Comments of the NERA's Report

"Electricity Generation Costs and Hurdle Rates.

Lot 1: Hurdle Rates Update for Generation Technologies"

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Background and Brief Summary

The report "Electricity Generation Costs and Hurdle Rates. Lot 1: Hurdle Rates update for Generation Technologies" (referred to throughout as the 'Report') has been prepared by NERA Economic Consulting at the request of the Department for Energy and Climate Change (DECC). The output of the Report is to provide DECC with estimated ranges for hurdle rates in 2015 and projections of how hurdle rates may develop in 2030.

Setting hurdle rates right is a complex issue in any environment but the features of renewable energy markets, in particular, the wide range of possible production technologies, the role of government and the rapid pace of technological development, make the exercise of setting the hurdle rates particularly difficult. Modern models of project valuation are data demanding and often built on strong assumptions. The standard approach is to base estimates on detailed estimates drawn from publically available financial data, particularly stock market data. The Capital Asset Pricing Model (CAPM), or more detailed multifactor models, are frequently used as the conceptual base for project appraisal analysis despite the strong assumptions and data requirements. The Report is open about the limitations of the CAPM and discusses these in detail.

A central problem that NERA have encountered, however, in determining hurdle rates for a wide range of technologies is that such stock market data are typically absent. To overcome the lack of data needed to estimate the CAPM parameters that are necessary to obtain a Weighted Average Cost of Capital (WACC), the Report uses information obtained from surveys and interviews. This information is subsequently cross-checked against statistics obtained via other sources (e.g., the limited existing market data and regulatory estimates).

The overall summary of this assessment is:

(i) I agree, subject to some minor points, with the Report's theoretical approach.

(ii) The spread of hurdle rates across technologies appears plausible.

(iii) Given the lack of data, it is difficult to be sure of the level of hurdle rates (reflected in the Report's broad ranges). I suggest that, in the light of the uncertainty, one could consider alternative approaches to aggregating the evidence which would suggest a slight shading of the absolute levels given in the Report.

Theoretical Methodology

In the absence of sufficient stock market data it is important to have a theoretical risk framework to interpret what data are available. The Report opts to use the CAPM framework to interpret and structure what limited data are available.

As it is explained in the Report, according to the CAPM investors are rewarded for the undiversifiable risk only, i.e., for the systematic risk. This assumption seems justifiable for energy generation projects as there is ample evidence that those investing in the projects are well diversified investors (e.g., pension funds, multinational corporations, etc.). The theory also states that the return on the investment is a function of the risk-free rate, market risk premium and beta (the single factor measure of the systematic risk of the investment). In addition to the single factor measure of risk (the CAPM beta) the Report also highlights that asymmetric risks and option values may be relevant risks.

When viewed in the context of the broad range of hurdle rates per technology given in the Report (see Appendix A), it is reasonable to say that there is relative consensus regarding the choice of proxies for the risk-free rate and also the expected risk premium. Thus the primary problem that exists given the limited data is how best to estimate the systematic risk, and risks not captured by the CAPM, of the various technologies. In the case of non-publicly traded companies, numerous complications arise. If there are traded companies similar in profile to the non-traded one that is being assessed, then the estimates to determine risk of these traded companies is often used to estimate a range of possible betas for the company in question. Specific technology energy projects are in a difficult position as practically there are no listed companies that could be convincingly used to proxy for them. First, many companies involved in energy generation are vertically integrated, i.e., produce, transport and supply energy. Obviously, each of these segments has different risk and these risks cannot be easily separated from 'aggregated' company data. Second, even if a company exclusively specialises in generation, it holds several projects at any given point in time. These projects may use different technologies, be at different levels of development, or even in different countries (i.e., subject to different regulation, cost of development, exchange rate risk, etc.) which makes the company-level data not particularly suitable for assessing individual projects. So estimating beta and the differences in betas across technologies is a significant problem.

NERA's central approach to the problem of absence of data is to survey investors to seek their opinion about relevant risks, hurdle rates, and individual CAPM parameters that could be informative in calculating hurdle rates. Given that the response rate was only 24 out of about 100 targeted investors the collection of survey information was complemented by in-depth interviews, to clarify the quantitative responses. As Figure 3.2 shows it was the qualitative questions about risk and scenarios that were most frequently answered. The majority of the quantitative questions were answered by '3 or less' investors (or received no answers). The Report is open about the survey data limitations and makes an attempt to check the findings based on surveys and interviews by considering statistics collected from other sources (yields on Yieldcos, information and estimates for traded companies, analysts' reports, etc.).

