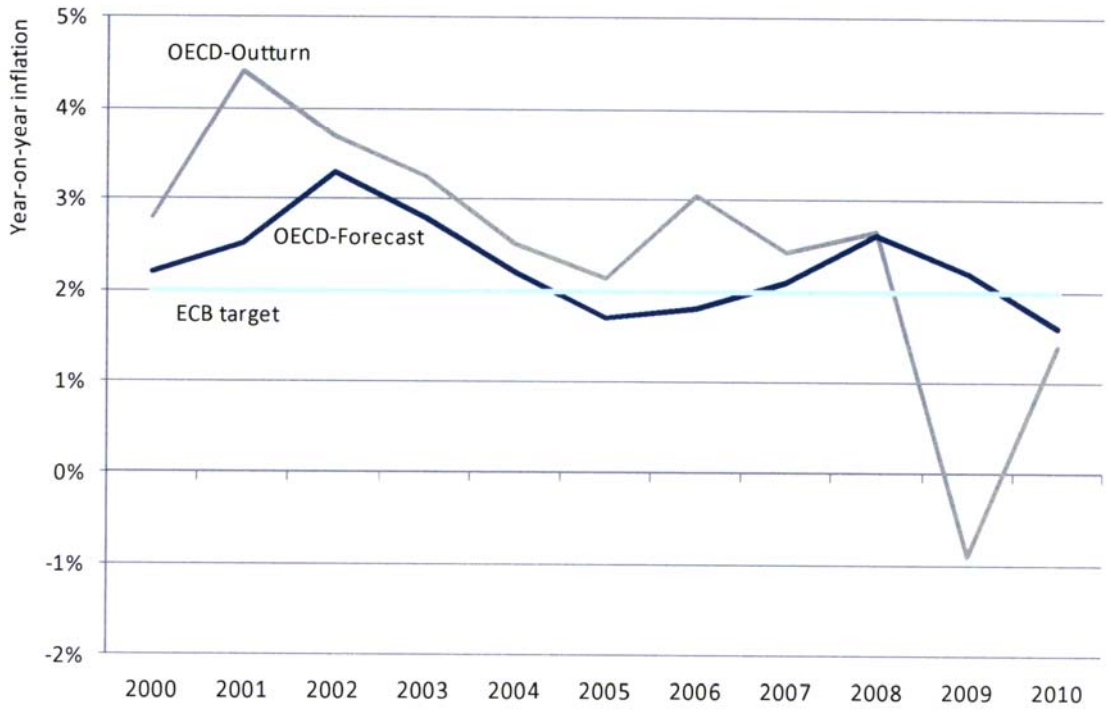
The basic source of data for this analysis has been Bloomberg. However, this has been supplemented in many cases, and again the additional data is discussed in the appendices.

We have developed a long-list of potential comparator companies (see Appendix 2). However, we have had to exclude some companies from this list due to lack of comparability or data issues.

4.1. Inflation

As we are seeking a real WACC, we need to deflate our nominal data. We have done so using inflation rates for Portugal based on OECD data (see Figure 4.1 below). In calculating forward-looking measures (e.g. estimates of the risk-free rate) we have used OECD forecasts as reported in the World Economic Outlook for the preceding year. All calculations involving inflation have been carried out based on the Fisher equation.

Figure 4.1: Inflation data for Portugal



Source: OECD[5]

[5] OECD outturn inflation based on harmonised CPI data from stats.oecd.org. OECD forecast inflation based on estimates for year-ahead Portuguese CPI and harmonised CPI data contained in annual World Economic Outlook reports from 1992-2010. ECB target assumed to be 2.0% for 2000-10.

4.2. The Cost of Equity

As discussed previously, three elements need to be considered:

- the risk-free rate;
- the MRP; and
- the equity beta.

4.2.1. Risk-free rate

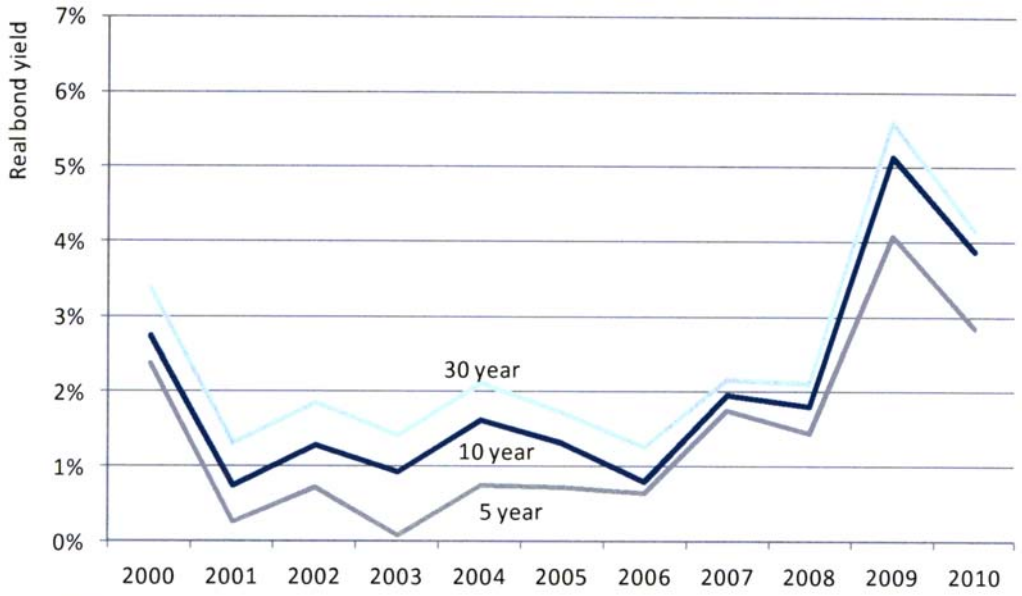
Figure 4.2 reports the different maturities of the nominal risk-free rate for Portugal. This is based on the yield to maturity of the various maturity bonds.

Figure 4.2: Nominal yields to maturity on 5-, 10- and 30-year Portuguese government bonds

Source: Bloomberg, OECD, CEPA analysis

Using these nominal yields and the inflation information previously provided allows us to estimate the real risk-free rate. This estimate is not perfect since it does not use a market estimate of the inflation over the appropriate maturity range, but it is the best that can be done with the information available. Figure 4.3 illustrates the resulting real risk-free rates across the different maturities of WACC.

Figure 4.3: Real yields to maturity on 5-, 10- and 30-year Portuguese government bonds[6]



Source: Bloomberg, OECD, CEPA analysis

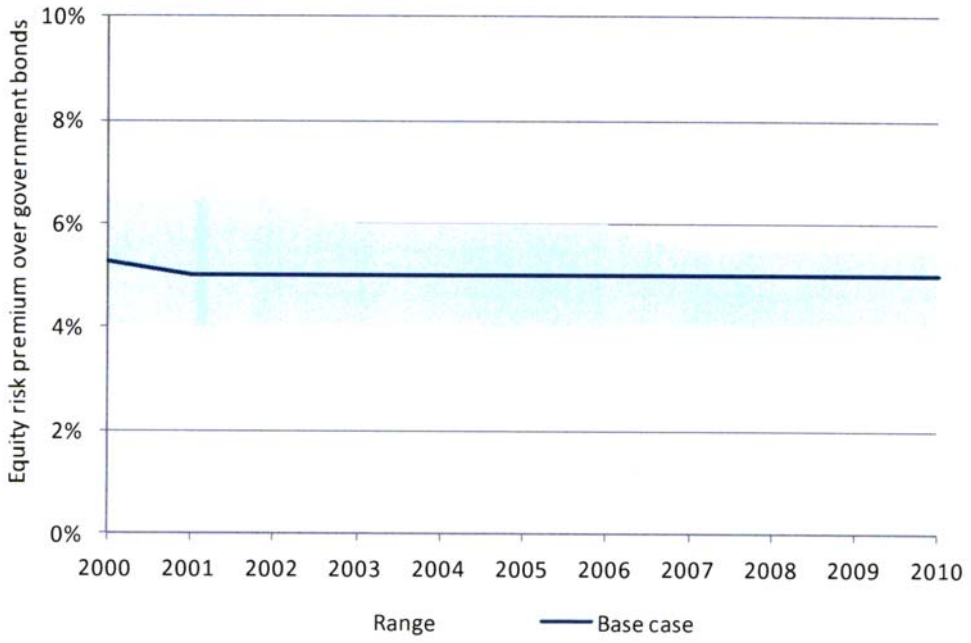
The real risk-free rate from in the early 2000's was relatively low before rising to close to 6% after the credit crunch in 2007. However, it should be noted for context that it was relatively high in the 1994/95 period at around 6%.

4.2.2. Equity/market risk premium

As discussed in Section 3, the MRP has been subject to significant uncertainty owing to the problems implicit in the way that the value used to be calculated. The starting point for our estimation period is the time when views about the MRP were starting to significantly change and so an unthinking adoption of high values would not be appropriate – significant academic and professional debate about the right number was underway. As such, we have set out a range that changes over time (see Figure 4.4 below).

[6] Nominal yields deflated based on OECD reported (harmonised) CPI inflation.

Figure 4.4: The MRP range



The upper value (6.5%) is towards the values used by some regulators in the mid-1990s (and interestingly regulators in Portugal and Australia have been increasing rates again to similar levels). The lower bound (4%) reflects the values used consistently for most of the 2000s. As shown in Figure 3.1, arguably the range of commonly-used values has fallen and narrowed over time, and we reflect this in our assumptions. Our base case is 5.0% for the 2000s.

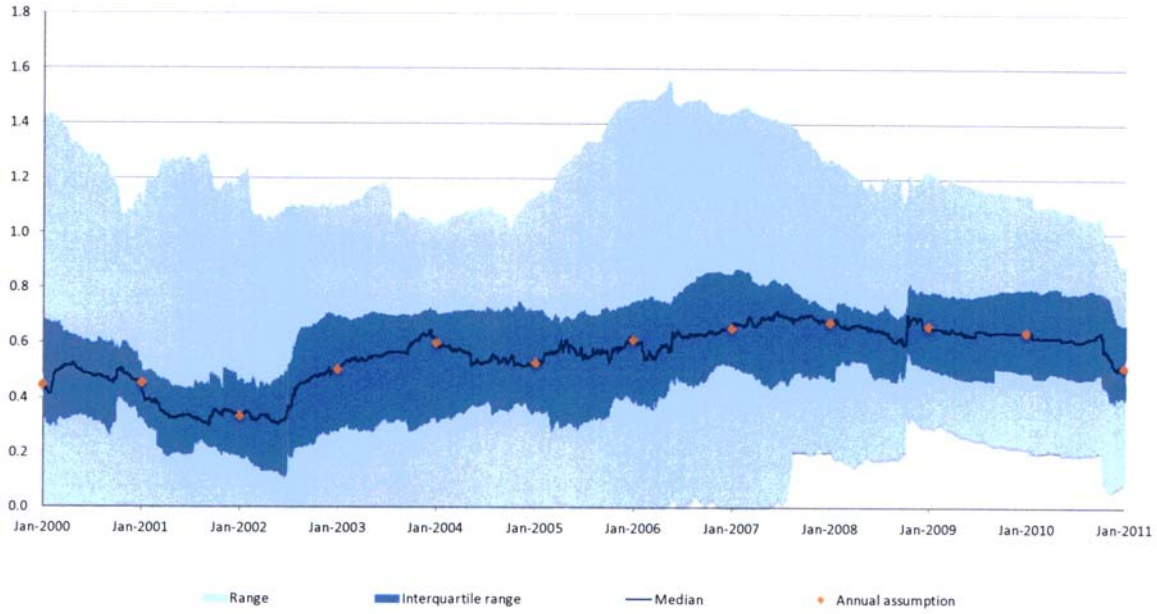
4.2.3. Equity betas

Our estimate of the equity beta has used several steps:

1. estimate the equity beta of generation companies (which has needed to include integrated energy companies to ensure a sufficient sample size);
2. estimate the asset beta by de-gearing the equity beta estimates; and
3. estimate a generation/integrated company benchmark using the asset betas and a notional level of gearing.

