Energy market investigation

Analysis of cost of capital of energy firms

25 February 2015

This is one of a series of consultative working papers which will be published during the course of the investigation. This paper should be read alongside the updated issues statement and the other working papers which accompany it. These papers do not form the inquiry group's provisional findings. The group is carrying forward its information-gathering and analysis work and will proceed to prepare its provisional findings, which are currently scheduled for publication in May 2015, taking into consideration responses to the consultation on the updated issues statement and the working papers. Parties wishing to comment on this paper should send their comments to energymarket@cma.gsi.gov.uk by 18 March 2015.

The Competition and Markets Authority has excluded from this published version of the working paper information which the Inquiry Group considers should be excluded having regard to the three considerations set out in section 244 of the Enterprise Act 2002 (specified information: considerations relevant to disclosure). The omissions are indicated by [✂].

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Introduction

1. The approach to assessing profitability, as set out in the Guidelines,[1] is to compare the profits earned with an appropriate cost of capital. In this working paper, we set out our estimate of the nominal pre-tax weighted average cost of capital (WACC) for the various elements of the energy value chain in Great Britain (GB), based on data for the period January 2007 to March 2014.

2. Our estimate of the WACC of a vertically integrated energy firm operating in GB is between 7.7 and 9.5% (see Table 1). We also considered what the WACC of a stand-alone electricity generator and a stand-alone energy retail supplier would be. Our current view is that a stand-alone generator would have a slightly higher WACC than a vertically integrated energy firm of between 7.9 and 9.7% due to a higher cost of debt, while a retail supply business would be entirely equity funded with a cost of equity of 9.3 to 11.0%.

TABLE 1 **CMA estimates of the WACC for the elements of the energy value chain**

	Vertically integrated	*Generation*	*Retail supply*
Real risk-free rate (%)	1.0–1.5	1.0–1.5	1.0–1.5
Nominal risk-free rate (%)	4.0	4.0	4.0
Equity risk premium (%)	4.0–5.0	4.0–5.0	4.0–5.0
Asset beta	0.5–0.6	0.5–0.6	0.7–0.8
Pre-tax Ke (%)	9.6–10.3	9.6–10.3	9.3–11.0
Pre-tax cost of debt (Kd) (%)	5.0–6.0	5.5–7.0	-
Gearing (%)	20.0–40.0	20.0–40.0	0
Tax rate (%)	27.0	27.0	27.0
Pre-tax WACC (%)	**7.7–9.5**	**7.9–9.7**	**9.3–11.0**

Source: CMA analysis.

3. We consider the above range to be a reasonable estimate of the cost of capital that would have been faced by a typical firm operating at the relevant stage(s) of the energy value chain in GB.

4. Five of the Six Large Energy Firms (Centrica, E.ON, RWE npower, Scottish Power, and Scottish and Southern Energy (SSE) provided the Competition and Markets Authority (CMA) with WACC estimates on a variety of bases. These are set out in detail in Appendix A. We make reference to these estimates and the views put forward by these firms and others active in the GB energy sector as appropriate in this paper.

5. The remainder of this section sets out our methodology and the analysis we have conducted. As set out in the Guidelines,[2] we generally look to the capital asset pricing model (CAPM) when considering the cost of capital, and this is

[1] *Guidelines for market investigations: Their role, procedures, assessment and remedies (CC3)*.
[2] *CC3*, Annex A, paragraph 16.

the approach we have adopted in estimating the cost of equity for the energy firms. We have estimated the cost of debt with reference to both the actual interest rates paid by the energy firms and corporate bond yields over the period.

General approach to estimating the WACC

6. There are several factors that we have taken into account in estimating an appropriate benchmark cost of capital for the various activities undertaken within the energy sector. These include:

   (a) how to estimate the WACC – use of the capital asset pricing model (CAPM);

   (b) which cost of capital provides an appropriate benchmark – specification of the basis of the WACC; and

   (c) over which time period should the cost of capital be measured – at the start of the relevant period, or an average for the relevant period?

Capital asset pricing model

7. The Guidelines highlight that we generally use the CAPM when considering the cost of equity since this is a widely understood technique with strong theoretical foundations.[3]

8. The CAPM relates the cost of equity $E[R_i]$ to the risk-free rate (R_{rf}), the expected return on the market portfolio (R_m), and a firm-specific measure of investors' exposure to systematic risk (beta or β) as follows:

$$E[R_i] = R_{rf} + \beta(R_m - R_{rf})$$

9. If a business were entirely funded by equity, the expected return on equity could be considered to be its 'cost of capital'. However, most firms are funded by a combination of both debt and equity, such that the appropriate cost of capital to consider is the weighted average cost of debt and equity. The WACC is given by the following expression:

$$WACC = E[R_i] \times E/(D+E) + K_d \times D/(D+E)$$[4]

[3] *CC3*, paragraph 116.
[4] Where D is debt, E is equity and K_d is the cost of debt.

10. Finally, the cost of capital must take into account the effects of tax on returns to capital providers. The returns to debt holders take the form of interest payments which are usually tax-deductible. The returns to equity holders (dividends), on the other hand, are taxed. Hence, where the cost of capital is expressed 'pre-tax', the cost of equity used must reflect the fact that the actual return to shareholders will be reduced by the rate of tax. We have estimated the cost of capital on a nominal pre-tax basis:[5]

$$\text{Pre-tax WACC} = [(1/(1-t)) \times E[R_i] \times E/(D+E)] + [K_d \times D/(D+E)]$$

Specification of the basis of the WACC

11. Our profitability analysis measures the returns earned by all sources of capital on the capital employed by the business. As these returns are measured before interest and/or tax is paid, they are not affected by the capital structure of the business.[6] The WACC of an individual business, on the other hand, is affected by its capital structure, ie the proportion of debt and equity used to finance the business. These financing choices may be driven by a number of factors, including the ability of the business to raise debt, the risk appetite of equity holders and the relative costs of debt and equity financing. In our analysis, we use the WACC as a benchmark for the level of 'normal' profits. As a result, we consider that it is appropriate to use the same WACC as the benchmark for all operators, rather than estimating a firm-specific cost of capital for each operator.[7]

12. In coming to a view on this benchmark WACC, we have sought to reflect a sustainable level of gearing, cost of equity and cost of debt that a hypothetical stand-alone operator in GB would incur when undertaking the relevant activities. Where possible, therefore, we have used GB (or UK) benchmarks and tailored the variable elements[8] of the cost of capital to reflect both the nature of the activities under consideration and the fact that some of the benchmarks we have used to estimate the WACC relate to multinational firms with a broad range of activities, ie may face different risks from a stand-alone GB firm.

13. RWE npower expressed concern with this approach, noting that by selecting a particular capital structure to include in its WACC calculation the CMA may discriminate against certain firms. It put forward the view that it would be inappropriate to make a finding of excessive profitability on the basis of

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[5] This avoids the need to adjust nominal financial information to remove the effects of inflation.
[6] The capital structure affects how earnings before interest and tax is divided between the various providers of capital.
[7] This approach ensures that all firms in an industry are treated equally.
[8] These are the beta value, gearing and cost of debt.

choosing a particular gearing, when a firm may have a different but still appropriate level of gearing. We do not consider that RWE npower's concerns in this respect are well founded. Our approach to estimating the WACC is based on the observed level of gearing and associated cost of debt in the industry and we would expect, therefore, that it would represent (at least approximately) the efficient capital structure for a given industry. In our view this is the appropriate benchmark. Although some firms may have chosen different capital structures with potentially higher WACCs, we do not consider that these costs represent the competitive benchmark.

14. We have measured the profitability of the energy firms on three separate bases: *(a)* stand-alone generation of electricity, *(b)* stand-alone retail supply of gas and electricity, and *(c)* vertically integrated energy businesses, ie those undertaking both generation and retail supply activities. We note that we would expect there to be variations in beta values, gearing and cost of debt across generation and retail, as well as for vertically integrated operators. Therefore, we have estimated three separate WACCs, one for each of the generation, retail and vertically integrated operations.

Relevant time period

15. We are analysing the profitability of the firms over the period between 2007 and 2013 (firms' results for FY07 to FY13). When a cost of capital is set for regulatory purposes, it is generally forward looking. In a market investigation, in contrast, we are looking backwards to understand whether the profits made by the firms have exceeded the cost of capital over the relevant period. RWE npower put forward the view that each of the component parameters of the WACC should reflect the reasonable expectations of the firms over the relevant period and not an ex post assessment of the actual outturn as at 2013. 'For example, for the risk-free rate, or the equity risk premium, the energy firms would have based their investment decisions on the reasonable expectations of the market at the time.' We agree that this is the correct approach. We have not sought, therefore, to estimate the WACC at a particular point in time but rather we have considered the average cost of capital for the relevant period as a whole.

CMA estimation of WACC

16. This section sets out the analysis that we have undertaken in order to estimate the components of the WACC calculation, which includes both generic and industry-specific components. The former comprise the risk-free rate (RFR), the equity risk premium (ERP) and the tax rate; the latter comprise beta, cost of debt and gearing. We note that the former are common

to all elements of the value chain, while the latter vary depending on whether the firm operates in generation, retail supply or both.

17. In conducting our cost of capital analysis, we have had reference to our price determination for Bristol Water, which was undertaken in 2009/10, ie during the relevant period for our analysis, as well as our price determination for NIE, which was undertaken in 2013.[9]

Risk-free rate

18. In principle, we regard index-linked gilt yields to be the most suitable source for estimating the real RFR, since index-linked gilts have negligible default and inflation risk. However, our profitability analysis measures the nominal returns made by energy firms, rather than real returns. As a result, we have also examined the yields on nominal gilts. These also have negligible default risk but are subject to inflation risk, for which we would expect investors to require an inflation risk premium.

19. We consider the yields on long-maturity gilts to be most relevant to the RFR in the cost of equity since equities also have long (indefinite) maturity.[10] FIGURE 1 shows the index-linked yield curve at the start and end of the relevant period, as well as the seven-year average (ie covering the whole period). For maturities of 15 years and more, the yield curves are between 0 and 1.5% with an average of just over 0.5%. Shorter-dated yields have fallen significantly over the last seven years, reflecting action by the authorities to address the credit crunch and recession, while yields on longer-dated gilts have been more stable over the period.