Suggested Hurdle Rates

The Report provides a range of estimates of the hurdle rates (low, high and reference) for 54 energy generation technologies grouped in 16 technology groups for 2015 and 2030. These are given in Appendix A. The rates include significant diversity across technology types, e.g., pre-tax real 2015 hurdle rates run from 7.4% for Hydro (> 5 megawatt) to 13.7 for Biomass CHP. The hurdle rates are noticeably higher than the rates used by DECC as of 2013. The Report argues that these differences in estimates are likely to be the result of differences in approaches. In particular, the calculations presented in the Report are more complete as they are based on clearly stated methodology, and more complete surveys (e.g., OXERA's study, which formed a base for DECC's figures, had a response rate of only 10%, which translates to about eight or nine responses in total and little information how these were utilised in producing the estimates). The Report is also conducted under a different regulatory regime, i.e., when the post-CfDs are in operation.

Assessment of the Methodology

As mentioned above, the CAPM is a well-established valuation model often used directly (through estimates based on market data), or indirectly (as the conceptual base of the risk, systematic or firm specific, that should be accounted for). Whatever estimation technique is used (e.g., univariate regressions, Fama-French specification, Carhart four factor model, etc.) it is important to keep in mind that all the estimates of the beta, and hence of the cost of equity, are subject to statistical error. This, of course, also applies to the survey data. The survey sample is small and, therefore, it should be treated with caution since the results will not be statistically significant. Given the small sample size and the small sample representation it may not be correct to rely solely on the survey data analysis. A more Bayesian approach may be more appropriate. Such an approach suggests one puts weight on all the evidence and places more on those estimates that have least error. This means that the survey based evidence should be weighed against any other market evidence rather than taken at its face value, with the non-survey evidence being used purely as a cross check.

In addition to the above, purely statistical, argument there are other reasons why the survey evidence should be taken with some caution. As already pointed out in the Report, the interviewees may be inclined to overstate those hurdle rates that are directly relevant to their businesses and understate those of the competing technologies. Given the information provided, it is impossible to say whether this is the case, but this possibility cannot be excluded (studies by Poterba and Summers, 1995, and Meier and Tarhan, 2007, support this notion).

A quick look at Figure 3.3 suggests that indeed there are some issues with the survey statistics. Figure 3.3 shows survey results of perceptions of the hurdle rates as a function of general risk perceptions. It shows that the higher the perception of risk for a given technology (e.g., CCS-coal is perceived as a more risky technology than onshore-wind), the higher the hurdle rates are reported (12% versus 9% for the CCs-coal and onshore-wind respectively). However, it also shows that the hurdle rates calculated on three or less responses can be considerably higher than the hurdle rates based on more than 3 responses.

Another potential issue arises from the survey construction. In the survey, interviewees were provided a long list of potential risks to consider. However, these risks are not mutually independent and, therefore, if viewed separately some risks may be 'double counted'. For instance, policy risk defined as "…a broad term that covers all potential changes to market design and subsidy regime", is accounted for as a component of the asymmetric risk factor and, hence, requires compensation on top of the systematic risk (named 'beta risks') in the Report. "Regulatory/Government choice can lead to expected under-recovery of cost" (p.18) and to the extent that this is non-symmetric can represent an additional risk. However, this risk could be mitigated by exercising a real option of waiting until some of the "…uncertainty about the future path of energy policy and the full implications of the EMR" (p.18) is better known, giving greater "…confidence that no additional uncertainty/risk factors will affect their expected returns under the new framework" (p.18). Hence companies need to be rewarded for forgoing the real option. But the risk the company faces by forgoing the real option is the policy risk that they have chosen not to sidestep by waiting. Hence, in many cases the policy risk and the option value are the same risk measured in two different ways. Either of these approaches covers the problem. Hence, asking respondents to identify each risk category separately (e.g., Table 3.1) makes it difficult to identify the true underlying risks and raises the possibility that the scale of respondents' concern with regard to risk is being double counted. A similar argument could be applied to allocation risk. It is also worth remembering that we are only dealing with those elements of policy risk, etc., that are not captured by beta. Grout and Zalewska (2006) show, for example, the extent that proposed policy changes can affect beta (Frontier Economics (2013) point out that the paper shows that ‘the proposed regulatory reform had a significant difference on the systematic risk of the regulated UK firms’ (my emphasis)).