The raw equity betas for our sample of integrated utility companies are presented in Figure 4.5 below.

Figure 4.5: Raw equity betas for integrated utility companies



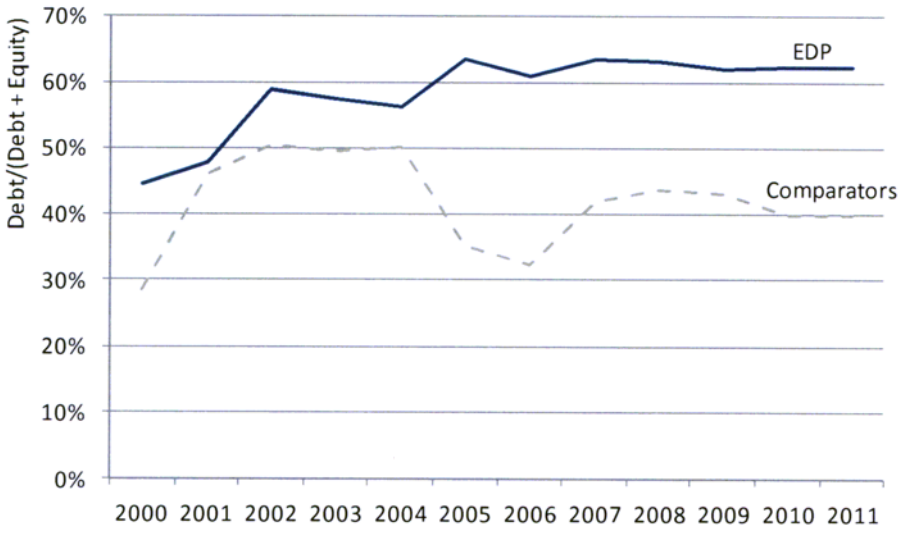
Source: Bloomberg, CEPA analysis

The following sections summarise our approach to generating asset betas.

4.2.4. Gearing

Figure 4.6 provides evidence from our sample of companies on the level of gearing (taken from Bloomberg and defined as long and short term financial debt as a proportion of debt and equity).

Figure 4.6 Gearing for comparator companies



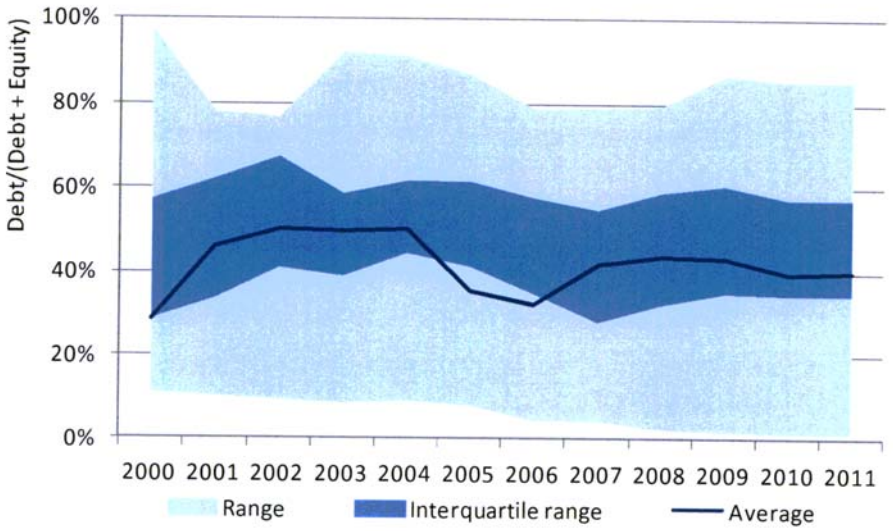
Our analysis of gearing shows that:

- For the integrated utility companies in our sample, average gearing rose in the early 2000s as high as 50%, but has since fallen back to around 40%; and

- Our good comparators have sustained higher average gearing levels, at around 50-60% since the early 2000s, suggesting that they are viewed as slightly lower risk than the broader sample.

We note that there is a significant amount of variation in actual gearing rates chosen by companies in our sample (see Figure 4.7 below).

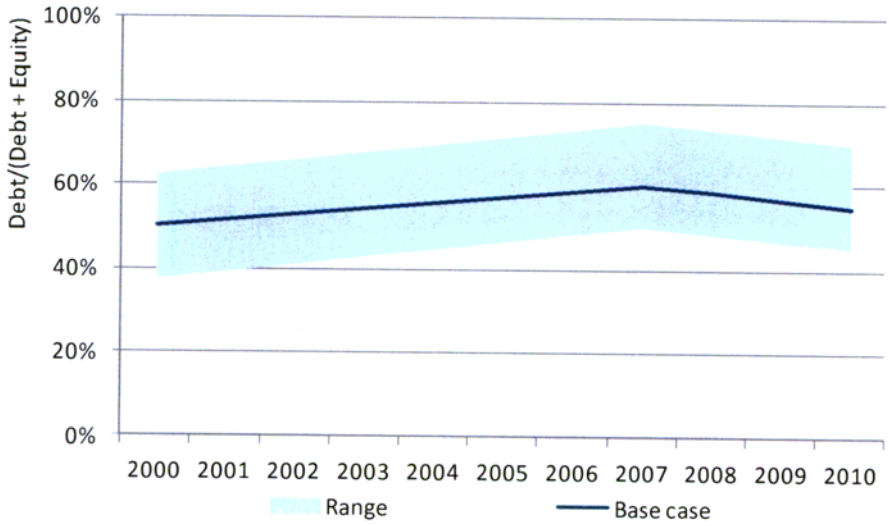
Figure 4.7: Range of gearing for comparator companies



Source: Bloomberg

We therefore consider it appropriate to show a range of values under low and high scenarios (see Figure 4.8 below).

Figure 4.8: Notional gearing assumptions



In our base case we take the view that the PPAs would attract a relatively high level of gearing owing to their relatively low level of risk and show and increase over time as investors became more familiar with these assets. However, in all scenarios we assume that gearing begins to decline slightly in 2007.

4.2.5. Asset betas

By de-gearing the equity betas (using the information outlined above) we have been able to estimate asset betas – reflecting the underlying business risk rather than a mix of business and financial structure risk (as captured in the equity beta). Figures 4.9 and 4.10 illustrate the results of this analysis. In the WACC estimation that follows, we use an annual estimate for each year; this value is labelled 'Annual' in the figures below (and in appendix figures), and represents the value based on evidence up to 1 January of each year.

Figure 4.9: Asset betas: integrated utilities

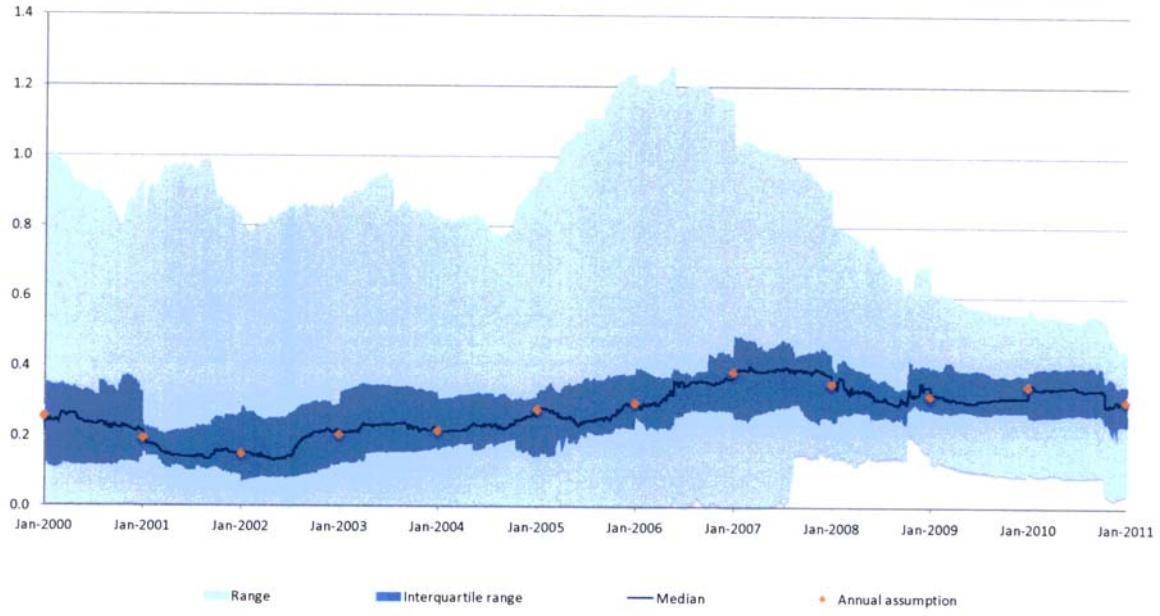
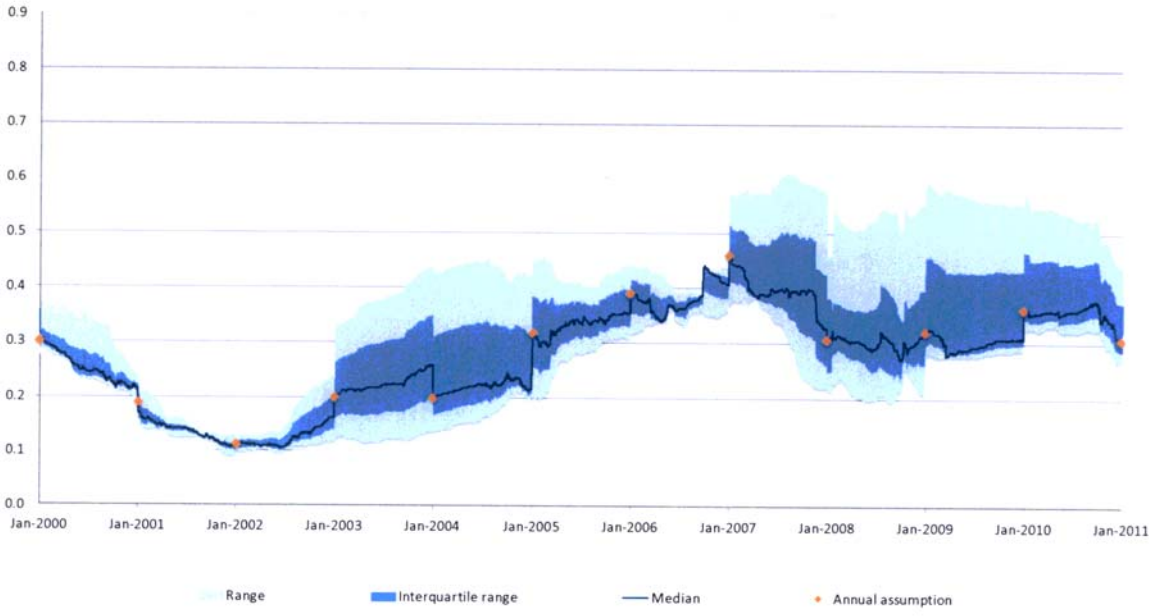