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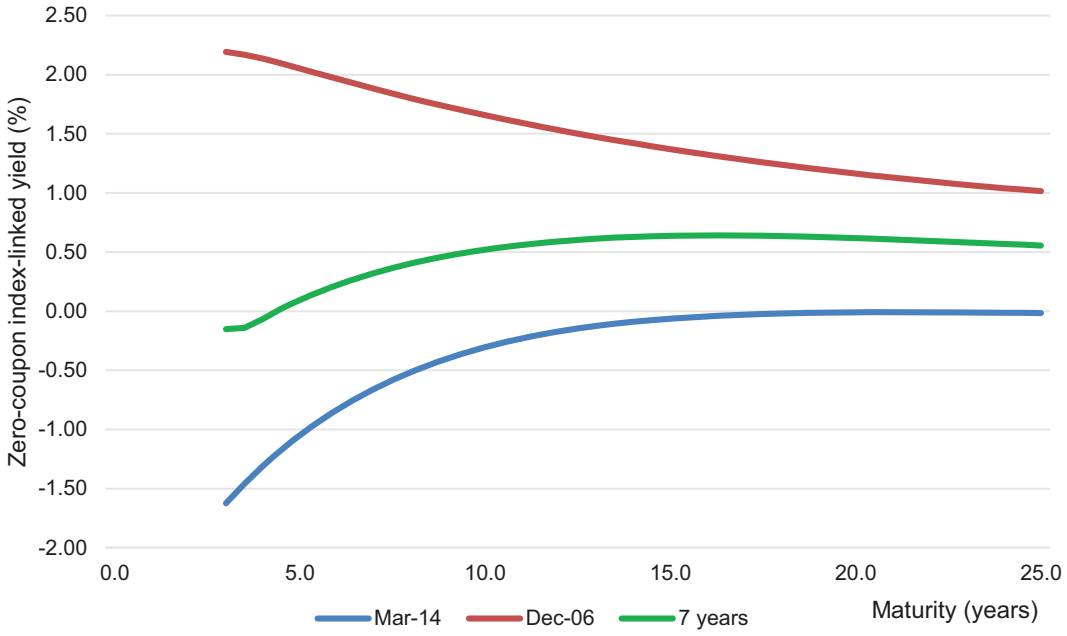
[9] Bristol Water plc: *determination on a reference under section 12(3)(a) of the Water Industry Act 1991*, August 2010. *Northern Ireland Electricity (NIE) price determination*.

[10] In previous reports in the last ten years, we paid attention to distortions in the index-linked markets that may affect the shape of the yield curve. In Bristol Water (2010), the Competition Commission (CC) noted that shorter-dated index-linked yields were affected by action by the authorities to address the credit crunch and recession and were therefore less relevant to estimating the RFR. In inquiries prior to 2010 the CC put less weight on longer-dated maturities, noting possible distortion from pension fund asset allocation policies. As we explained in NIE, the effects of monetary policies and pension fund dynamics are increasingly well understood by the markets. Consequently we expect the market prices of index-linked gilts to incorporate effectively expectations of the effects of these factors and therefore to provide a reasonable guide to future returns.

FIGURE 1

Yield curves on UK index-linked gilts, 2007 to 2014

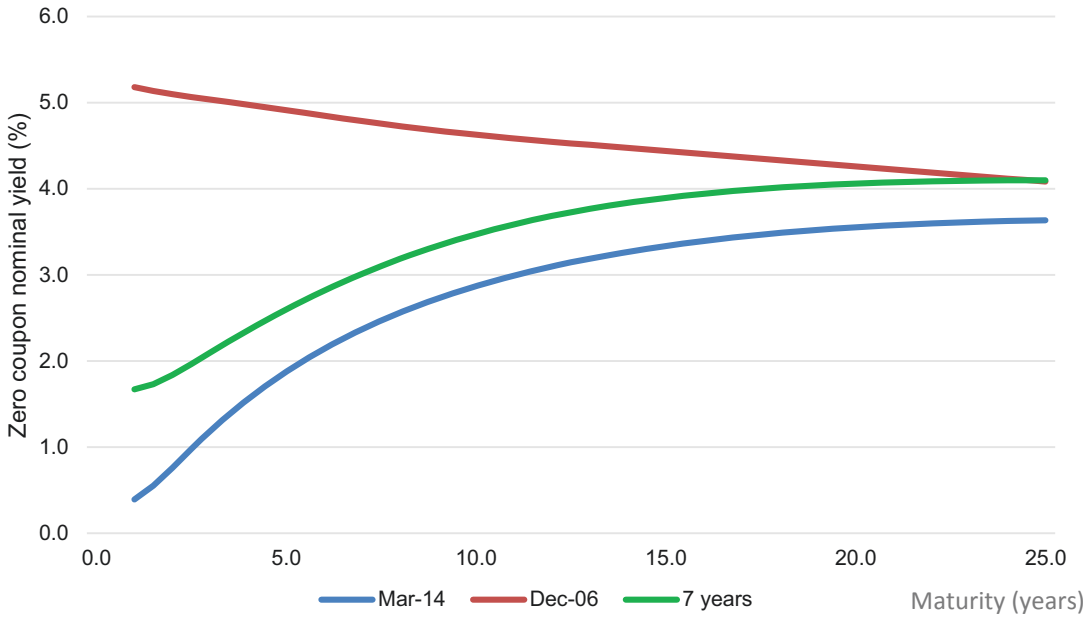


Source: Bank of England, real spot yield curve data.
Note: The three lines show yields on 31 December 2006, 31 March 2014, and the average yields covering the seven and a quarter year period between January 2007 and March 2014.

20. FIGURE 2 shows nominal gilt yields at the start and end of the relevant period, as well as the seven-year average (ie covering the whole period). For maturities of 15 years and more, the yield curves are between 3.3 and 4.5% with an average of 4%. A similar pattern of declining yields on shorter maturities can be seen on these nominal gilts.

FIGURE 2

Nominal yield curves on UK gilts, 2007 to 2014



Source: Bank of England, nominal spot yield curve data.
Note: The three lines show yields on 31 December 2006, 31 March 2014, and the average yields covering the seven and a quarter year period between January 2007 and March 2014.

21. In assessing this evidence, we have had regard to the nature of the benchmark that we require, ie a reasonable, nominal return on capital over the seven-year period from January 2007 to March 2014. We observe that an investor at the start of this period would have had regard to a higher gilt yield (real or nominal) than an investor towards the end of the period, although the difference is less material when considering long-dated gilts. On this basis, we consider that a reasonable nominal RFR for the period is 4%.[11] The average yield on long-dated index-linked gilts has been approximately 0.5% over the period (which is consistent with Retail Prices Index (RPI) inflation of 3.5%). However, in the NIE price determination we used a real RFR of between 1 and 1.5%, which was considerably above rates on long-duration index-linked debt, in order to allow for the possibility that rates might rise during the remainder of the price control period. In this case, we are not seeking to determine an appropriate cost of capital for a future period and therefore do not face the uncertainties associated with forecasting. We have historic information on which to base our estimates. This could provide a reason for using a lower real RFR.

[11] We note that this is consistent with the upper end of the estimates used for the nominal RFR in both the private healthcare and the aggregates market investigations.

22. However, we have also taken into account the fact that the yields observed on index-linked gilts are likely to be affected by the imperfections associated with the RPI as a measure of underlying inflation. We note the historical gap between RPI and Consumer Price Index (CPI) measures of inflation of around 0.5% between 2005 and 2013.[12] To the extent that the CPI better reflects underlying inflation, measures of return relative to the RPI (of which index-linked gilts are one such measure) may be reduced as a result of that gap. This may be a factor behind negative short-term real yields. In our NIE decision, we noted that, given that the regulated asset base of the company was also indexed by the RPI, we did not need to adjust our estimate of the RFR for this effect. However, in this investigation, the financial information of the companies is likely to have been affected by the general rate of inflation in the economy, which we consider to be most accurately measured by the CPI. Therefore, we consider that it is appropriate to use the nominal yield on gilts and deduct the CPI over the period to come to an estimate of the real RFR. Between January 2007 and March 2014, the CPI averaged between 2.6 (geometric) and 2.9% (arithmetic). Therefore, we have used a range of 2.5 to 3%, which gives a real RFR of between 1 and 1.5%.[13]

Equity risk premium

23. The ERP is the additional return that investors require to compensate them for assuming the risk associated with investing in equities rather than in risk-free assets. When seeking to understand what the ERP was over a historic period of time, it is necessary to identify the returns which investors expected to make on the market and deduct the relevant RFR (as estimated above).

24. There are two types of approach that can be used to estimate the ERP. Historical methods seek to derive the ERP from a long run of data on realised returns on equities. Forward-looking approaches seek to estimate the expected ERP based on either the reported expectations of market participants or the ERP implied in asset prices at the start of the period.

Historical approaches (ex post and ex ante)

25. The key assumptions behind the historical ex post approach are that expected returns remain constant over time and that average realised returns reflect the expected return. Dimson, Marsh and Staunton estimated the average ERP for a number of countries, including the UK, on the basis of equity and gilt yields

[12] See *Bank of England inflation report 2014*, p34.
[13] We note that this range is consistent with the real RFR that would result from adding the difference between the RPI and the CPI (0.5%) to the average yield on index-linked gilts (of 0.5%), ie 1%.

over the past 114 years.[14] These ERPs are estimated as the difference between the real return on equities and the real return on gilts over the period.[15]

26. Table 2 shows the geometric and arithmetic average returns on UK equities, bonds and bills over the period between 1900 and 2013, together with the historic equity risk premium implied by these returns.[16]

TABLE 2 **Real returns on UK equities and government debt, 1900 to 2013**

%

	Geometric mean	*Arithmetic mean*
UK real returns		
Equities	5.3	7.2
Bonds	1.4	2.3
Bills	0.9	1.1
ERP		
Bonds	3.9	5.2
Bills	4.4	6.1

Source: Dimson et al. (2014) *Credit Suisse Global Investment Returns Sourcebook*.