Assessment of the Findings

There are two fundamental questions that need to be addressed in the light of the above discussion: (i) are the presented spreads of the estimates of the hurdle rates across the technologies plausible and, (ii) are the presented estimates of the levels of the hurdle rates reasonable? I take these questions in turn starting with the spread across technologies.

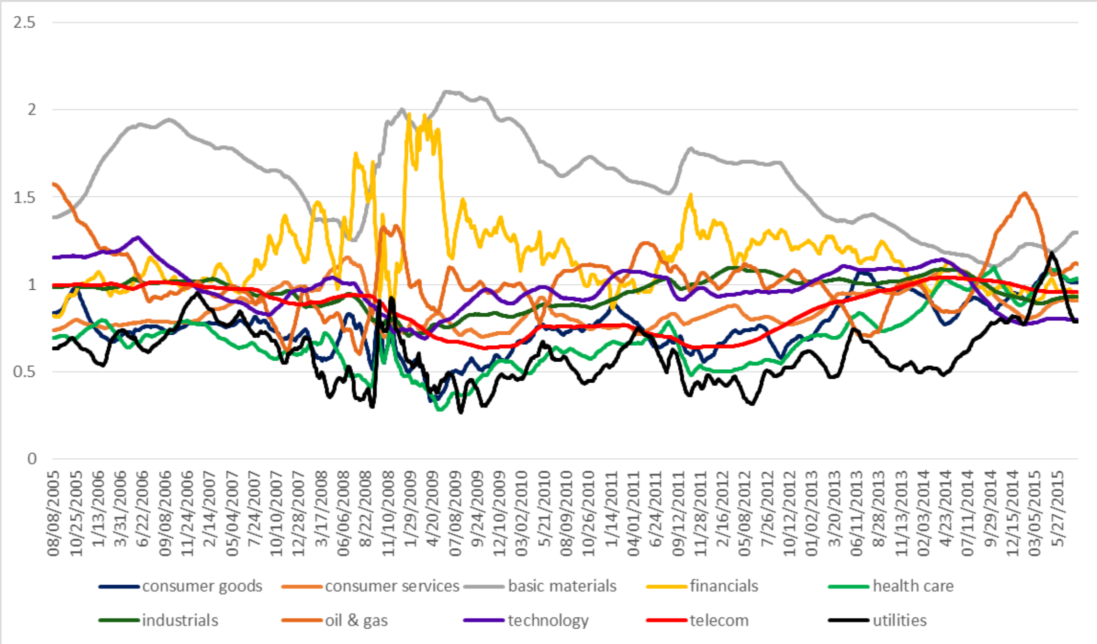
Spread across technologies

The proposed hurdle rates for the range of energy generation technologies considered in the Report are quite diverse (Table 1 and Appendix A). For instance the low bounds for the 2015 hurdle rates vary between 5.5% and 11.7%, while their high bound counterparts vary between 8.9% and 15.6% (Table 1). One could ask whether such wide spreads across the technologies are plausible. To address this question, given the paucity of data, it may be informative to step aside from energy generation and look at the spread of estimates of the equity betas for the ten main UK sector indexes of the London Stock Exchange to see if these spreads are radically different from those given for different generation technologies.

The data used for the analysis is taken from Datastream. It covers the last ten years, i.e., August 2005 – July 2015. Figure 1 below shows the time paths of the beta coefficients estimated on a daily basis using the Kalman filter technique, and using the FTSE All Share index as the proxy for the market portfolio.

Figure 1 reveals that there are considerable differences across sectors’ betas. Indeed, the differences in equity betas between sectors can be four-fold (e.g., the building materials versus utilities). These differences could be reduced somewhat once capital structure is accounted for, but it is rather unlikely that the adjustment for the cost of debt, and the proportion of debt and equity holdings would eliminate the observed differences. Therefore, this evidence suggests that there is nothing innately implausible in the suggestion that the hurdle rates of some generation technologies can be twice others.

Figure 1. Daily beta time-paths estimated for the 10 sector indexes of the London Stock Exchange for the August 2005 – July 2015 period



Levels of hurdle rates

The second question is whether the estimated levels of the hurdle rates are reasonable?

The lower bounds of the hurdle rates presented in Appendix A (and Table 1) are in the range of the hurdle rates of 2013 DECC estimates, but given that the higher bound values are typically 3%-4% higher than the lower bound values, the reference hurdle rates are typically higher than the 2013 DECC hurdle rates by 1%-2% (except for the geothermal technology for which the reference hurdle rates are about half of the 2013 DECC ones and CCS coal which are 0.6% lower and CCS gas which are 1% lower). Note that in the last couple of years changes in the systematic risk across sectors can be observed (Figure 1). If the beta of the energy generation sector correlates with the beta of utilities, it might have increased somewhat, leading to higher estimates of the hurdle rates (assuming that these of 2013 DECC were based on the CAPM framework). However, there is insufficient evidence to suggest this is an important factor.