Figure 4.10 Asset betas: good comparators



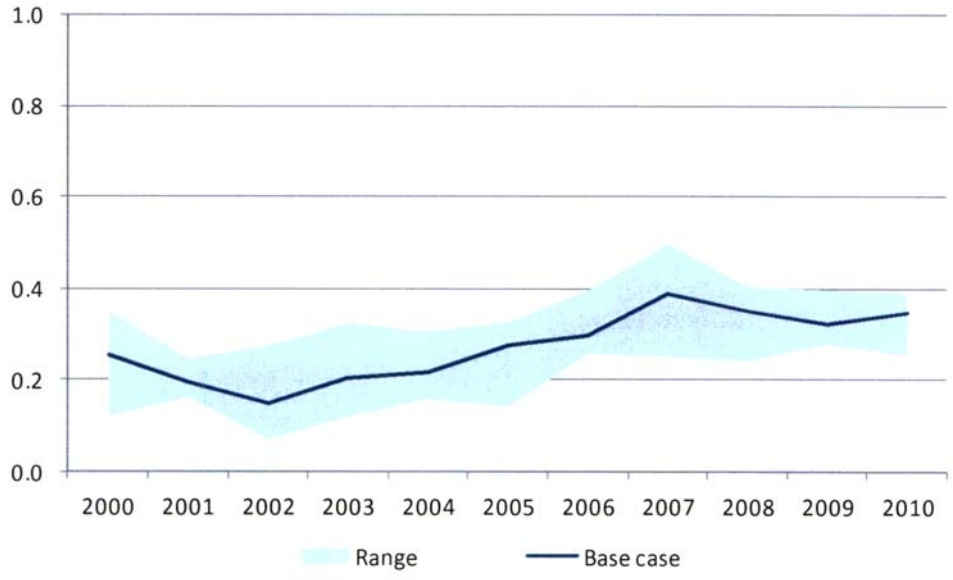
Our analysis of asset betas shows that:

- Asset betas fell to very low levels of around 0.2 in the early 2000's before returning to around 0.4 on average in the late 2000s.
- Our good comparators also have relatively volatile asset betas, declining sharply to 0.1 in the early 2000's and then more recently (post 2007) stabilising at around 0.3-0.4. The evidence suggests they were then seen as lower risk or on average no more risky than the wider sample.

The central figures shown above are median values for each group of companies. We also considered the mean across companies (either a simple mean or weighted by market capitalisations). The mean values were more volatile, with the peaks around 2007 being substantially more pronounced. They were also frequently outside the interquartile range – higher, therefore than at least 75% of our comparator companies.

There are strong arguments to suggest that the degree of systemic risk faced under the PPAs would be towards the low end of that faced by many of the comparator businesses. Since it has not been possible in the time available to gather evidence for purely PPA-backed businesses, we have been forced to use our judgement to select an appropriate range. We consider it likely that the (relatively high) mean betas would be at the upper end of what would have been required by private investors into the PPA-backed assets. As a result, we use the median values as our base case, and refer to high and low cases based on the interquartile range (see Figure 4.11).

Figure 4.11: Asset beta assumptions



4.3. The Cost of Debt

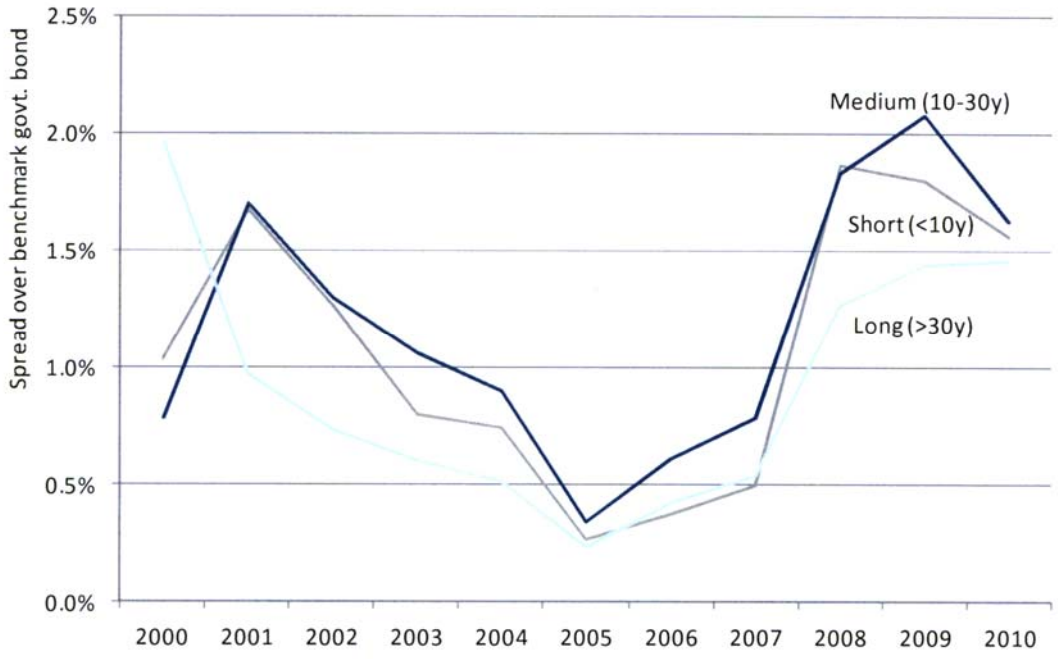
4.3.1. Risk-free rate

The risk-free rate for the cost of debt is of course taken to be identical to the risk-free rate shown in Section 4.2.1 above.

4.3.2. Debt premium

There is relatively little publicly available information on historic debt premia. For the early 2000s we have therefore relied on several sources for spread at issue for electricity company bonds. From the early 2000s onwards we have used daily spread estimates for electricity bonds based on secondary trading data. These are reported by Bloomberg and summarised in Figure 4.12 below.

Figure 4.12: Spreads on utility company bonds vs. benchmark government bonds



Source: Financial Times, Bloomberg, CEPA analysis. We include only European and US bond issuances. We exclude six issuances by AES in 2001/02 due to the specific difficulties faced by Drax during that period. Data were available for all years for medium term bonds. Where data were unavailable for short or long term, we interpolated values based on data for the closest available year.

Whilst there has been significant movement in bond spreads over the period, the medium term spread has been much more stable. This is likely to be in part due to the higher quality of available data for medium term bonds. Our assumption regarding the debt premium is driven by the asset life under consideration; where appropriate, however, we focus on the medium term as a 'base case' given the higher data quality.

4.4. Tax

We use the headline tax rate to compute a pre-tax cost of equity and thus a pre-tax WACC (cost of debt data is already pre-tax). We are advised that both the corporation tax rate and the municipal tax rate were applied to profits and as such use a combined (and by definition higher) rate to gross up the cost of equity.

Table 4.1: Tax rates

	2000-01	2002-04	2005-08	2009-10
Total tax rate	35.2%	33.0%	27.5%	26.5%

Note: The total tax rate is a combination of the corporation tax rate multiplied by municipal tax at 10%

4.5. The WACC

This section presents our conclusions for the overall WACC. We also present further detail on how our estimates change over time, as well as an illustration of the relevant parameters for a specific scenario (the medium term base case). Note that the yearly data points are the outputs of our modelling, and should not necessarily be interpreted as individual point estimates.

It is based on the ranges shown above for each of the building blocks. Our estimates cover each year from 2000 to 2010, but the table below focuses on the appropriate comparator cost of capital at the time of the CMEC agreements in 2007. More detailed tables showing the detailed figures and building blocks that underpin each of the scenarios are available in Appendix 3, along with sensitivity and robustness checks.

Our estimates in Table 4.2 below are specific to a point in time (i.e. year) and time horizon (i.e. remaining asset life – short, medium or long). To capture the latter we adjust the time horizon used for our evidence on the risk-free rate and the debt premium. We do not consider we have evidence to justify calculating a rate that is specific to the technology concerned. In our view these rates are likely to have been very similar. We acknowledge that a range of plausible values exist. As well as our base case, we present low and high estimates based on alternative assumptions for gearing and beta.

Table 4.2: WACC estimates for PPA/CMEC agreements

Contract	Year	Remaining asset life	Base case	Low	High
CMEC	2007	Short (<10 yrs)	5.4%	4.4%	6.2%
CMEC	2007	Medium (10-30 yrs)	5.8%	4.8%	6.5%
CMEC	2007	Long (30+ yrs)	5.9%	4.9%	6.7%

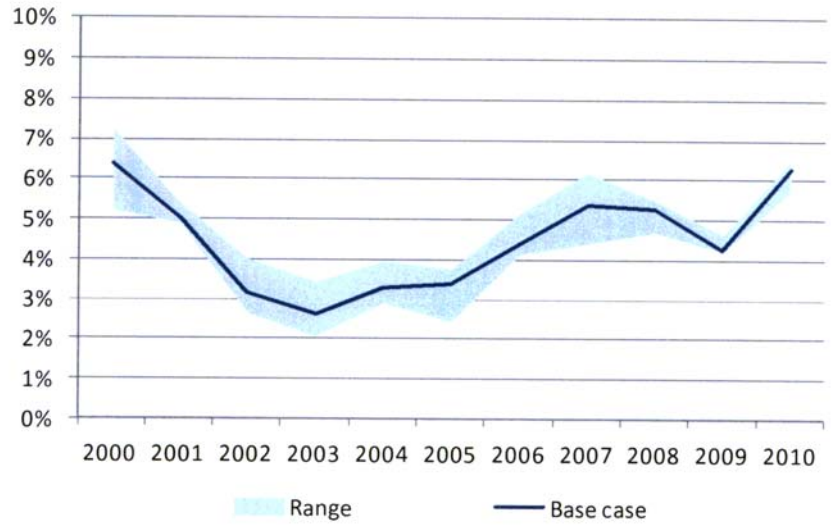
We are aware that the Ministry is particularly interested in the results of our analytical work for the year when the CMEC regime came into operation (2007). Our focus has been on estimating the returns that would have been required by private investors at the time. An important cross-check for this is the viewpoint of regulators: typically, WACCs are set by regulators or within contracts based on a view of the recent past and likely changes to rates over the period, i.e. a fixed allowed return is informed by past events and the regulator's expectations of any changes in market conditions, plus the need to ensure that the company can finance itself over the period.

In 2007, we show for the 'medium asset lives' base case a pre-tax real WACC of 5.8%, based on data for that year. At this point in time our yearly WACC data was on an upward trend, but we note the Regulator allowed a pre-tax nominal WACC of 8% for EDP or about 5.2% real. We therefore believe that our 2007 base case estimate of the WACC is not unreasonable.

WACC over time

Figures 4.13, 4.14 and 4.15 show our WACC estimates over time for each category of asset life.