27. We note that the arithmetic mean reflects the returns that an investor could expect to make in any given year, while the geometric mean reflects the compound returns that an investor would have made if they had invested over the full 114-year period covered by the Dimson et al. dataset. It is usual to quote figures for the average of one-year returns but investors in the equity market usually expect to invest in the market for longer than a year. As the holding period increases, the expected return declines from the arithmetic mean towards the geometric mean. Therefore, in coming to a view on the appropriate market return, we have had reference to the range of mean returns (geometric to arithmetic).

28. An alternative approach to identifying the ERP suggested by Fama and French is to estimate directly the market returns expected by investors historically (ie ex ante returns). They do this by using average dividend yields

[14] *Credit Suisse Global Investment Returns Sourcebook 2014*. As Dimson et al. explain (p7), 'To understand risk and return, we must examine long periods of history. This is because asset returns, and especially equity returns, are very volatile. Even over periods as long as 20 years or more, we can still observe 'unusual' returns.' On this basis, we have used the full 114-year mean equity returns estimates in our analysis. The advantage of this approach is also that the larger sample size (ie number of years), increases the accuracy of the estimates – the standard errors of the estimations are reduced, narrowing the confidence interval.

[15] The formula used to estimate the ERP is: ((1+ Equity rate of return) / (1+ Riskless return)) – 1, which is approximately equivalent to deducting the riskless returns from the returns on equities. Dimson et al. categorise 'gilts' into two groups for the purposes of their analysis; shorter-dated 'treasury bills' and longer-dated 'treasury bonds'. The former have maturities of up to ten years, while the latter have an average maturity of 20 years. The difference between 'bond' and 'bill' returns is referred to as the 'maturity premium'.

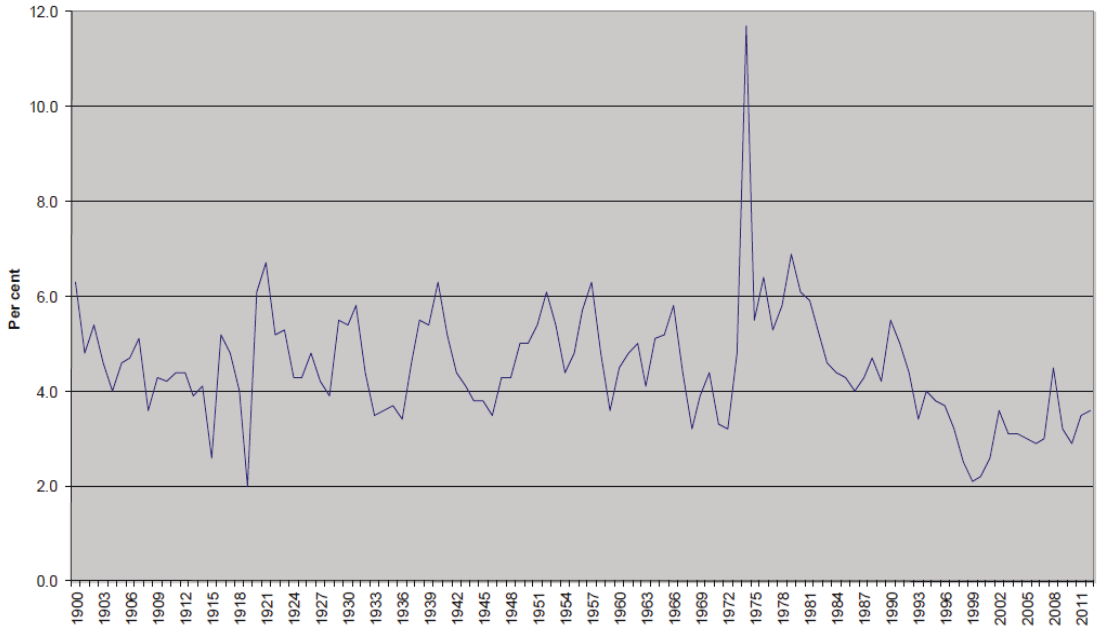
[16] We note that the real global market returns over the 1900 to 2013 period are very similar to those of the UK, with a geometric mean return of 5.2% and an arithmetic mean return of 6.7%. (*Source: Credit Suisse Global Investment Returns Sourcebook 2014*).

and earnings growth rates to measure the expected rate of capital gain.[17] Using the full run of historical data for the UK, this suggests an underlying market return of 5.5%.[18]

29. Fama and French's work on US securities provides evidence of a fall in expected returns over time, with expected returns being lower since 1950 than before. The statistical evidence for the UK is less extensive[19] but, as illustrated in Figure 3, the dividend yield as of the start of the relevant period (of about 3.5%) was below the historical average (4.5%). Unless future dividend growth is higher than in the past, this would suggest that expected returns are about 1% lower than the past average, implying a market return of about 4.5% (using Barclays data).[20]

FIGURE 3

Dividend yield for UK market (Barclays data)



Source: Barclays equity gilt study, 2013.

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[17] EF Fama and KR French (2002),'The equity premium', *Journal of Finance*, April.
[18] This result is derived from an average dividend yield of 4.5% and dividend growth of 1% a year (Barclays data). Fama and French note that their estimates of the ERP are much lower than those derived from the average stock return. They suggest that achieved returns may have been higher than expected returns over the period between 1951 and 2000 due to a decline in discount rates that produced a large unexpected capital gain for investors.
[19] Two papers that find evidence of a reduction in the expected market return or ERP for the UK (albeit at different times) are Buranavityawut, Freeman and Freeman (2006) 'Has the equity premium been low for 40 years?', *North American Journal of Economics and Finance* 17, pp191–205; and Vivian (2007) 'The UK equity premium, 1901–2004', *Journal of Business and Financial Accounting* 34(9–10), pp1496–1527. The first paper suggests that the expected equity premium may have fallen in the 1960s in the UK and other countries, while the second paper suggests that there was a permanent decline in the UK market dividend-price ratio during the early 1990s.
[20] These figures do not take into account payments to shareholders other than dividends, eg share repurchases.

30. Dimson et al. (2014) sought to infer what investors may have been expecting, on average, in the past, by separating the historical equity premium into elements that correspond to investor expectations and elements of non-repeatable good or bad luck. These elements include the mean dividend yield, the growth rate of real dividends, the expansion of the price/dividend ratio and change in real exchange rates. Dimson et al. concluded that the worldwide historical premium was larger than investors were likely to have anticipated because of factors such as unforeseen exchange rate gains and unanticipated expansion in valuation multiples. Noting that dividend yields are lower than in the past, Dimson et al. inferred that, for the world index, a forward-looking risk premium (over treasury bills) would be 4.5 to 5%. Given a difference of 1% between average return on bills and ERP (see TABLE 2), this implies an expected return of 5.5 to 6%.[21]

Forward-looking approaches

31. The ERP is also commonly estimated using projected dividends from analysts' forecasts (which extend out by four or five years) and a longer-term dividend growth rate. The expected return is then the discount rate at which the present value of future dividends is equal to the current market price. A limitation of this approach is that it is necessary to make an assumption about future long-term growth of dividends (which has a major effect on the calculation since dividends beyond year four or five account for a large part of present value at plausible discount rates).

32. Figure 4 shows estimates of ERP using this methodology published in an article in the *Bank of England Quarterly Bulletin*. These estimates are based on the assumption that the future long-term growth in dividends per share is equal to an estimate of the potential growth of the economy. However, the authors of the article noted that this choice of future long-term growth rate is essentially arbitrary.[22] The estimates in Figure 4 suggest that since 2007 the expected ERP has fluctuated around 5%, towards the upper end of the historical inter-quartile range of between 4.25 and 5.3%.[23] We attempted to calculate the expected market return implied by these estimates of the ERP by adding the yield on zero-coupon ten-year gilts. Calculated on this basis, since the 2008 financial crisis the market return has fluctuated around 6%. It has declined markedly following the financial market turmoil of 2009 to 5% or less. Indeed, the Bank of England's November 2013 *Financial Stability Report*

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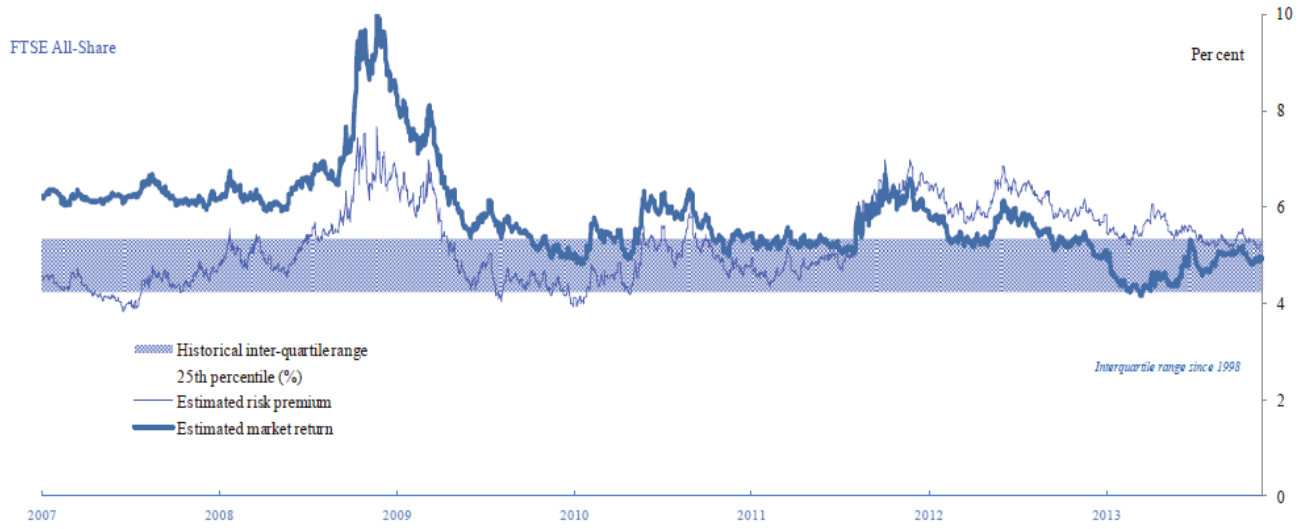
[21] *Credit Suisse Global Investment Returns Sourcebook 2014*, pages pp29–34. The 4.5 to 5% range is the arithmetic mean. The equivalent geometric mean is 3 to 3.5%.
[22] M Inkinen, M Stringa and K Voutsinou (2010) 'Interpreting equity price movements since the start of the financial crisis', Q1.
[23] Calculated by the Bank of England based on a longer time series of data between 1998 and 2013.

notes rising equity prices, improved earnings expectations, and a fall in equity risk premia towards long-term average levels.[24]

FIGURE 4

Estimated ERP and approximate implied real market return



Source: Bank of England and CMA calculations.