As mentioned in the Methodology section, the Report's methodology is to base estimates on the survey evidence and "sense check this against a range of market data and other evidence". The alternatives do not measure exactly what one would ideally like but some of the estimates have less error associated with the estimate and there is a trade-off to some degree here.

There is a dearth of listed companies that could be used as a reliable proxy for calculations of the hurdle rates, but those that exist do provide some evidence. The Report uses data of Drax and of Infinis to shed some lights on their WACC. I cannot reproduce all the calculations provided in Table B3, Appendix B, due to the lack of data but using FTSE All Share Index my estimates of the equity beta were slightly different than those presented in the Report. This difference might result from the differences in the periods used (I choose November 2013 as the starting of Infinis' trading on the London Stock Exchange, and August 2014 to estimate the betas for the last 12 months) or from Bayesian weighting of the estimates. The WACC calculations using Table 1 would be about 1%-2% lower than those presented in Table B3 for both companies but the message here is consistent with the Report, namely that the implied hurdle rate is statistically significant at 5% and much lower than the survey results.

Table 1. Equity beta estimates using GARCH(1,1) variance specification.

	Drax		Infinis	
	Nov.2013-July2015	Aug.2014-July2015	Nov.2013-July2015	Aug.2014-July2015
Equity beta (standard error)	0.734 (0.120)	0.863 (0.167)	0.305 (0.141)	0.380 (0.190)
95% confidence interval	0.499-0.970	0.536-1.190	0.029-0.581	0.008-0.752

The Report also quotes Yieldcos' cost of equity as being on average 6.3% in real terms, which is much less than the survey results. These figures may fall somewhat over time.

According to yieldcon.com the UK Yieldcos are among those with the highest yields (in line with the yields paid by Canadian and Spanish Yieldcos), but as Yieldcos' yields depend on the prices they are traded at, any substantial growth in demand for Yieldcos' or increase in inflation will reduce their yields to the extent they are not indexed linked. The current inflation rate is close to zero but it is unrealistic that it will remain so low for the next few years and, in particular, until 2030. Therefore, taking 6.3% as the real rate of return on green-energy projects over a longer period may be an upper rather than a lower bound.

The Report also quotes that the 2015 hurdle rates of the Competition and Market Authority (CMA) and those used by the European Commission. The CMA suggested a cost of capital of around 5.8%-7.6% (pre-tax real) for electricity generators (p. 25). These figures are based on companies that hold a range of different technology projects, and these projects are at different asset lifecycle stages, and can only be used as "a benchmark on the lower bound for technology whole project hurdle rates to the extent that they exclude the development, allocation, and construction risks that would face new projects". Note, however, to the extent that assets are replaced over the life of a company some elements of these risks are present in all companies and the comparator companies. For example, Drax has been much involved in the CfD process and faces some development, allocation and construction risk. The Report's medium risk scenario sets asymmetric risks plus option values at a range of 1.5% to 2.5% (Table 4.2). In contrast, Grant Thornton (2013) have suggested an addition of 0.91% for construction risk and 0.5% for development risk for interconnectors during the construction phase of interconnector projects. The EC gives hurdle rates for specific projects that include the relevant asymmetric and/or option values but companies do have a contract (save for state aid legal risk). These range from 9.4% to 10.1%.

The general point is that the alternative approaches do not measure exactly what is required but are potentially prone to less error in measuring what is being estimated than the survey results. These alternative approaches suggest that the asymmetric risks and option values need to be fairly significant to square the numbers. I would suggest that a plausible approach is to put a small weight on the alternative approaches, reflecting the balance between what they purport to measure and the statistical significance of these results. A similar argument would suggest putting more weight on the lower survey numbers since these are associated with greater responses. The net effect would imply a slight shading the Report's figures across all ranges.

This would also seem to apply to the 2030 rates. Given that the 2015 estimates put strong emphasis on asymmetric risks and option values, common sense would suggest that these would diminish over time. Over time one would expect the technology surrounding green energy generation, storage and transportation to be less uncertain and policy towards green energy should become more established, so, if anything, the future cost of green-energy projects should not be higher than the current one. Therefore, it is not clear why the 2030 rates would be higher than those estimated for 2015.

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