Figure 4.13: Short term (real, pre-tax)



Notes:

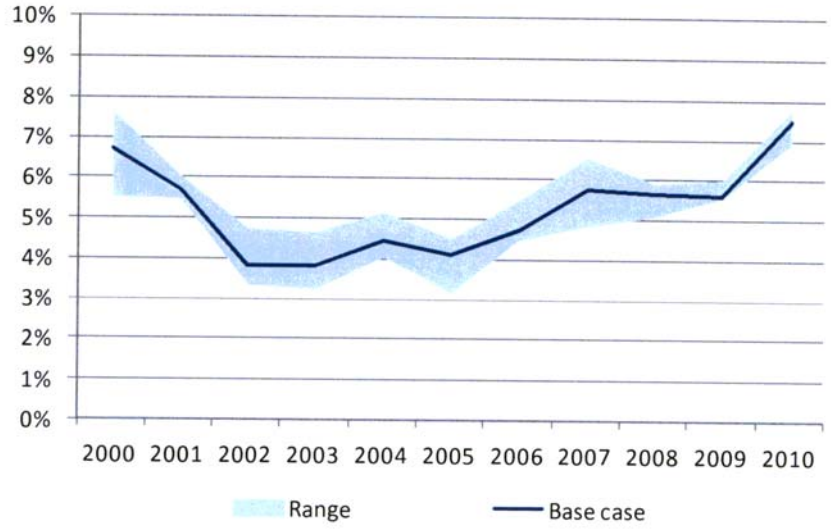
Comparator companies are European integrated utilities

Real risk-free rate based on 5 year nominal Portuguese government bond yields to maturity deflated based on OECD forecast inflation

Debt premium based on <10 year corporate bond spreads over national government bonds

Range based on alternative estimates for asset betas and notional gearing

Figure 4.14: Medium term (real, pre-tax)



Notes:

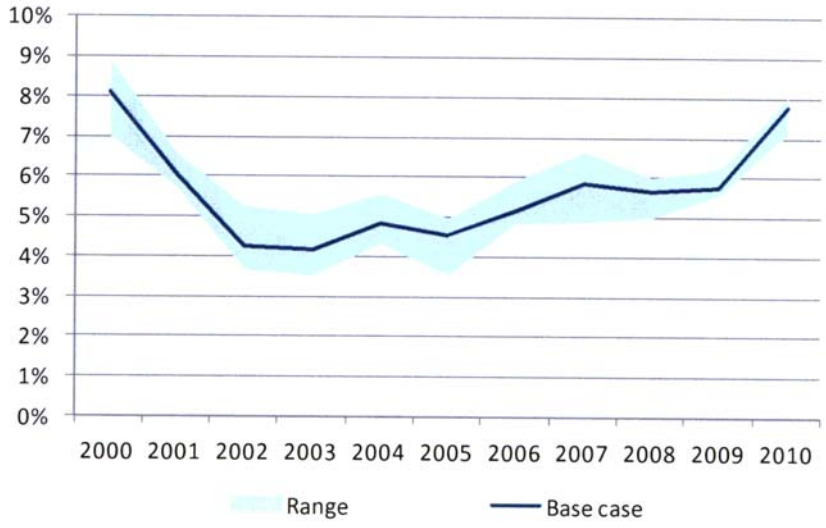
Comparator companies are European integrated utilities

Real risk-free rate based on 10 year nominal Portuguese government bond yields to maturity deflated based on OECD forecast inflation

Debt premium based on 10-30 year corporate bond spreads over national government bonds

Range based on alternative estimates for asset betas and notional gearing

Figure 4.15: Long term (real, pre-tax)



Notes:

Comparator companies are European integrated utilities

Real risk-free rate based on 30 year nominal Portuguese government bond yields to maturity deflated based on OECD forecast inflation

Debt premium based on 30+ year corporate bond spreads over national government bonds

Range based on alternative estimates for asset betas and notional gearing

Illustration of building blocks (for medium term base case scenario only)

Table 4.3: Cost of capital breakdown – Medium term base case

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	50%	51%	53%	54%	56%	57%	59%	60%	58%	57%	55%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.3%	2.6%	1.7%	1.4%	1.9%	1.7%	2.0%	2.3%	1.9%	2.0%	3.6%
Debt premium	0.8%	1.7%	1.3%	1.1%	0.9%	0.3%	0.6%	0.8%	1.8%	2.1%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.25	0.20	0.15	0.21	0.22	0.28	0.30	0.39	0.35	0.32	0.35
Equity beta	0.51	0.40	0.32	0.45	0.49	0.65	0.72	0.97	0.85	0.74	0.78
Cost of debt (real, pre-tax)	4.1%	4.3%	3.0%	2.4%	2.8%	2.1%	2.6%	3.1%	3.7%	4.0%	5.3%
Cost of equity (real, pre-tax)	9.3%	7.1%	4.8%	5.4%	6.5%	6.9%	7.8%	9.8%	8.4%	7.7%	10.2%
Cost of equity (real, post-tax)	6.0%	4.6%	3.2%	3.6%	4.4%	5.0%	5.6%	7.1%	6.1%	5.6%	7.5%
Cost of capital (real, pre-tax)	6.7%	5.7%	3.8%	3.8%	4.5%	4.1%	4.8%	5.8%	5.7%	5.6%	7.5%
Cost of capital (real, vanilla)	5.1%	4.5%	3.1%	3.0%	3.5%	3.3%	3.9%	4.7%	4.7%	4.7%	6.3%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

5. RENEWABLES

As part of our analysis, we have been asked to consider any evidence emerging on the returns for renewables, although this has not been a focus of the work.

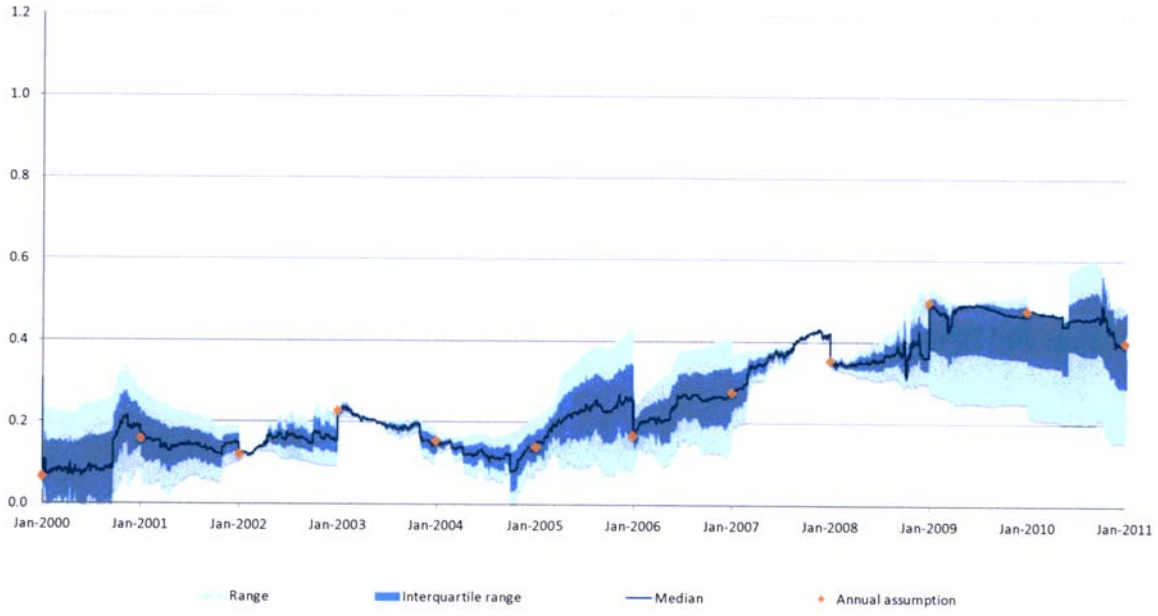
As part of our data set, we have identified a number of quoted comparator stocks which are, broadly speaking, 'renewable only' and the relevant beta analysis and WACC data is presented for them below. We have also undertaken a limited review of published literature on returns to renewables.

The renewable-only companies in our data set are:

- Acciona SA
- EDP Renovaveis
- EDF EN
- Enel Green Power
- Greentech Energy (note: relatively low weighting in sample)

The asset betas for these companies are set out in Figure 5.1 below. Estimates in the early 2000s are at a very low average level of below 0.2, before rising to a (still low) average of around 0.4 post 2007.

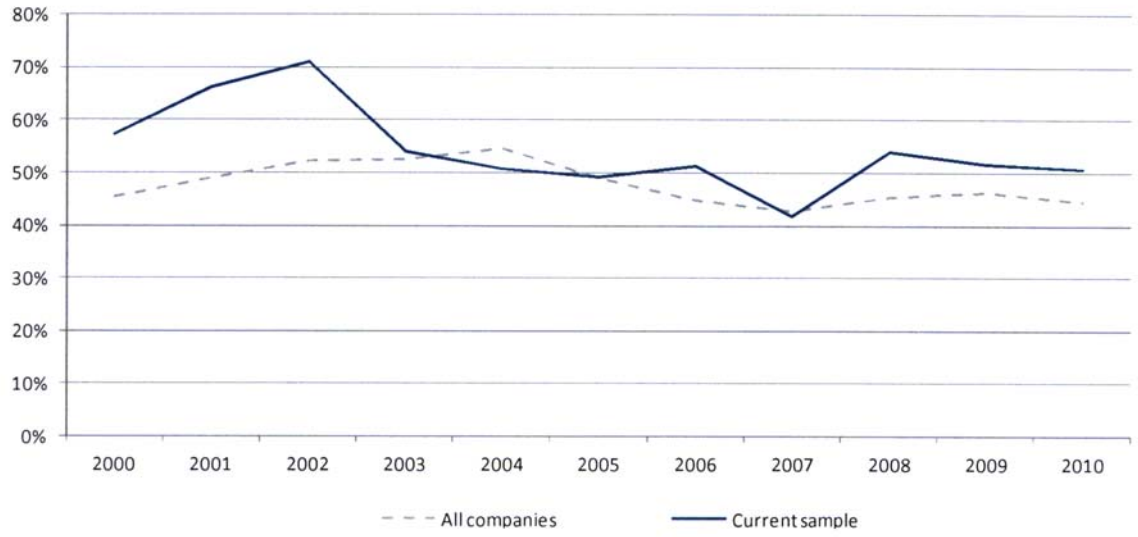
Figure 5.1: Asset beta estimates for renewable energy companies



Source: Bloomberg, CEPA analysis

Gearing levels for these companies have tended to be above the average for the fuller sample, as illustrated in Figure 5.2.

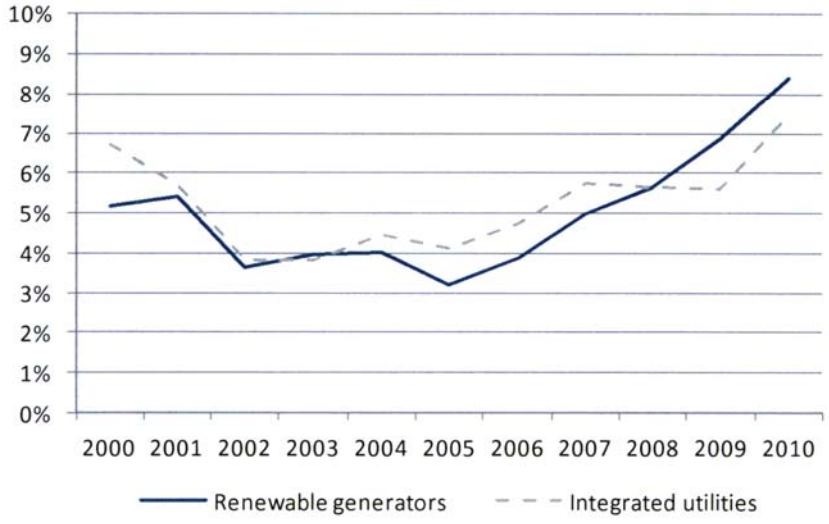
Figure 5.2: Weighted average gearing for renewable energy companies



Source: Bloomberg, CEPA analysis

These factors combine with our standard assumptions for other inputs to provide similar WACC numbers to our main 'Integrated utilities' sample. Figure 5.3 below compares the WACC estimate for renewable energy companies with our base case estimate presented in Section 4.