33. We agree that it is essentially arbitrary to assume future long-run growth in dividends per share equal to potential economic growth. Indeed, we see empirical support for expecting long-run growth in dividends per share to be less than potential economic growth. The historical growth rate in real dividends for the UK from the Credit Suisse/Dimson et al. data is only 0.5% and around zero using the Barclays data – this is significantly less than real UK economic growth over the same period (1900 to 2010) of 1.9%.[25] It is also the case that growth in dividends per share has been significantly less than economic growth in more recent periods. Since 1950, growth in dividends per share has been 1.1%, compared with 2.4% for GDP growth, while, since 1980, growth in dividends per share has been 1.6%, compared with 2.3% for GDP growth.[26]

34. Bearing in mind these points and also that analysts' forecasts may be subject to upward bias, we consider that the approximate 5% ERP and 5 to 6%

[24] *Financial Stability Report*, p8 and Chart 1.6.
[25] *Credit Suisse Global Investment Returns Sourcebook 2013*, Table 11. SH Williamson (2015) 'Annualized growth rate of various historical economic series'.
[26] A large body of literature suggests that there may be a tendency for analysts' forecasts to overreact to changes and on average to be too optimistic, eg WFM DeBondt and RH Thaler (1990) 'Do security analysts overreact?', *American Economic Review* 80, pp52–57.

market return suggested by FIGURE 4 are likely to be at the upper end of expected returns.

CMA discussion

35. The interpretation of the evidence on market returns remains subject to considerable uncertainty. Historic approaches (ex post and ex ante) indicate a market return of between 4.5 and 7.2%, while forward-looking approaches indicate a market return of between 5 and 6%. In the recent NIE determination, we came to the view that the appropriate market return was between 5% and an upper limit of 6.5%. We consider that this represents a reasonable range in this case as well. Together with a real RFR of between 1 and 1.5%, this range implies an ERP of between 4 and 5%.

Tax rate

36. The corporation tax rates applicable over the period are set out in Table 3. For the purpose of estimating the WACC, we have used an average of the tax rates over the period of 27%.

TABLE 3 **UK corporation tax rates**

%

2006/07	*2007/08*	*2008/09*	*2009/10*	*2010/11*	*2011/12*	*2012/13*	*2013/14*
30	30	28	28	28	26	24	23

Source: HMRC.

Equity betas

37. The beta of an asset measures the correlation between the volatility of the returns on the asset and the returns on the market as a whole, or the exposure of the firm to systematic or 'non-diversifiable' risk. It is in return for assuming this (market) risk that investors require an (equity risk) premium over the risk-free return.

38. The beta value of a listed firm can be directly estimated as the covariance between the stock's returns and the market's returns, divided by the variance of market returns. However, when estimated in this way, the beta value reflects the full range of activities undertaken by a listed business and, as a result, may differ from the beta of the relevant activities for the purposes of our investigation.

39. Within a CAPM framework, changes in gearing affect equity betas. Hence, it is necessary to adjust for gearing differences in order to make comparisons between equity betas. We do this by calculating the asset beta, ie the beta at

zero gearing. In this section, we first set out the range of beta estimates that we have collected on a range of listed energy companies. Then, we discuss the extent to which we consider the activities of these firms to be representative of those of our hypothetical stand-alone GB operator and, therefore, the extent to which their beta values are likely to be comparable.

Beta estimates

40. The betas of the listed companies are shown in Table 4. We have estimated these on both a monthly and a quarterly basis.[27] This approach follows the research findings of Gilbert et al. which show that monthly and quarterly betas are generally more reliable than those estimated on the basis of high frequency data, ie daily or weekly betas.[28]

41. The Six Large Energy Firms which are active in GB have an average asset (or unlevered) beta of approximately 0.5 to 0.6, with a range of between 0.24 and 0.75. We observe that both Centrica and SSE have slightly lower beta values than the other four firms, averaging 0.55 to 0.70 (on a quarterly and monthly basis, respectively). The asset beta values for the other, non-GB vertically integrated energy firms and for firms which mainly focus on generation are very similar, averaging around 0.5. The evidence collected from retail supply businesses does not appear to provide a reliable basis for the estimation of an asset beta.

[27] Betas have been estimated for the period between January 2007 and March 2014 when information is available for the full period. In some cases, companies have been listed for a shorter period of time, in which case betas have been estimated since the date of listing. Beta estimates are based on the covariance between the 'excess' total return on each company's shares and the 'excess' total return on the relevant index (in each case assuming the reinvestment of dividends. Note that the 'excess' return is the realised return less the RFR, taken to be 1% for the purposes of this calculation. We have not applied any adjustments to the beta values, eg mean reversion.

[28] T. Gilbert, C Hrdlicka, J Kalodimos and S Siegal (2014) 'Daily data is bad for beta: Opacity and frequency-dependent betas', *Review of Asset Pricing Studies*.

TABLE 4 **Equity and asset betas of energy firms**

Company	*Levered beta*		*Unlevered beta**	
	Monthly	*Quarterly*	*Monthly*	*Quarterly*
Six Large Energy Firms				
Centrica plc	0.47	0.46	0.42	0.41
SSE plc	0.46	0.31	0.36	0.24
EDF SA	1.05	0.93	0.75	0.67
E.on SE	0.97	0.70	0.70	0.50
Iberdrola SA†	1.01	0.85	0.66	0.55
RWE npower AG	0.86	0.59	0.67	0.45
Average			***0.59***	***0.47***
VI firms (non-GB)				
Enel S.p.A.	0.86	0.99	0.41	0.47
Gas Natural SA	0.77	0.76	0.49	0.49
EnBW AG	0.32	0.35	0.25	0.27
Verbund AG	0.72	0.58	0.54	0.44
Fortum Oyj	0.77	0.95	0.59	0.72
Contact Energy Limited	0.89	0.83	0.76	0.70
TrustPower Limited	0.39	0.34	0.32	0.28
NRG Energy Inc	0.78	1.12	0.42	0.60
Origin Energy	0.57	0.34	0.45	0.27
AGL (Australian Gas Light Co)	0.43	–0.12	0.38	–0.11
Average (excl. AGL)			***0.47***	***0.47***
Generation firms				
GDF Suez	0.77	0.64	0.54	0.45
Drax plc	0.42	0.35	0.40	0.34
AES Corp	1.33	1.56	0.60	0.71
American Electric Power Corp	0.51	0.54	0.33	0.35
Average			***0.47***	***0.46***
Energy retailers				
Telecom Plus plc	0.01	–0.33	0.01	–0.33
Good Energy	0.61	–1.71	0.57	–1.60
Just Energy	1.30	1.00	1.18	0.91
Crius Energy Trust	–0.58	1.44	–0.58	1.44

Source: Bloomberg data, CMA analysis.

*Betas have been unlevered using the following formula: Unlevered Beta = Levered Beta / (1 + ((1 – Tax Rate) x (Debt/Equity))), where the tax rate used is the average statutory corporate tax rate in the country in which each firm has its headquarters. The tax rates used are set out in Appendix B. The levered beta is also called the equity beta; the unlevered beta is also called the asset beta.
†Iberdrola SA acquired Scottish Power in 2007.

Comparability of firms

42. For the purposes of our profitability analysis, we wish to identify appropriate beta values for *(a)* a vertically integrated energy firm with operations in GB (alone); *(b)* a stand-alone GB electricity generator; and *(c)* a stand-alone GB electricity and gas retail supplier. Centrica put forward the view that using the betas of diverse and vertically integrated businesses may be misleading when seeking to estimate the WACC of a stand-alone business – particularly in retail supply – because the former will benefit from diversity in their operations and hence will not be comparable.

43. We consider that there are two main dimensions to take into account in determining the comparability of the betas of the firms covered in TABLE 4:

(a) The geographical scope of operations, including whether the firms are active in GB and the extent to which they are diversified across a number of different countries.

(b) The type and range of activities undertaken by the firms, including whether they are vertically integrated and whether they also undertake regulated business, such as owning distribution networks.

44. TABLE 5 sets out the proportion of revenues and profits earned by the Six Large Energy Firms in the UK and overseas, as well as the countries in which they have operations. It shows that SSE and Centrica have the greatest relative exposure to GB, with the majority of their activities here. SSE is the most heavily GB-focused firm with operations in GB and Ireland (only), while Centrica has around two- thirds of its business in the UK. In contrast, EDF Energy only generates around 12 to 13% of its sales and profits in the UK, with the majority of its operations in France. E.ON and RWE npower derive a similarly low proportion of their revenues and profits from their GB operations.