Figure 5.3: Base case vs. renewable WACC (pre-tax, real, base case assumptions)



Notes: See notes to Figure 4.13.

BENCHMARK ON RATES OF RETURN FOR GENERATION ASSETS IN PORTUGAL

APPENDICES

January 2012

CONFIDENTIAL

Submitted by:

Cambridge Economic Policy Associates Ltd

CEPA

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CONTENTS

APPENDIX 1: DETAILS OF REGULATORY DECISIONS ON ALLOWED RETURNS FOR ENERGY NETWORKS IN PORTUGAL

Tables A2.1 and A2.2 below show the allowed rates of return for EDP and REN's network business. The figures have been provided by the Ministry of Economy and Employment and show pre-tax nominal WACC allowances. We have then converted the WACC allowances into real terms based on outturn inflation according to OECD.

Comparing the resulting figures to our (real, pre-tax) medium term base case estimates for the four distinct periods:

- For 2002-05, due to concurrent movements in several parameters, our estimates fall significantly. The allowances actually rise slightly, and are as a result significantly higher.
- Over the period 2006-08, the allowances (particularly for REN) fall dramatically and are again generally lower than our estimates.

Table A2.1: Allowed WACC for REN (TSO), 1999-2013

		1999-2001	2002-2004				2005		2006-2008		2009-2011		2012-2014	
Nominal interest rate without risk	A		5.0%	5.7%	5.1%	5.8%	3.9%	4.4%	3.8%	4.4%	4.5%	4.5%	3.4%	3.4%
Debt risk premium	B		1.0%	1.0%	1.0%	1.0%	0.5%	0.5%	0.7%	0.7%	0.5%	0.9%	4.3%	4.3%
Debt cost before taxes	C=A+B		6.0%	6.7%	6.1%	6.8%	4.4%	4.9%	4.5%	5.0%	5.0%	5.4%	7.7%	7.7%
Debt cost after taxes	D=Cx(1-J)		4.0%	4.5%	4.1%	4.5%	3.2%	3.6%	3.2%	3.6%	3.7%	4.0%	5.3%	5.3%
Gearing Debt/(Equity + Debt)	E		42%	42%	54%	54%	46%	46%	45%	45%	61%	61%	50%	50%
Equity risk premium	F		4.0%	5.0%	4.0%	5.0%	4.3%	5.3%	3.5%	4.5%	3.5%	4.5%	6.5%	6.5%
Equity Beta	G		34%	44%	41%	54%	35%	45%	30%	40%	89%	93%	51%	60%
Cost of Equity after taxes	H=A+(FxG)		6.4%	7.9%	6.8%	8.5%	5.4%	6.8%	4.9%	6.2%	7.7%	8.7%	6.7%	7.3%
Cost of Equity before taxes	I=H/(1-J)		9.5%	11.7%	10.1%	12.6%	7.5%	9.4%	6.7%	8.5%	10.4%	11.9%	9.8%	10.7%
Tax rate	J		33%	33%	33%	33%	28%	28%	28%	28%	27%	27%	32%	32%
Cost of Capital before taxes	K		8.1%	9.6%	8.0%	9.5%	6.1%	7.3%	5.7%	6.9%	7.2%	8.0%	8.8%	9.2%
Cost of Capital defined for the Regulatory Period (Pre-tax nominal)		8.50%	9.00%				8.00%		7.00%		Indexed to 10yr Govt. Bonds 2009 = 7.55% 2010 = 7.39% 2011 = 7.56%		9.00%	
Cost of capital (Pre-tax real based on OECD-reported outturn inflation)		5.21%	5.67%				5.75%		4.18%		2009 = 6.12% 2010 = 5.96% 2011 = 6.13%		N/A	

Table A2.2: Allowed WACC for EDP (DSO), 1999-2013

		1999-2001	2002-2004				2005		2006-2008		2009-2011		2012-2014	
Nominal interest rate without risk	A		5.0%	5.7%	5.0%	5.6%	3.9%	4.4%	4.4%	5.0%	4.5%	4.5%	3.4%	3.4%
Debt risk premium	B		1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.8%	1.0%	4.3%	4.3%
Debt cost before taxes	C=A+B		6.0%	6.7%	6.0%	6.6%	4.9%	5.4%	5.4%	6.0%	5.3%	5.5%	7.7%	7.7%
Debt cost after taxes	D=Cx(1-J)		4.0%	4.5%	4.0%	4.4%	3.6%	3.9%	3.9%	4.3%	3.9%	4.1%	5.3%	5.3%
Gearing Debt/(Equity + Debt)	E		42%	42%	34%	34%	48%	48%	55%	55%	49%	49%	50%	50%
Equity risk premium	F		4.0%	5.0%	4.0%	5.0%	4.3%	5.3%	3.5%	4.0%	3.5%	4.5%	6.5%	6.5%
Equity Beta	G		39%	51%	35%	46%	60%	78%	84%	93%	90%	98%	65%	67%
Cost of Equity after taxes	H=A+(FxG)		6.6%	8.2%	6.4%	7.9%	6.5%	8.5%	7.4%	8.7%	7.7%	9.0%	7.6%	7.8%
Cost of Equity before taxes	I=H/(1-J)		9.8%	12.3%	9.5%	11.8%	8.9%	11.8%	10.2%	12.0%	10.5%	12.2%	11.1%	11.3%
Tax rate	J		33%	33%	33%	33%	28%	28%	28%	28%	27%	27%	32%	32%
Cost of Capital before taxes	K		8.2%	9.9%	8.3%	10.0%	7.0%	8.7%	7.6%	8.7%	7.9%	8.9%	9.4%	9.5%
Cost of Capital defined for the Regulatory Period (Pre-tax nominal)		8.50%	9.00%				8.50%		8.00%		Indexed to 10yr Govt. Bonds 2009 = 8.55% 2010 = 8.39% 2011 = 8.56%		9.50%	
Cost of capital (Pre-tax real based on OECD-reported outturn inflation)		5.21%	5.67%				6.24%		5.15%		2009 = 7.11% 2010 = 6.95% 2011 = 7.12%			

APPENDIX 2: COMPARATOR COMPANIES

The starting point of the analysis was the Bloomberg European Electricity Generation Index in the beginning of 2012. To those companies, we have added electricity companies previously listed on the stock market and currently acquired or delisted, as well as other utilities currently listed. The table below gives a brief categorisation of these comparators.

Table A3: Comparator companies

Company name	Description of business	Sub-categories
GAS NATURAL SDG SA	Vertically integrated utility company	N/A
ENERGIAS DE PORTUGAL (EDP)	Integrated electric utility with position in renewables	N/A
ENDESA SA	Vertically integrated electric utility	Good comparator Integrated utility
REN	Portuguese TSO and owner of transmission grids	Transmission utility
RED ELECTRICA DE ESPANA (REE) SA	Spain's TSO and regulated transmission company	Transmission utility
A2A SPA	Vertically integrated utility company	Integrated utility
ACEA SPA	Vertically integrated utility company	Integrated utility
ALPIQ HOLDIN-REG	Vertically integrated utility company	Integrated utility
ACCIONA ENERGIA SA	Renewable energy power generator	Pure generator Renewables
BKW FMB ENERGIE	Vertically integrated electric utility	Integrated utility
CEZ AS	Vertically integrated electric utility	Integrated utility
CENTRICA PLC	Integrated energy company	Integrated utility
DRAX GROUP PLC	Coal-fired electricity generation company	Pure generator
EDF	Vertically integrated utility company	Good comparator Integrated utility
ENERGIEDIENST AG	Vertically integrated utility company	Integrated utility
EDISON SPA	Vertically integrated utility company	Pure generator
EDP RENOVAVEIS	Wind-energy based renewables company	Pure generator Renewables
ENEL GREEN POWER	Renewable energy generator	Pure generator Renewables
ENEA	Vertically integrated utility company	Integrated utility
ENEL SPA	Vertically integrated utility company Majority shareholder in Endesa SA	Integrated utility
E.ON AG	Vertically integrated utility company	Integrated utility

Company name	Description of business	Sub-categories
EVN AG	Vertically integrated utility company	Integrated utility
FORTUM OYJ	Vertically integrated utility company	Integrated utility
GREENTECH ENERGY	Renewable energy producer	Pure generator Renewables
GDF SUEZ	Vertically integrated utility company	N/A
HAFSLUND-B SHS	Vertically integrated utility company	Integrated utility
ROMANDE ENE-REG	Electricity producer and distributor	Integrated utility
IBERDROLA SA	Integrated electric utility with large wind power portfolio	Good comparator Integrated utility
INTL POWER PLC	Independent power generation company	N/A
IREN SPA	Vertically integrated utility company	Integrated utility
MVV ENERGIE AG	Vertically integrated utility company	Integrated utility
PGE SA	Vertically integrated utility company	Integrated utility
PUBLIC POWER CORP	Vertically integrated utility company	Integrated utility
RWE AG	Vertically integrated utility company	Integrated utility
SECHILIENNE-SIDEC	Independent power generation company	Pure generator
SSE PLC	Vertically integrated utility company	Integrated utility
TAURON	Vertically integrated utility company	Integrated utility
VERBUND AG	Vertically integrated utility company	Integrated utility Hyrdo
UNION FENOSA	Vertically integrated utility company	Good comparator Integrated utility
HIDRO CANTABRICO (HC ENERGIA)	Vertically integrated utility company	Good comparator Integrated utility
FESCA	An Endesa subsidiary	Integrated utility
CIA SEVILLANA DE ELECTRICIDAD	An Endesa subsidiary	Pure generator
ENEL VIESGO	An Endesa subsidiary	Integrated utility
GESA	An Endesa subsidiary	Integrated utility
POWERGEN	Vertically integrated utility company	Integrated utility
BRITISH ENERGY	Producer of electricity & gas Part of EDF since 2009	Pure generator
NATIONAL POWER	Vertically integrated utility company	Integrated utility
NATIONAL GRID	Power transmission network company	Transmission utility
SCOTTISH POWER	Vertically integrated utility company	Integrated utility
ENERGINET.DK	Danish Transmission Systems Operator	N/A

Company name	Description of business	Sub-categories
TERNA SPA	Italian Transmission System Operator	Transmission utility
EDF ENERGIES NOUVELLES	Renewable energy generator Acquired by EDF in 2011	Pure generator Renewables

APPENDIX 3: WACC AND BETA ESTIMATES – SUPPORTING ANALYSIS

This appendix presents further scenario analysis for our beta and WACC estimates.

WACC estimates

For the WACC estimates, we present:

- tables of the results underlying Figures 4.13, 4.14 and 4.15 in our main report;
- detailed tables showing the breakdown of our WACC estimates into their component parts and presenting estimates of different variants of the WACC; and
- the following robustness checks of alternative estimation assumptions for our base case:
    - using beta estimates generated using different groups of comparator companies;
    - using beta estimates based on the Eurotop index as the benchmark for all companies, instead of the relevant local market;
    - calculating 5-year rather than 2-year rolling betas; and
    - basing the WACC calculation on raw equity betas rather than re-levered asset betas.