TABLE 5 **Breakdown of company revenue and profits by location**

Company	*Proportion of revenue*		*Proportion of operating profits*		*Countries with business presence*
	UK	*Overseas*	*UK*	*Overseas*	
Centrica*	c.2/3rd	c.1/3rd	c.2/3rd	c.1/3rd	UK, US, Netherlands, Norway, Canada, Trinidad & Tobago
EDF SA†	13%	87%	12%	88%	France, UK, Italy, Austria, Switzerland, Belgium, Hungary, Poland, Russia, China, US, Brazil, Vietnam, Laos
E.ON‡	c.10%	c.90%	c.5%	c.95%	Germany, UK, Spain, Italy, Hungary, Sweden, Czech Republic, Slovakia, Turkey, Brazil, Russia, US, France, Netherlands, Belgium, Poland, Denmark, Romania, Portugal
Iberdrola§	30%	70%	35%	65%	Spain, Portugal, UK, US, Brazil, Mexico
RWE npower¶	18.8%	81.2%	3.6%	96.4%	Germany, UK, Netherlands, Belgium, Czech Republic, Poland, Austria, France, Spain, Portugal, Slovakia, Slovenia, Romania, Turkey, Hungary, US, Italy, Singapore
SSE#	97%	3%	n/a	n/a	UK, Ireland

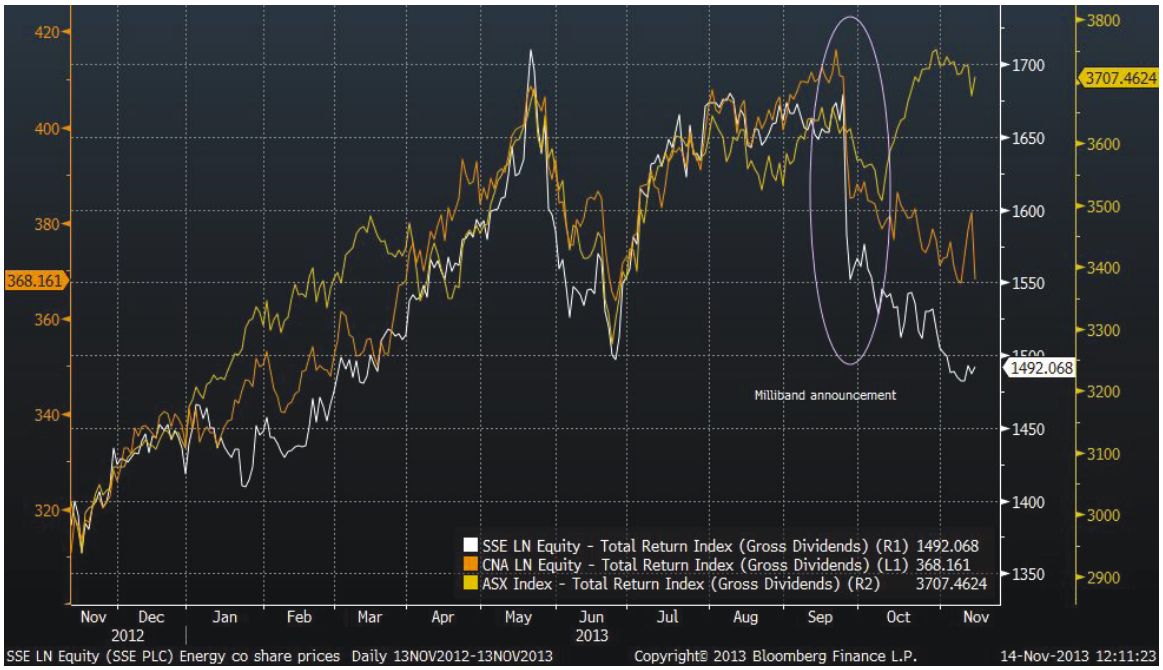
Source: Company annual reports 2013/2014.

*The Centrica *Annual report* 2013 (p99) indicated that just over 57% of revenues were derived from UK operations, and just over 27% from overseas operations, with the remaining 16% coming from a mix of UK and overseas activities. Similarly, the annual report indicated that 47% of adjusted operating profits came from UK operations, with 10% from overseas operations and 43% from a mix of UK and overseas operations. Hence the 2/3rds/1/3rd split is an approximate estimate of the overall split of total revenues and total operating profits.
†EDF *Annual report* 2014, pp3&17. The UK proportion highlighted is for EDF Energy. 'Overseas' includes the results of EDF Trading, which will include an amount for UK revenues and profits.
‡E.ON *Annual report* 2013, p190. Note figures are for E.ON's supply activities only. While it is not possible to separate out E.ON's UK generation and trading revenues and profits from those earned in other territories, supply revenues and profits can be identified.
§Iberdrola *Annual report* 2013, p81.
¶RWE npower *Annual report* 2013, pp64&193. 2013 proportion of revenue consists of GenCo UK (€903m) and Supply UK (€9,259m) divided by Total RWE (€54,070m). 2013 proportion of operating result consists of GenCo UK (€-76m) and Supply UK (€290m) divided by Total RWE (€5,881m). These figures exclude UK Renewables, whose numbers are not separately disclosed in the RWE AG *Annual report*.
#SSE *Annual Report* 2014, p109.

45. This differing relative exposure to the UK can also be seen in the responsiveness of the firms' share prices to 'shocks' to the sector in the UK. For example, on 24/25 September 2014 Ed Miliband announced a potential energy prize freeze in the case that the Labour Party won the General Election. Figures 5 and 6 show the impact of this announcement on the share prices of the Six Large Energy Firms. The share prices of Centrica and SSE underperformed the all-share index by around 12% between the date of the announcement and mid-November, while those of EDF, E.ON, RWE npower and Iberdrola were relatively unaffected following the announcement.

FIGURE 5

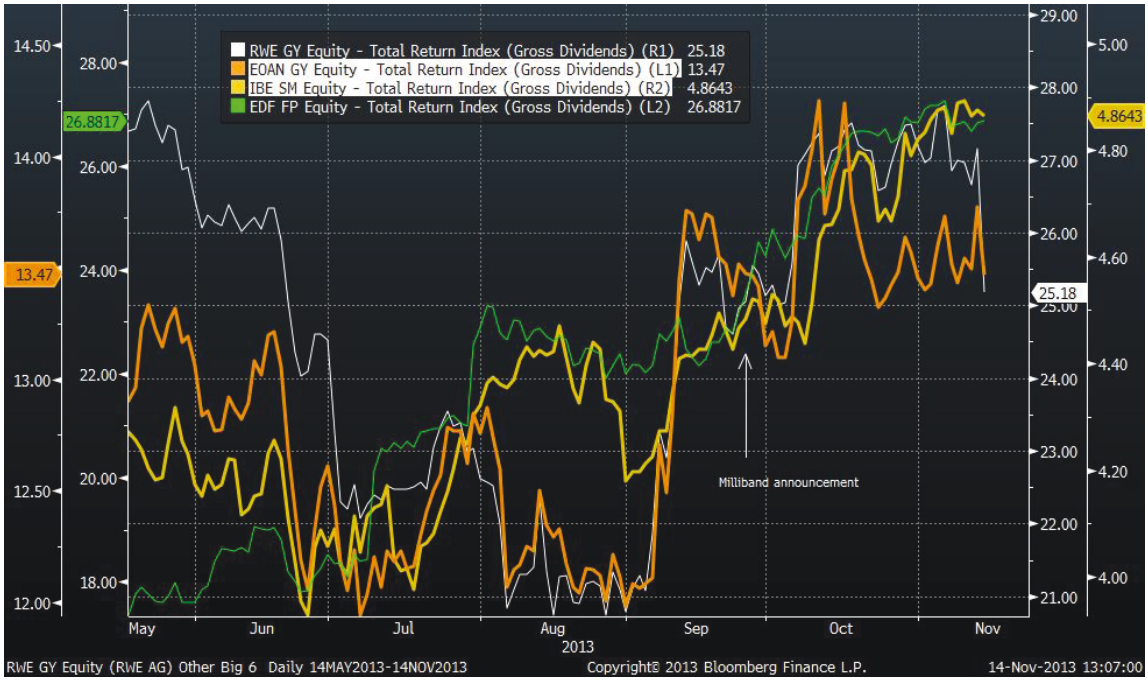
Centrica and SSE returns against FTSE all-share index



Source: Bloomberg.

FIGURE 6

RWE npower, E.ON, EDF and Iberdrola returns



Source: Bloomberg.

46. This evidence suggests that the beta information taken from Centrica and SSE is likely to provide the clearest insight into the systemic risks faced by an

operator in GB. In addition, we observe that Centrica and SSE are the least geographically diversified of the Six Large Energy Firms and hence are also likely to be the closest comparables from the point of view of a stand-alone GB business. We observe, however, that these firms have lower rather than higher betas than the more geographically diversified operators active in GB.

47. We next considered the extent to which the Six Large Energy Firms generated revenues and profits from activities with a significantly different (systemic) risk profile from that of generation and retail supply. In particular, we have sought to understand which firms derive significant revenue and profits from economically regulated (non-competitive) activities. TABLE 6 sets out a brief overview of the activities of the Six Large Energy Firms.

TABLE 6 **Description of company activities**

Company	*Description of activities*	*Importance of economically regulated activities*
Centrica	Active in E&P*, storage, generation and retail supply, as well as provision of home services across both the UK and North America	Centrica does not have significant exposure to regulated activities
EDF	Active in generation and retail supply, as well as the transmission and distribution of power	EDF has regulated transmission and distribution businesses in France and Hungary.†
E.ON	Active in E&P, generation and retail supply, as well as distribution networks	E.ON has regulated distribution businesses in a number of countries, including Germany, Sweden and Spain. These businesses have a total regulated asset base of c.€26bn and account for approximately 30% of total group EBITDA.‡
Iberdrola	Active in generation and retail supply, distribution networks and power generation, engineering and construction	C.25% of revenues and 100% of operating profits from regulated activities.
RWE npower	Active in lignite mining, power generation and retail supply, as well as distribution networks and commodity trading	More than one-third of RWE npower's operating profits are currently derived from regulated activities.§
SSE	Active in E&P, generation, transmission and retail supply	Approximately half of operating profits from its network business.

Source: Centrica annual report 2013; SSE annual report 2014.

*Gas exploration and production, ie extraction of natural gas.
†EDF electricity distribution.
‡E.ON charts. E.ON facts and figures.
§RWE npower presentation.

48. Iberdrola and SSE have a significant proportion of their activities (50% or more) in economically regulated sectors of the energy industry, while Centrica does not have (significant) exposure to these sectors. We observe that SSE's asset beta is significantly lower than the average for the Six Large Energy Firms but that of Iberdrola is around the average.