Table A4.1: Cost of capital over time for different remaining asset lives

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Short term											
Base case	6.4%	5.1%	3.1%	2.6%	3.3%	3.4%	4.4%	5.4%	5.3%	4.3%	6.3%
Low	5.2%	4.9%	2.6%	2.0%	2.9%	2.4%	4.1%	4.4%	4.7%	4.2%	5.7%
High	7.2%	5.4%	4.0%	3.4%	3.9%	3.8%	5.1%	6.2%	5.5%	4.6%	6.5%
Medium term											
Base case	6.7%	5.7%	3.8%	3.8%	4.5%	4.1%	4.8%	5.8%	5.7%	5.6%	7.5%
Low	5.5%	5.5%	3.3%	3.2%	4.0%	3.1%	4.5%	4.8%	5.1%	5.5%	6.9%
High	7.6%	6.0%	4.7%	4.6%	5.1%	4.5%	5.5%	6.5%	5.9%	6.0%	7.8%
Long term											
Base case	8.1%	6.1%	4.3%	4.2%	4.8%	4.5%	5.2%	5.9%	5.7%	5.8%	7.8%
Low	7.0%	5.7%	3.6%	3.5%	4.3%	3.5%	4.8%	4.9%	5.0%	5.6%	7.1%
High	9.0%	6.6%	5.3%	5.1%	5.6%	5.0%	5.9%	6.7%	6.0%	6.2%	8.0%

Note: These estimates relate to Figures 4.13, 4.14 and 4.15 in the main report.

Table A4.2: Cost of capital breakdown – Short term base case

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	50%	51%	53%	54%	56%	57%	59%	60%	58%	57%	55%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.0%	2.1%	1.1%	0.5%	1.0%	1.1%	1.9%	2.1%	1.5%	0.9%	2.6%
Debt premium	1.0%	1.7%	1.3%	0.8%	0.7%	0.3%	0.4%	0.5%	1.9%	1.8%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.25	0.20	0.15	0.21	0.22	0.28	0.30	0.39	0.35	0.32	0.35
Equity beta	0.51	0.40	0.32	0.45	0.49	0.65	0.72	0.97	0.85	0.74	0.78
Cost of debt (real, pre-tax)	4.0%	3.8%	2.4%	1.3%	1.8%	1.4%	2.2%	2.6%	3.4%	2.7%	4.2%
Cost of equity (real, pre-tax)	8.7%	6.4%	4.0%	4.1%	5.2%	6.0%	7.5%	9.6%	7.9%	6.3%	8.8%
Cost of equity (real, post-tax)	5.7%	4.1%	2.7%	2.8%	3.5%	4.4%	5.5%	6.9%	5.7%	4.6%	6.5%
Cost of capital (real, pre-tax)	6.4%	5.1%	3.1%	2.6%	3.3%	3.4%	4.4%	5.4%	5.3%	4.3%	6.3%
Cost of capital (real, vanilla)	4.8%	4.0%	2.5%	2.0%	2.5%	2.7%	3.6%	4.3%	4.3%	3.5%	5.2%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.3: Cost of capital breakdown – Short term low case (high gearing, low beta)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	63%	64%	66%	68%	70%	71%	73%	75%	73%	72%	70%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.0%	2.1%	1.1%	0.5%	1.0%	1.1%	1.9%	2.1%	1.5%	0.9%	2.6%
Debt premium	1.0%	1.7%	1.3%	0.8%	0.7%	0.3%	0.4%	0.5%	1.9%	1.8%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.12	0.16	0.07	0.12	0.16	0.14	0.26	0.25	0.24	0.28	0.25
Equity beta	0.32	0.45	0.21	0.37	0.52	0.49	0.96	1.01	0.90	0.98	0.84
Cost of debt (real, pre-tax)	4.0%	3.8%	2.4%	1.3%	1.8%	1.4%	2.2%	2.6%	3.4%	2.7%	4.2%
Cost of equity (real, pre-tax)	7.2%	6.8%	3.2%	3.6%	5.4%	5.0%	9.2%	9.8%	8.3%	7.9%	9.3%
Cost of equity (real, post-tax)	4.7%	4.4%	2.1%	2.4%	3.7%	3.6%	6.7%	7.1%	6.0%	5.8%	6.8%
Cost of capital (real, pre-tax)	5.2%	4.9%	2.6%	2.0%	2.9%	2.4%	4.1%	4.4%	4.7%	4.2%	5.7%
Cost of capital (real, vanilla)	4.3%	4.0%	2.3%	1.7%	2.3%	2.0%	3.4%	3.7%	4.1%	3.6%	5.0%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.4: Cost of capital breakdown – Short term high case (low gearing, high beta)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	38%	39%	41%	43%	45%	46%	48%	50%	48%	47%	45%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.0%	2.1%	1.1%	0.5%	1.0%	1.1%	1.9%	2.1%	1.5%	0.9%	2.6%
Debt premium	1.0%	1.7%	1.3%	0.8%	0.7%	0.3%	0.4%	0.5%	1.9%	1.8%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.35	0.25	0.28	0.32	0.31	0.33	0.40	0.50	0.40	0.40	0.39
Equity beta	0.57	0.41	0.47	0.57	0.55	0.61	0.77	1.00	0.78	0.75	0.71
Cost of debt (real, pre-tax)	4.0%	3.8%	2.4%	1.3%	1.8%	1.4%	2.2%	2.6%	3.4%	2.7%	4.2%
Cost of equity (real, pre-tax)	9.2%	6.4%	5.1%	5.0%	5.7%	5.8%	7.9%	9.7%	7.5%	6.3%	8.4%
Cost of equity (real, post-tax)	5.9%	4.2%	3.4%	3.4%	3.8%	4.2%	5.7%	7.1%	5.4%	4.6%	6.2%
Cost of capital (real, pre-tax)	7.2%	5.4%	4.0%	3.4%	3.9%	3.8%	5.1%	6.2%	5.5%	4.6%	6.5%
Cost of capital (real, vanilla)	5.2%	4.0%	3.0%	2.5%	2.9%	2.9%	4.0%	4.8%	4.4%	3.7%	5.3%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.5: Cost of capital breakdown – Medium term base case

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	50%	51%	53%	54%	56%	57%	59%	60%	58%	57%	55%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.3%	2.6%	1.7%	1.4%	1.9%	1.7%	2.0%	2.3%	1.9%	2.0%	3.6%
Debt premium	0.8%	1.7%	1.3%	1.1%	0.9%	0.3%	0.6%	0.8%	1.8%	2.1%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.25	0.20	0.15	0.21	0.22	0.28	0.30	0.39	0.35	0.32	0.35
Equity beta	0.51	0.40	0.32	0.45	0.49	0.65	0.72	0.97	0.85	0.74	0.78
Cost of debt (real, pre-tax)	4.1%	4.3%	3.0%	2.4%	2.8%	2.1%	2.6%	3.1%	3.7%	4.0%	5.3%
Cost of equity (real, pre-tax)	9.3%	7.1%	4.8%	5.4%	6.5%	6.9%	7.8%	9.8%	8.4%	7.7%	10.2%
Cost of equity (real, post-tax)	6.0%	4.6%	3.2%	3.6%	4.4%	5.0%	5.6%	7.1%	6.1%	5.6%	7.5%
Cost of capital (real, pre-tax)	6.7%	5.7%	3.8%	3.8%	4.5%	4.1%	4.8%	5.8%	5.7%	5.6%	7.5%
Cost of capital (real, vanilla)	5.1%	4.5%	3.1%	3.0%	3.5%	3.3%	3.9%	4.7%	4.7%	4.7%	6.3%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.6: Cost of capital breakdown – Medium term low case (high gearing, low beta)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	63%	64%	66%	68%	70%	71%	73%	75%	73%	72%	70%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.3%	2.6%	1.7%	1.4%	1.9%	1.7%	2.0%	2.3%	1.9%	2.0%	3.6%
Debt premium	0.8%	1.7%	1.3%	1.1%	0.9%	0.3%	0.6%	0.8%	1.8%	2.1%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.12	0.16	0.07	0.12	0.16	0.14	0.26	0.25	0.24	0.28	0.25
Equity beta	0.32	0.45	0.21	0.37	0.52	0.49	0.96	1.01	0.90	0.98	0.84
Cost of debt (real, pre-tax)	4.1%	4.3%	3.0%	2.4%	2.8%	2.1%	2.6%	3.1%	3.7%	4.0%	5.3%
Cost of equity (real, pre-tax)	7.8%	7.5%	4.0%	4.9%	6.8%	5.8%	9.5%	10.1%	8.8%	9.3%	10.7%
Cost of equity (real, post-tax)	5.0%	4.9%	2.7%	3.3%	4.5%	4.2%	6.9%	7.3%	6.4%	6.9%	7.9%
Cost of capital (real, pre-tax)	5.5%	5.5%	3.3%	3.2%	4.0%	3.1%	4.5%	4.8%	5.1%	5.5%	6.9%
Cost of capital (real, vanilla)	4.5%	4.5%	2.9%	2.7%	3.3%	2.7%	3.8%	4.1%	4.4%	4.8%	6.0%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.7: Cost of capital breakdown – Medium term high case (low gearing, high beta)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	38%	39%	41%	43%	45%	46%	48%	50%	48%	47%	45%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	3.3%	2.6%	1.7%	1.4%	1.9%	1.7%	2.0%	2.3%	1.9%	2.0%	3.6%
Debt premium	0.8%	1.7%	1.3%	1.1%	0.9%	0.3%	0.6%	0.8%	1.8%	2.1%	1.6%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.35	0.25	0.28	0.32	0.31	0.33	0.40	0.50	0.40	0.40	0.39
Equity beta	0.57	0.41	0.47	0.57	0.55	0.61	0.77	1.00	0.78	0.75	0.71
Cost of debt (real, pre-tax)	4.1%	4.3%	3.0%	2.4%	2.8%	2.1%	2.6%	3.1%	3.7%	4.0%	5.3%
Cost of equity (real, pre-tax)	9.7%	7.2%	6.0%	6.3%	7.0%	6.6%	8.1%	10.0%	8.0%	7.7%	9.8%
Cost of equity (real, post-tax)	6.3%	4.6%	4.0%	4.2%	4.7%	4.8%	5.9%	7.3%	5.8%	5.7%	7.2%
Cost of capital (real, pre-tax)	7.6%	6.0%	4.7%	4.6%	5.1%	4.5%	5.5%	6.5%	5.9%	6.0%	7.8%
Cost of capital (real, vanilla)	5.5%	4.5%	3.6%	3.5%	3.9%	3.5%	4.3%	5.2%	4.8%	4.9%	6.3%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.8: Cost of capital breakdown – Long term base case

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	50%	51%	53%	54%	56%	57%	59%	60%	58%	57%	55%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	4.0%	3.2%	2.2%	1.9%	2.4%	2.1%	2.5%	2.5%	2.2%	2.4%	3.9%
Debt premium	2.0%	1.0%	0.7%	0.6%	0.5%	0.2%	0.4%	0.5%	1.3%	1.4%	1.5%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.25	0.20	0.15	0.21	0.22	0.28	0.30	0.39	0.35	0.32	0.35
Equity beta	0.51	0.40	0.32	0.45	0.49	0.65	0.72	0.97	0.85	0.74	0.78
Cost of debt (real, pre-tax)	6.0%	4.2%	3.0%	2.5%	2.9%	2.4%	2.9%	3.0%	3.4%	3.8%	5.4%
Cost of equity (real, pre-tax)	10.3%	8.1%	5.7%	6.2%	7.3%	7.4%	8.4%	10.1%	8.8%	8.3%	10.6%
Cost of equity (real, post-tax)	6.7%	5.2%	3.8%	4.1%	4.9%	5.4%	6.1%	7.3%	6.4%	6.1%	7.8%
Cost of capital (real, pre-tax)	8.1%	6.1%	4.3%	4.2%	4.8%	4.5%	5.2%	5.9%	5.7%	5.8%	7.8%
Cost of capital (real, vanilla)	6.3%	4.7%	3.4%	3.2%	3.8%	3.7%	4.2%	4.7%	4.7%	4.8%	6.5%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.9: Cost of capital breakdown – Long term low case (high gearing, low beta)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	63%	64%	66%	68%	70%	71%	73%	75%	73%	72%	70%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	4.0%	3.2%	2.2%	1.9%	2.4%	2.1%	2.5%	2.5%	2.2%	2.4%	3.9%
Debt premium	2.0%	1.0%	0.7%	0.6%	0.5%	0.2%	0.4%	0.5%	1.3%	1.4%	1.5%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.12	0.16	0.07	0.12	0.16	0.14	0.26	0.25	0.24	0.28	0.25
Equity beta	0.32	0.45	0.21	0.37	0.52	0.49	0.96	1.01	0.90	0.98	0.84
Cost of debt (real, pre-tax)	6.0%	4.2%	3.0%	2.5%	2.9%	2.4%	2.9%	3.0%	3.4%	3.8%	5.4%
Cost of equity (real, pre-tax)	8.8%	8.5%	4.9%	5.6%	7.5%	6.4%	10.1%	10.4%	9.2%	9.9%	11.1%
Cost of equity (real, post-tax)	5.7%	5.5%	3.3%	3.7%	5.0%	4.6%	7.3%	7.5%	6.7%	7.3%	8.2%
Cost of capital (real, pre-tax)	7.0%	5.7%	3.6%	3.5%	4.3%	3.5%	4.8%	4.9%	5.0%	5.6%	7.1%
Cost of capital (real, vanilla)	5.9%	4.6%	3.1%	2.9%	3.6%	3.0%	4.1%	4.1%	4.3%	4.8%	6.2%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.10: Cost of capital breakdown – Long term high case (low gearing, high beta)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Notional gearing	38%	39%	41%	43%	45%	46%	48%	50%	48%	47%	45%
Tax	35.2%	35.2%	33.0%	33.0%	33.0%	27.5%	27.5%	27.5%	27.5%	26.5%	26.5%
Inflation	2.2%	2.5%	3.3%	2.8%	2.2%	1.7%	1.8%	2.1%	2.6%	2.2%	1.6%
Risk-free rate (real)	4.0%	3.2%	2.2%	1.9%	2.4%	2.1%	2.5%	2.5%	2.2%	2.4%	3.9%
Debt premium	2.0%	1.0%	0.7%	0.6%	0.5%	0.2%	0.4%	0.5%	1.3%	1.4%	1.5%
EMRP	5.3%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Asset beta	0.35	0.25	0.28	0.32	0.31	0.33	0.40	0.50	0.40	0.40	0.39
Equity beta	0.57	0.41	0.47	0.57	0.55	0.61	0.77	1.00	0.78	0.75	0.71
Cost of debt (real, pre-tax)	6.0%	4.2%	3.0%	2.5%	2.9%	2.4%	2.9%	3.0%	3.4%	3.8%	5.4%
Cost of equity (real, pre-tax)	10.7%	8.1%	6.8%	7.0%	7.7%	7.2%	8.7%	10.3%	8.4%	8.3%	10.2%
Cost of equity (real, post-tax)	7.0%	5.2%	4.6%	4.7%	5.2%	5.2%	6.3%	7.5%	6.1%	6.1%	7.5%
Cost of capital (real, pre-tax)	9.0%	6.6%	5.3%	5.1%	5.6%	5.0%	5.9%	6.7%	6.0%	6.2%	8.0%
Cost of capital (real, vanilla)	6.6%	4.8%	3.9%	3.8%	4.2%	3.9%	4.7%	5.2%	4.8%	5.1%	6.6%

Note: 'Vanilla' WACC based on pre-tax cost of debt and post-tax cost of equity.

Table A4.11: WACC robustness checks (for medium term base case)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Baseline	6.7%	5.7%	3.8%	3.8%	4.5%	4.1%	4.8%	5.8%	5.7%	5.6%	7.5%
All companies	6.6%	5.7%	3.8%	3.8%	4.4%	4.0%	4.6%	5.6%	5.6%	5.6%	7.4%
Good comps.	7.1%	5.6%	3.6%	3.8%	4.3%	4.4%	5.4%	6.3%	5.3%	5.6%	7.6%
Euro	5.9%	5.5%	3.4%	3.4%	4.1%	3.3%	4.4%	5.6%	5.4%	5.6%	7.5%
5-year	7.1%	6.1%	4.0%	3.9%	4.4%	3.8%	4.7%	5.2%	5.5%	5.6%	7.6%
Raw equity	6.5%	5.9%	3.9%	4.0%	4.8%	3.8%	4.5%	4.9%	5.2%	5.4%	7.1%

Notes:

'Baseline' estimates are those presented in the main report for the medium term base case, using our 'Integrated utilities' set of comparators.

'All companies' estimates use all relevant companies for which data are available.

'Good comps.' estimates use a subset of companies identified as the most relevant comparators.

'Euro' estimates use beta estimates calculated using the Eurotop 100 index as the reference index for each company (instead of each company's local reference index).

'5 –year' estimates use beta estimates calculated using a 5-year rolling window (instead of a 2-year). 'Raw equity' estimates use companies' raw equity betas (instead of de-levered asset betas that are then re-levered using our notional gearing assumption).

Beta estimates

For the beta estimates, we summarise asset betas for the following sets of comparator companies:

- all companies;
- good comparators;
- pure generators;
- integrated utilities (base case);
- transmission utilities; and
- renewable energy companies.

Figure A4.1: Asset betas – All companies

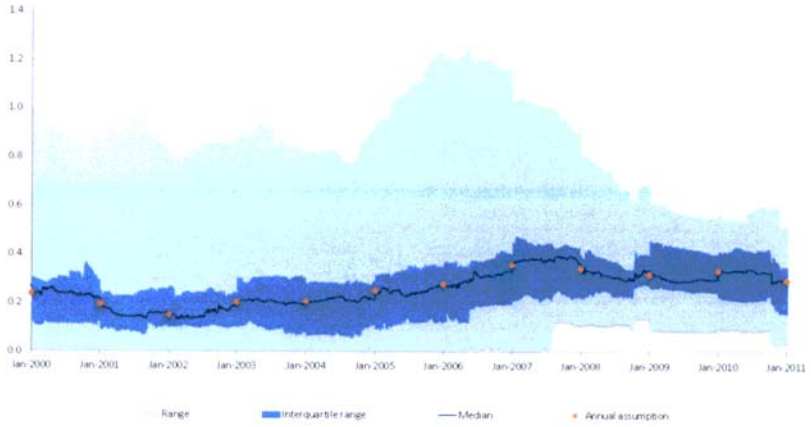


Figure A4.2: Asset betas – Good comparators

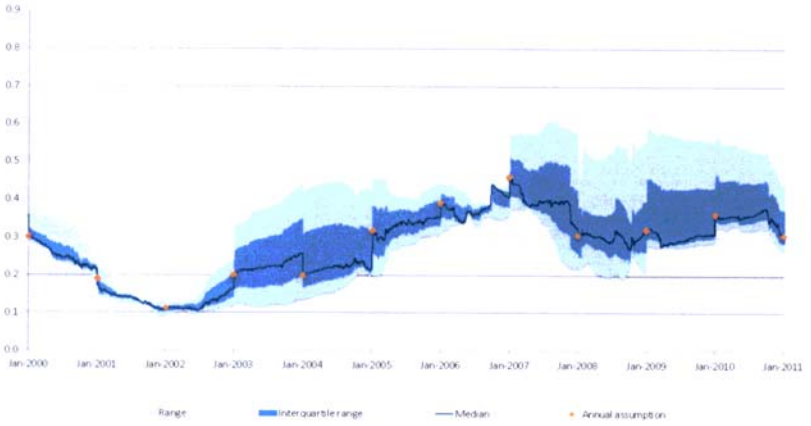


Figure A4.3: Asset betas – Pure generators

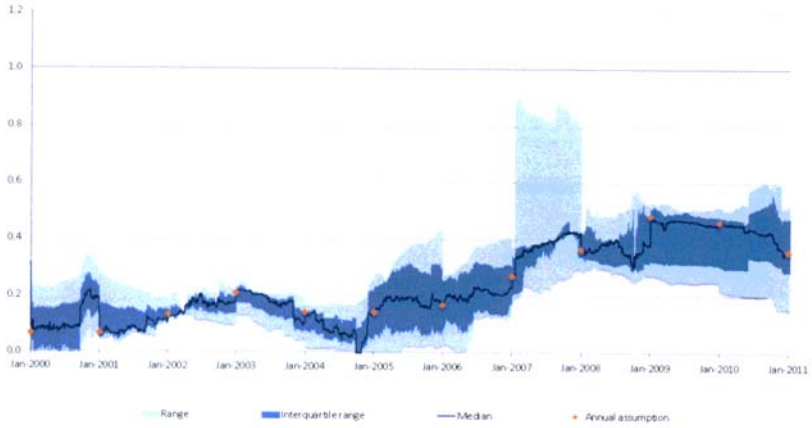


Figure A4.4: Asset betas – Integrated utilities (base case)