CMA discussion of beta estimates

49. The evidence that we have collected on asset beta indicates a range of between 0.25 and 0.75, with an average of around 0.5. While there is

reasonable variation in the asset betas of individual firms, the direction of these variations is not always consistent with what theory may suggest. For example, Iberdrola has a significant network business and is internationally diversified but has an above average asset beta, while Centrica is largely UK-focused and does not have a network business but has a lower than average beta. Our initial review of the evidence in relation to beta values indicates that:

(a) firms with a significant focus on GB do not appear to have higher beta estimates than those firms which are more internationally diversified;

(b) there do not appear to be systematic differences between the asset betas of firms that are vertically integrated and those that focus largely on generation; and

(c) there is little reliable evidence on the appropriate beta value for a stand-alone energy retailer. We consider that demand for energy (gas and electricity) is likely to be less variable than overall demand in response to the economic cycle. However, we will consider this further.

50. On this basis, we consider that the appropriate asset beta for a vertically integrated, GB energy firm is between 0.5 and 0.6. Similarly, that for a stand-alone, GB generation business is between 0.5 and 0.6. We observe that this is in line with the asset beta estimates provided by the Six Large Energy Firms (see TABLE and TABLE). Because of the lack of reliable information, our current approach is to assume that the appropriate asset beta for a stand-alone energy retailer is equal to the average for the market as a whole. This is between 0.7 and 0.8, which is equivalent to an equity beta of 1 (taking into account the average level of gearing).[29]

Gearing

51. We examined the levels of gearing of both the Six Large Energy Firms active in GB and a number of European and non-European comparable companies.

[29] With a beta of 1 (by definition) and average gearing among firms of approximately 30%, UK equities generally can be thought of as having an asset beta of around 0.7.

The results of this analysis, as set out in TABLE 7, show that there is significant variation both within firms across time and across energy firms.

TABLE 7 **Gearing levels of energy firms**

%

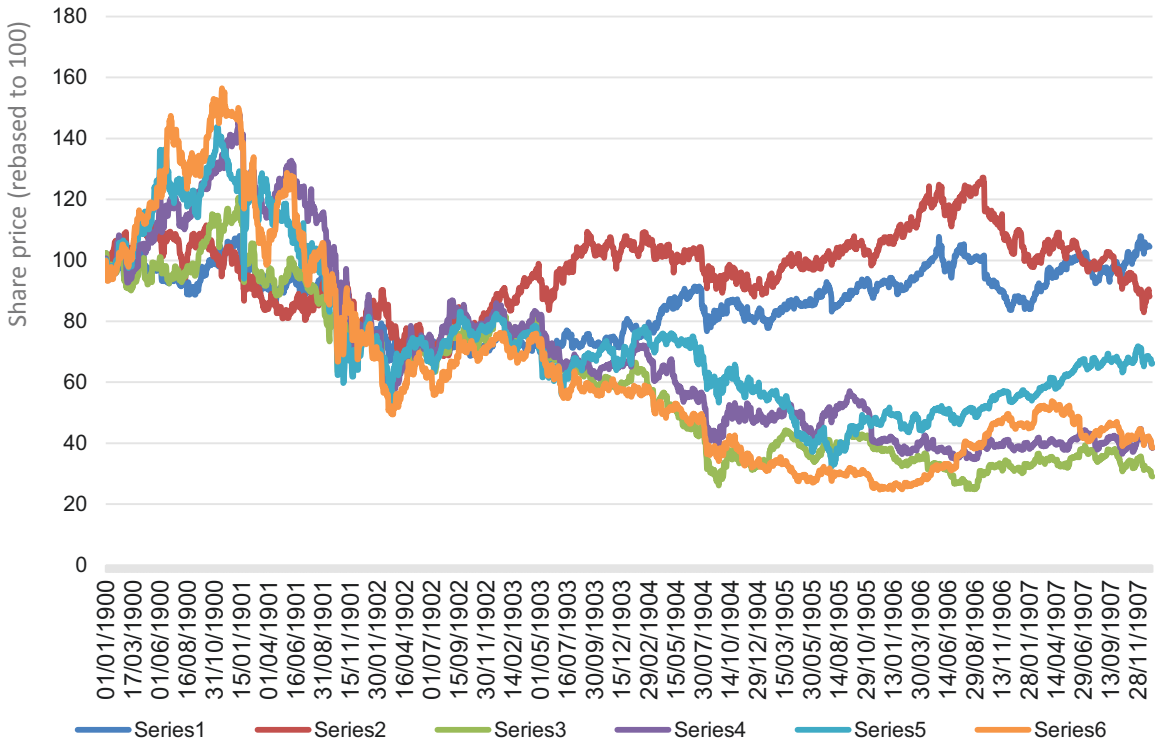
Company	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*Average*
Six Large Energy Firms									
Centrica plc	13.9	6.3	4.3	19.0	17.2	19.5	20.2	22.9	*15.4*
SSE plc	18.2	14.3	23.1	33.3	36.1	30.3	32.5	27.9	*27.0*
EDF SA	24.9	9.3	25.0	37.8	39.7	51.5	64.5	45.1	*37.2*
E.ON SE	13.2	18.2	42.0	38.9	39.5	45.8	46.9	43.2	*36.0*
Iberdrola SA	31.0	30.8	49.0	44.1	45.6	49.2	51.5	48.6	*43.7*
RWE npower AG	1.0	2.2	14.5	28.9	37.8	52.0	49.9	50.3	*29.6*
Average	***17.0***	***13.5***	***26.3***	***33.7***	***36.0***	***41.4***	***44.2***	***39.7***	
VI firms (non-UK)									
Enel S.p.A.	22.0	57.4	69.3	67.1	68.6	71.5	71.2	69.9	*62.1*
Gas Natural Fenosa	19.5	19.1	37.2	60.2	64.0	56.7	54.3	45.8	*44.6*
EnBW AG	23.9	16.3	21.0	38.2	36.1	35.2	36.2	34.4	*30.2*
Verbund AG	14.6	14.6	23.5	32.8	31.0	38.5	42.6	45.7	*30.4*
Fortum Oyj	19.4	14.8	32.9	27.6	26.9	34.1	40.1	36.5	*29.0*
Contact Energy Limited	13.3	9.3	12.9	23.6	27.1	21.8	27.3	25.6	*20.1*
TrustPower Limited	14.3	15.1	18.5	24.1	24.1	26.0	25.1	27.4	*21.8*
NRG Energy Inc	57.1	44.9	58.7	52.1	61.8	69.0	66.3	62.8	*59.1*
Origin Energy	0.0	24.8	24.3	7.6	6.0	5.8	23.7	26.1	*14.8*
AGL Co	36.5	31.7	23.6	6.4	22.6	24.1	34.1	37.5	*27.1*
Generation firms									
GDF Suez	10.3	26.5	32.0	36.2	43.1	55.7	61.1	47.8	*39.1*
Drax plc	9.7	14.1	11.0	3.5	0.0	0.0	0.0	0.0	*4.8*
AES Corp	53.6	55.5	77.5	69.6	65.9	71.6	72.6	67.9	*66.8*
AEP Corp	43.6	43.6	56.1	50.3	50.3	46.9	46.7	45.0	*47.8*
UK retail only firms									
Good Energy Group plc							0.0	18.0	*9.0*
Telecom Plus plc	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	*0.5*
Just Energy	0.7	1.5	2.7	1.5	12.1	19.3	27.4	49.2	*14.3*

Source: Bloomberg data, CMA analysis.

52. We observe that across the industry there was a general trend of increasing leverage between 2007 and 2012, with a slight decline in 2013. This was caused, at least in part, by the financial crisis and declines in the equity value (and therefore market capitalisation) of these firms. FIGURE 7 shows the share prices of the Six Large Energy Firms over the period (rebased to 100). RWE npower, E.ON, Iberdrola and EDF have all experienced significant declines in their equity value over the period, falling by 50% or more for each from the value as of mid 2007. The share prices of Centrica and SSE, in contrast, have performed better, ending the period at a similar level to that at the beginning of the period. As a result, we consider that the gearing of these firms is likely to be closest to a long-run sustainable level for a vertically integrated energy firm.

FIGURE 7

Share prices of the Six Large Energy Firms (rebased), 2007 to 2014



Source: Bloomberg data, CMA analysis.

53. We have also taken into account the views of the Six Large Energy Firms regarding the long-term sustainable level of gearing as set out in their cost of capital estimates (see TABLE and TABLE). These range from 25 to 50%. For example, Centrica noted that its target level of leverage was [✂].

CMA discussion

54. Our initial review of the evidence on gearing suggests that the long-term sustainable level of gearing for a vertically integrated firm or a stand-alone generation business is between 20 and 40%. In 2006 and 2007, the (unweighted) average level of gearing for the Six Large Energy Firms was below 20%, increasing over the period to a peak of 44% in 2012. While we recognise that certain firms have had levels of gearing that have been outside this range (both above and below), we consider that it is a reasonable range for our analysis which seeks to identify the cost of capital for a 'typical' operator.

55. Several parties have told us that a stand-alone retail supplier would not be able to carry any debt on its balance sheet. Centrica stated that a stand-alone retail business the size of British Gas would not be able to raise debt finance

owing to its higher level of business risk. Similarly, [✂]. On this basis, our current view is that a stand-alone retail supplier would not be able to support any material level of gearing and therefore we have estimated the WACC of a stand-alone supplier on the basis that it is entirely funded by equity.

Cost of debt

56. In order to come to a view on the likely cost of debt of a GB energy firm, we have examined a range of evidence, including:

(a) yields and spreads on sterling-denominated corporate bonds issued by the Six Large Energy Firms with a maturity of between 10 and 30 years;

(b) spreads on UK corporate bonds of various credit ratings over the relevant period; and

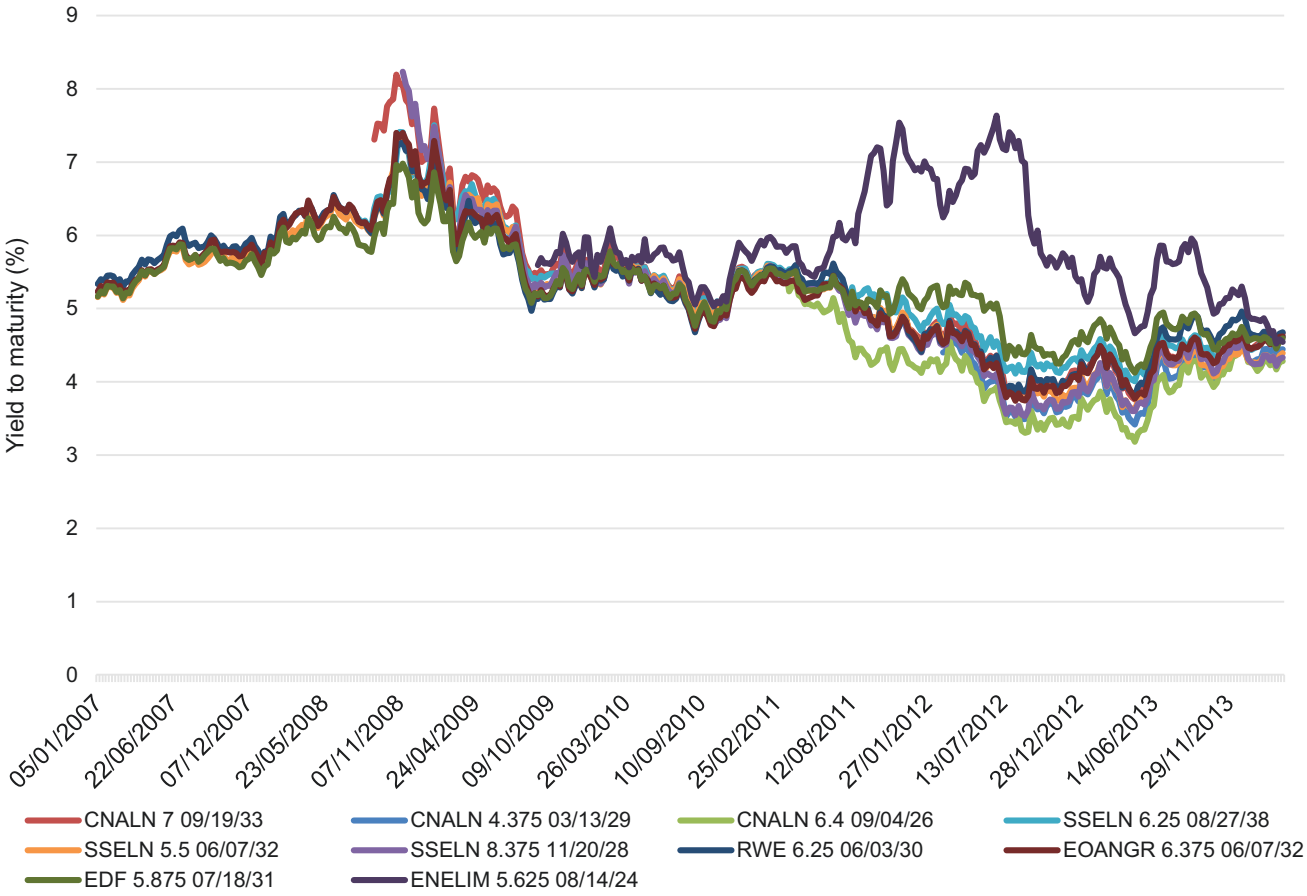
(c) the credit ratings of the Six Large Energy Firms, as compared with those of smaller, less diversified operators.

57. FIGURE 8 shows the yields on the sterling-denominated corporate bonds of a number of large, vertically integrated European energy firms (Centrica, SSE, RWE npower, E.ON, EDF and the Italian-based electricity company, Enel). We have examined returns on corporate bonds with relatively long-dated maturities in order to make them comparable with the gilt yields examined in paragraphs 19 to 22, ie maturities of between 10 and 30 years over the period as a whole. Yields have fluctuated over the period, increasing during the financial crisis to between 7 and 8% before falling back to pre-crisis levels between 2009 and 2011. In 2012 and 2013, yields fell further to between 3.5 and 5%. We note that the yields on Enel's bonds rose above those of its competitors between 2011 and 2013. Given the pattern of yields on other companies' bonds, we consider this to be indicative of company-specific factors and we have, therefore, discounted Enel's yields in reaching a view on the relevant cost of debt.

58. For the period as a whole, we consider that this evidence suggests a cost of debt of between 5 and 6% for companies with an investment-grade credit rating. This is equivalent to a spread of between 100 and 200 basis points over nominal gilt yields.

FIGURE 8

Energy firm corporate bond yields, 2007 to 2014



Source: Bloomberg data, CMA analysis.

59. FIGURE 9 shows the redemption yields on UK corporate bonds of differing credit ratings for the majority of the period under review. Between 2007 and 2012, yields on A-rated bonds averaged just over 5%, while those on BBB-rated bonds fluctuated between 4.4 and 8%, with an average of approximately 6.1%. These figures are consistent with the yields on energy company bonds.

FIGURE 9

UK corporate bond redemption yields, 2007 to 2012

Source: Thompson Reuters, based on ten-year corporate bonds.

60. We next considered the credit ratings of the Six Large Energy Firms and the extent to which these might be different for a stand-alone GB operator and for a generation-only business.[30] TABLE 8 shows the credit ratings of the Six Large Energy Firms, as well as some other energy businesses (as of December 2014). All these firms have investment-grade credit ratings apart from Drax and AES Corp, which have BB-ratings.

TABLE 8 **Credit ratings of European energy firms**

Company	*Moody's*	*Standard & Poor's*	*Fitch*
Centrica plc	A3	A-	A-
SSE plc	A3	A-	A-
EDF SA	Aa3	A+	A+
E.ON SE	A3	A-	A-
RWE npower AG	Baa1	BBB+	BBB+
Iberdrola SA	Baa1	BBB	BBB+
GDF Suez	A1	A	-
Enel S.p.A.	Baa2	BBB	BBB+
Drax		BB	-
AES Corp*	-	-	BB-

Source: Bloomberg.

*Business Wire, 'Fitch affirms AES' ratings'.

[30] As set out in paragraph 55, in our analysis of the WACC of electricity and gas retail suppliers, we are assuming that they are entirely financed by equity. Therefore, we do not consider further the credit rating that they would achieve.

61. We consider that a vertically integrated energy firm with operations only in GB would achieve a similar credit rating to an internationally diversified business and therefore would incur a cost of debt of between 5 and 6%. The evidence on Drax indicates that a stand-alone generator in GB would probably achieve a credit rating of BB (ie just below investment grade). There is limited information available on the yields on BB-rated corporate bonds. We have examined the differences in yields across bonds of different ratings and consider that an additional premium of between 50 and 100 basis points would be required by lenders for firms with such a credit rating, giving a cost of debt of between 5.5 and 7% for a stand-alone generator. This is consistent with the approach suggested by E.ON.[31]

Interpretation of WACC

62. Our estimate of the WACC provides a benchmark against which to assess the profitability of the industry. At this stage, we have not sought to draw conclusions from our profitability analysis. However, several parties have raised issues of interpretation of the WACC. In this section, we provide a summary of these points together with our current view on them.

Fair bet principle

63. RWE npower noted that while the cost of capital only takes into account the market risk faced by an investor, when performing an investment appraisal, the specific risks of a project are reflected in the cash flow forecasts used. For example, a project may have a 50% probability of success and a 50% probability of failure, with expected returns an average of these two outcomes. A comparison of the ex ante cost of capital with the ex post returns made on a given project may give a misleading view of profitability. The observed returns may reflect a successful project whereas ex ante there was a reasonable risk that the project would be unsuccessful such that the expected returns did not exceed the cost of capital.

64. We agree in principle with the argument put forward by RWE npower. However, we consider that this principle is more relevant to the appraisal of the profitability of a single project, such as the construction and operation of a single power station, than the appraisal of the profitability of an industry as a whole, which is the exercise that we are undertaking. The latter depends on a large number of projects with differing risk profiles undertaken by a number of

[31] E.ON suggested that a pre-tax cost of debt of around [✂]% would be appropriate for a stand-alone generation business, on the [✂] basis of [✂] listed debt securities, which it observed had (as of September 2014) a yield to maturity of [✂]% on 10-year bonds.

firms over many years. As RWE npower states, '[i]f this project were repeated many times, then on average we would expect the weighted outcome'. Our current view is that it is reasonable to expect approximately the weighted outcome in this case.

Political and regulatory risk

65. E.ON and OVO put forward the view that there was an increase in political and regulatory risk over the period. E.ON suggested that this will have increased the return that both equity and debt investors required for bearing these and other risks.

66. The theory underlying the CAPM is that when determining the level of return they require, investors should only take into account the systematic or non-diversifiable risk associated with a firm. This is captured by the firm's beta value and, at least in theory, does not need to be adjusted for in any other respect. As discussed in paragraphs 63 and 64, the specific risks associated with a project should be reflected in the cash flow forecasts. If political and regulatory risks were to increase over time, we would expect firms to take this into account in their sensitivity analyses before undertaking investments. Our current view is that this would not affect the underlying cost of capital.

Size and value premia

67. E.ON observed that there are examples of divergences between returns on small and large capitalisation stocks, as well as between returns on 'value' and 'glamour' stocks, such that the CMA may wish to consider including such size and value premia in arriving at appropriate WACC values. It noted that a stand-alone generator or retail supplier may be a 'small' stock where the integrated firm (combination of the generation and supply business) may not. Similarly, RWE npower stated that an additional risk premium may be appropriate when considering the WACC of a stand-alone generation business.

68. While we recognise that there may be some examples of divergences between the returns on 'small' and 'large' stocks and on 'value' and 'glamour' stocks, our initial review of the literature indicates that Fama-French models generally fail to describe reliably the cross-section of returns in the UK.[32] Moreover, even if there were such evidence in relation to the UK market, we consider that it would not necessarily be right to infer from this that the typical

[32] See A Gregory, R Tharyan and A Christidis (2011) *Constructing and testing alternative versions of the Fama-French and Carhart models in the UK*, University of Exeter, and S. Mouselli, M. Michou and A. Stark (2008) *On the information content of the Fama and French factors in the UK*, University of Manchester.

stand-alone energy business (whether vertically integrated, or operating either in generation or in retail supply) would require a size premium. In the first instance, we note that the majority of the energy firms active in GB are generally very large businesses. Second, it is not clear that these businesses would necessarily share any (unknown) general characteristics of small firms that increase their cost of capital due to higher risk. Our current view, therefore, is that it is not appropriate to reflect a size or value premium. This is in line with previous CMA (and CC) decisions in both market investigations and price determinations, such as private healthcare and Bristol Water.