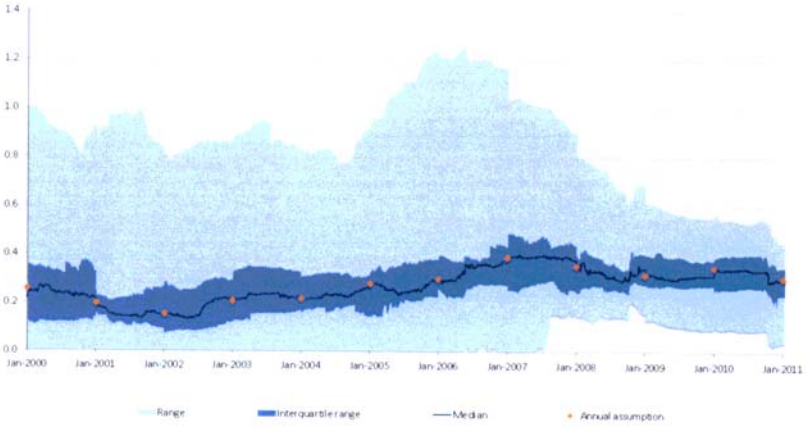


Figure A4.5: Asset betas – Transmission utilities

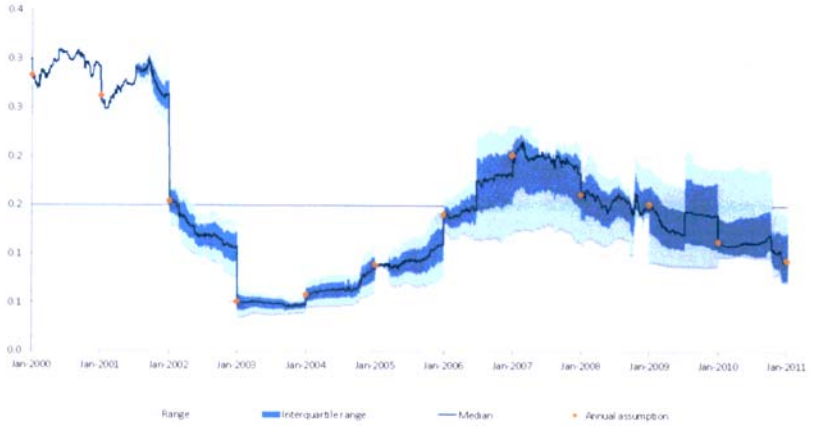
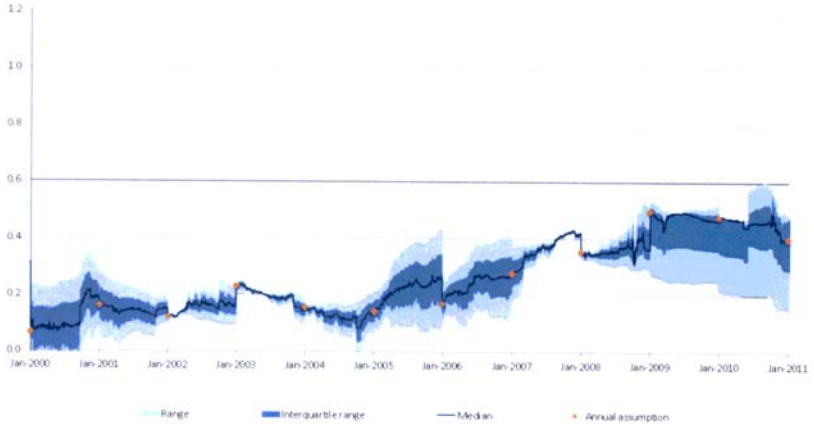


Figure A4.6: Asset betas – Renewable generators



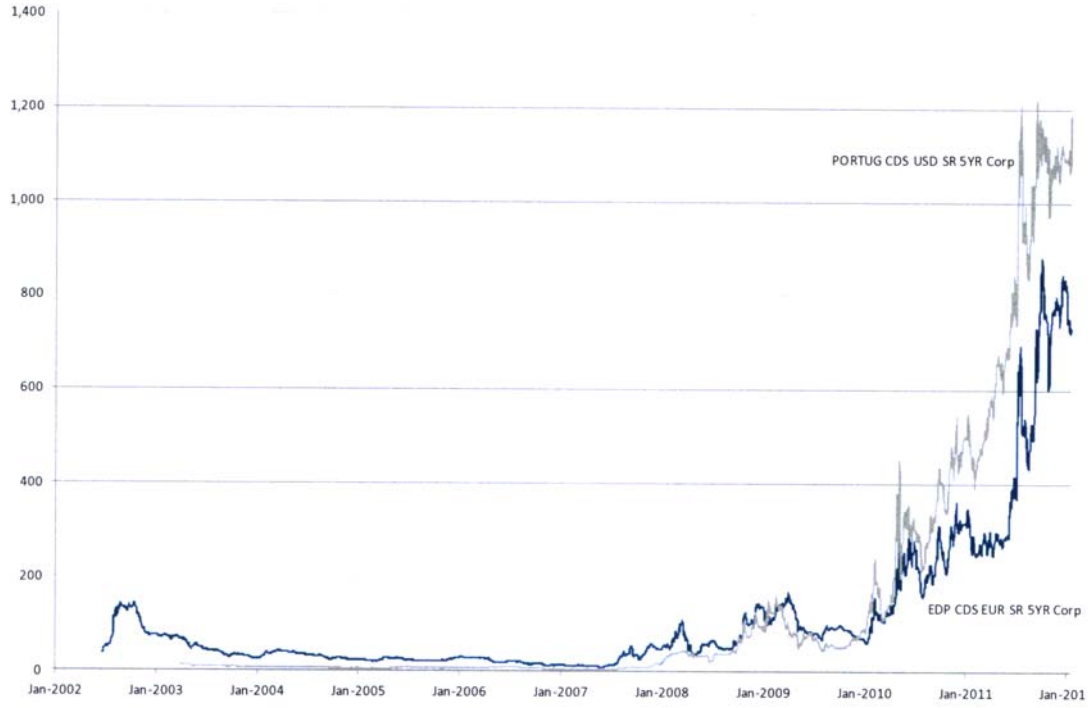
APPENDIX 4: ALTERNATIVE VIEWS ON RISK-FREE RATE AND ERP

Alternative approaches to the risk-free rate

The appropriate country risk-free rate in the context of the current (especially 2010 onwards) financial crisis in Europe is the topic of considerable debate. Some analysts have considered the spreads between a utility's CDS pricing and the country CDS as indicative of the perceived appropriate risk-free rate i.e. the risk-free rate could be adjusted downwards by the spread. We replicate such analysis in the chart below. The issue though is one of interpretation – in the case of EDP and Portuguese Government debt, there is such a spread and in recent times it is over 200bps, which might indicate that EDP is perceived as less risky than Government short-term debt. But care is needed, as other factors drive the analysis e.g. international diversification of EDP earnings. Unfortunately we have not found similar data for REN.

But nonetheless the data is illustrative and does point to a case that in times of extreme stress on Government debt, the appropriate risk-free rate for a national utility might be marginally lower. Further evidence would be provided by the nominal yields on actual debt issuances by the utility.

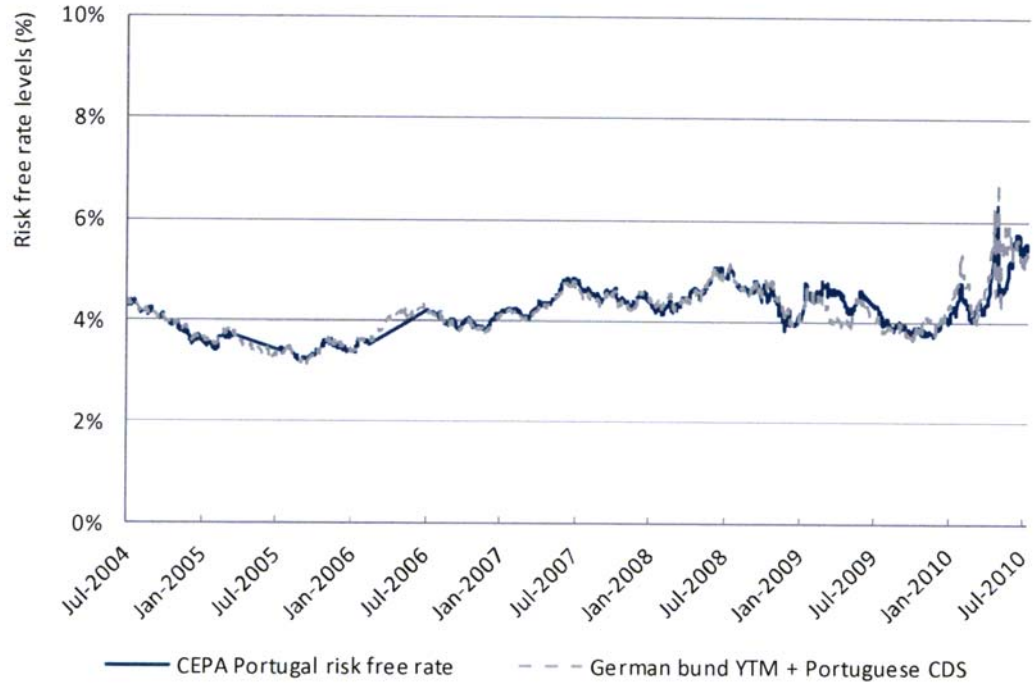
Figure A6.1: EDP vs. Portuguese government bond CDS prices



Source: Bloomberg

Another alternative approach to estimating the risk-free rate is applying the Portuguese debt premium (measured by the CDS on Portuguese government bonds) to the Euro zone risk-free rate (the yield to maturity of the German bund). Even if we have not employed this approach, the figure below demonstrates that our estimation yields practically the same results.

Figure A6.2: Alternative approaches: CEPA baseline vs. German bund + Portuguese CDS

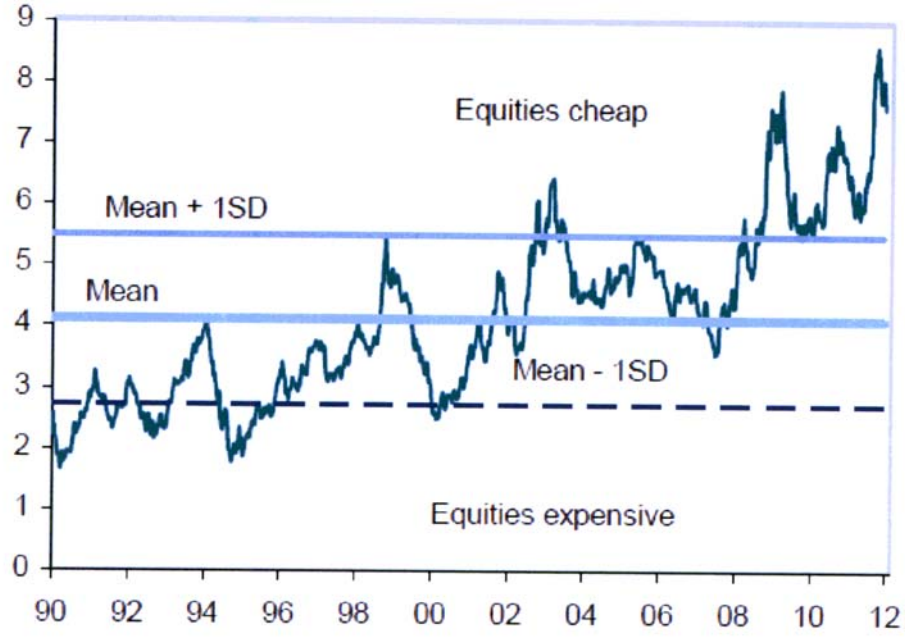


Alternative approaches to the ERP

We are aware that analysts sometimes attempt alternative approaches to calculating the Equity Risk Premium, as compared to the more conventional regulatory approaches. One such approach is to consider growth prospects and back out ERP's from share price data. We have not focused on this approach due to its 'black box' nature and its dependency on forward-looking assumptions, but it is nonetheless informative.

The chart below is extracted from a research note entitled Strategy Calls prepared by Exane BNP Paribas from December 2011. It shows an ERP with a mean of 4%, but moving significantly over time. This is in line with the lower end of our range.

Figure A6.3: Nominal equity risk premium (Europe; %)



Source: Exane BNP Paribas

We are also aware that Credit Suisse's Valuation Report of 16 February 2007 refers to a Portuguese ERP of 5.63% based on the 'Damoraran Files. Geometric Returns 1928-2005'. They also provide an historic ERP based on Credit Suisse research for Spain, with a 10 year average of 5.27% and for a 'Euro 5' (Germany, France, Netherlands, Italy, Spain) of 4.70%. Again, these numbers are consistent with our ranges.