Appendix A: Firms' submissions on their cost of capital

1. In this appendix, we set out the views of both the Six Large Energy Firms and the mid-tier generators and suppliers on their cost of capital. Table 1 shows the cost of capital estimates of four of the Six Large Energy Firms for their operations as a whole. We note that these may include activities that are outside the scope of our investigation, such as overseas generation and retail activities or UK-based exploration and production, gas storage or other activities.

TABLE 1 **WACC estimates for vertically integrated or whole-group operations**

	Centrica	*EON*	*RWE npower*	*SSE*
Real RFR (%)	[✂]	[✂]	[✂]	[✂]
Nominal RFR (%)	[✂]	[✂]	[✂]	[✂]
ERP (%)	[✂]	[✂]	[✂]	[✂]
Asset beta	[✂]	[✂]	[✂]	[✂]
Equity beta	[✂]	[✂]	[✂]	[✂]
Post-tax Ke (%)	[✂]	[✂]	[✂]	[✂]
Pre-tax Ke (%)	[✂]	[✂]	[✂]	[✂]
Pre-tax cost of debt (Kd) (%)	[✂]	[✂]	[✂]	[✂]
Gearing (%)	[✂]	[✂]	[✂]	[✂]
Tax rate (%)	[✂]	[✂]	[✂]	[✂]
Pre-tax WACC	[✂]	[✂]	[✂]	[✂]
Post-tax WACC (%)	[✂]	[✂]	[✂]	[✂]

Source: Centrica, E.ON, RWE npower and SSE submissions to the CMA.

2. EDF Energy did not provide a view of its group WACC or the WACC of its generation business in its responses to the generation and supply questionnaires.[33] In its response to the generation questionnaire, SSE suggested that the appropriate nominal pre-tax WACC for the SSE group as a whole was [✂].

3. Scottish Power provided a range of evidence collected from broker reports, some of which estimated the WACC of the business as a whole and some of which focused on the generation activities. This evidence is set out in Table 2 and on average indicates a nominal, pre-tax WACC of 9.5%.

[33] EDF Energy did provide this information for EDF Trading.

TABLE 2 **Scottish Power's submission on its WACC, based on broker reports**

Broker	*Report date*	*Report ref*	*Business*	*WACC (post-tax nominal) (%)*	*WACC (pre-tax nominal) (%)*
Santander	11-May-12	Page 3	UK Liberalised	6.8	9.3
Bank of America Merrill Lynch	01-Jun-12	Page 17	SP Supply and Generation	8.0	10.9
Societe Generale	30-Jul-12	Page 17	SP Wholesale	8.0	10.9
Credit Suisse	01-Aug-12	Page 29	UK Power Generation	7.5	10.2
Citi	29-Oct-13	Page 12	UK Power Generation	5.8	7.7
Bankia	30-Oct-13	Page 2	UK Liberalised	7.0	9.3
N + 1 Equities	29-May-14	Page 6	UP Power Generation	6.6	8.6
Mean				*7.1*	**9.5**

Source: Scottish Power.

4. Some of the Six Large Energy Firms highlighted that their group WACC estimates did not provide appropriate benchmarks for the CMA's profitability analysis for a number of reasons. In particular, they emphasised that a stand-alone generation or supply business would face a different WACC, as would a vertically integrated firm that was not diversified internationally.[34] Therefore, we next set out the firms' estimates of the appropriate WACC for their stand-alone generation and supply businesses.

5. In contrast, Scottish Power told us that the evidence it collected from broker reports and independent advice it received from Oxera did not show that a substantial difference existed between the WACC for Scottish Power's generation businesses and its combined unregulated business activities. It stated that:

> [w]hen combined with the uncertainty in estimating the WACC more generally, Oxera recommends that the plausible range for the WACC of our whole value chain is broadly similar to the range Oxera estimated for Generation… Similarly, there is no robust market evidence to conclude that were Scottish Power to operate on a stand-alone basis, our WACC would be materially different to the estimates provided. (As explained [elsewhere], there are likely to be differences in risk capital requirements between VI [vertically integrated] and non-VI businesses).

Generation WACC

6. [✂] and standard UK tax rates (20%) [✂]. It noted that a stand-alone generation business would be likely to have a lower credit rating, a higher cost

[34] Per E.ON SE *Annual report* 2013. For example, E.ON noted that the cost of debt that formed the basis of E.ON SE group's cost of debt is heavily influenced by historically low yields on German bunds and therefore does not represent an achievable cost of debt in the GB financing marketplace.

of debt and/or different gearing levels when compared with a vertically integrated firm. [✂].

7. E.ON put forward the view that the appropriate pre-tax nominal WACC for either a stand-alone GB generation business (excluding GB trading) would be approximately [✂]% on the basis of:

   (a) a nominal RFR of between 4.5 and 5% (a real RFR of 1 to 1.5% and RPI inflation of 3.5% over the relevant period);

   (b) a country risk surcharge of [✂]% to be added to the ERP to reflect the impact of greater political and regulatory risk in the UK;

   (c) an asset beta of [✂], which E.ON states is in line with the asset beta of [✂] over the relevant period; and

   (d) a cost of debt of around [✂]%, based on the reference point of AES Corporation's listed debt securities which had (as of September 2014) a yield to maturity of [✂]% on 10-year bonds.

8. [✂]

9. SSE submitted a report carried out by Frontier Economics (Frontier) that sought to identify an appropriate WACC for a stand-alone generation business based on industry benchmarks. Frontier sought to exclude evidence which was derived from vertically integrated and/or regulated businesses because it considered that the WACCs of these would not necessarily be appropriate. It also focused on businesses with thermal generation rather than nuclear or renewable technologies, with the latter viewed as being more risky. Frontier proposed a range of nominal pre-tax WACC of between 9.8 and 14.3%, although it did not provide a breakdown of the various components of the estimate, ie RFR, ERP etc. We observe that this range is broadly in line with the estimates provided by the other firms for their generation businesses.

TABLE 3 **WACC estimates for generation businesses**

	EON	*RWE npower*	*Scottish Power*
Real RFR (%)	[✂]	[✂]	[✂]
Nominal RFR (%)	[✂]	[✂]	[✂]
ERP (%)	[✂]	[✂]	[✂]
Asset beta	[✂]	[✂]	[✂]
Equity beta	[✂]	[✂]	[✂]
Post-tax Ke (%)	[✂]	[✂]	[✂]
Pre-tax Ke (%)	[✂]	[✂]	[✂]
Pre-tax cost of debt (Kd) (%)	[✂]	[✂]	[✂]
Gearing (%)	[✂]	[✂]	[✂]
Tax rate (%)	[✂]	[✂]	[✂]
Pre-tax WACC	[✂]	[✂]	[✂]
Post-tax WACC (%)	[✂]	[✂]	[✂]

Source: E.ON, RWE npower and Scottish Power submissions to the CMA.

Note: [✂]

Supply WACC

10. While Centrica questioned the feasibility of a stand-alone supply business of the scale of British Gas it estimated that a (hypothetical) appropriate cost of capital for a stand-alone supply business would be between 11 and 15% based on:

    (a) a combined nominal RFR and ERP giving an implied required market return of between 10 and (just over) 11%;

    (b) an equity beta of between 0.9 and 1.2 (although in the absence of debt, this range would be reduced); and

    (c) where it was possible for some debt to be raised, a debt premium of between 5 and 6% (over the RFR) would be required.

11. E.ON put forward the view that the appropriate pre-tax nominal WACC for a stand-alone GB supply business would be approximately [✂]% on the basis of:

    (a) a nominal risk-free rate of between 4.5 and 5% (a real risk-free rate of 1 to 1.5% and RPI inflation of 3.5% over the relevant period);

    (b) a country risk surcharge of [✂]% to be added to the ERP to reflect the impact of greater political and regulatory risk in the UK;

    (c) an asset beta of 0.7, which E.ON stated was in line with the asset beta of [✂] of a selection of retailers, over the relevant period; and

    (d) a cost of debt before taxes of approximately [✂]% and gearing of [✂]%, taking as a reference point the margins on debt observed for a selection of retailers.

12. RWE npower estimated a pre-tax WACC of [✂]% for a supply business based on:

(a) an RFR of [✂]%, estimated using the interest rate yield curve published by the Bundesbank;

(b) an ERP of [✂]% based on a KPMG study and a recent Ofgem decision;

(c) a beta of [✂] based on a number of comparator companies;

(d) a cost of debt of [✂]% on a pre-tax basis and [✂]% on a post-tax basis (therefore assuming a tax shield of [✂]%); and

(e) gearing of [✂]%, which is guided by the RWE npower target credit rating and also takes into account typical financing structures given the owned asset classes and sector norms.

13. SSE did not provide a WACC estimate for a supply business but did suggest that the most natural comparators for energy retailers included supermarkets, high street retailers and airline operators because these businesses tend to be asset light in nature and face similar levels of risk to energy retailers. However, SSE observed that energy retailers may not be able to change retail prices in response to rising costs as rapidly as high street retailers such that they may be exposed to additional risk.

Appendix B: Corporate tax rates

Corporate tax rates

Country	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*Average*
UK	30.00	30.00	28.00	28.00	26.00	24.00	23.00	27.00
France	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
Germany	38.36	29.51	29.44	29.41	29.37	29.48	29.55	30.70
Australia	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Hong Kong	17.50	16.50	16.50	16.50	16.50	16.50	16.50	16.60
Spain	32.50	30.00	30.00	30.00	30.00	30.00	30.00	30.40
Italy	37.25	31.40	31.40	31.40	31.40	31.40	31.40	32.20
Austria	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Greece	25.00	25.00	25.00	24.00	20.00	20.00	26.00	23.60
Canada	36.10	33.50	33.00	31.00	28.00	26.00	26.00	30.50
Finland	26.00	26.00	26.00	26.00	26.00	24.50	24.50	25.60
US	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
NZ	33.00	30.00	30.00	30.00	28.00	28.00	28.00	29.60

Source: KPMG global tax rates.