Review of cost of capital ranges for new assets for Ofgem's Networks Division

Ofgem

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FINAL REPORT

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CONTENTS

IMPORTANT NOTICE

1. INTRODUCTION

CEPA has been appointed by Ofgem to provide support in reviewing the component parts of the cost of capital estimates used across its Networks Division. This report focuses on cost of capital estimates pertaining to three categories of assets, collectively referred to as new asset investments:

- Offshore Transmission Operator (OFTO) assets;
- interconnectors; and
- new, separable and high value onshore electricity transmission projects proceeding under the proposed Competition Proxy model, with particular reference to the Hinkley-Seabank (HSB) connection.

Each of these asset categories is introduced more fully in Section 2 of this report.

The remainder of this section summarises the objectives and scope of the report, and outlines its structure.

1.1. Objectives and scope

This report addresses three main objectives:

1. It provides an assessment of Ofgem's current approach to cost of capital estimation in relation to new asset investments.
2. It identifies and assesses the main high level options specifically relating to the Competition Proxy model.
3. It provides an overall approach to cost of capital estimation for new asset investments, including updates where appropriate to existing approaches and a detailed approach covering the Competition Proxy model.

The report also sets out recommended ranges to be applied in each case. These are intended to reflect our view of the cost of capital based on currently available evidence. We have not been asked to provide point estimates for the cost of capital, though we do provide discussion of how a point estimate might be reached. The report also provides guidance on how the proposed ranges could be updated for future decisions.

We have used the Capital Asset Pricing Model (CAPM) for assessing the cost of equity, as per the current Ofgem approach. Though it has been subject to extensive debate over its suitability, the CAPM is well-understood and the basis for a number of regulatory determinations. It is introduced more fully in Section 3. A full review of the CAPM and its suitability is outside the scope of this report. We do, however, make use of alternative sources of evidence, both as cross-checks to ensure overall rate of return estimates are appropriate, and where evidence on individual CAPM parameters is not available.

This report is part of a framework study covering cost of capital estimation across Ofgem's Networks Division. The analysis and approaches set out in this report relate only to new asset investments, and not onshore network price controls. Onshore networks will be the subject of a separate report. The scope of this report also excludes instances where Ofgem is not required to estimate a cost of capital for the purpose of setting an allowance, in particular the OFTO operational period regime.

1.2. Report structure

Following this introductory section, the report is structured as follows:

- Section 2 provides background and context on the three categories of new asset investments.
- Section 3 outlines the general methodological issues involved in cost of capital estimation; it includes an overview of the CAPM.
- Section 4 is an assessment of Ofgem's current approaches to estimating the cost of capital for new asset investments. It covers the estimation of Interest During Construction (IDC), which is applied to the construction phase of OFTO and interconnector projects, and the estimation of the rates of return used in the interconnector cap and floor regime.
- Section 5 discusses the high level options available in relation to the Competition Proxy model.
- Section 6 proposes an approach to estimating IDC.
- Section 7 proposes an approach to estimating an operational phase cost of capital for the Competition Proxy model.
- Section 8 proposes an approach to estimating rates of return for the interconnector cap and floor regime.
- Section 9 summarises our proposed ranges, and where relevant compares them to Ofgem's current approach. It also discusses how Ofgem might select a point estimate within each range, and how parameter estimates might be updated over time.

The report is also supported by two annexes. Annex A is an overview of CEPA's Dividend Growth Model (DGM) analysis, used in the estimation of market returns. Annex B presents CEPA's detailed relative risk analysis between different regimes, which is summarised more briefly in the main report.

2. Context

This report covers three distinct categories of new asset investments: OFTO assets, interconnectors and assets to be covered under Ofgem's proposed Competition Proxy regime. This section provides background information on each category.

2.1. OFTOs

OFTO assets connect offshore wind farms to the onshore grid. The OFTO regime allows for assets to be owned by a competitively appointed entity distinct from the owner of the associated generation assets (i.e. the offshore wind farms) and the onshore grid.

There are two models for development of OFTOs. In the generator build model, the offshore wind farm generation developer builds the OFTO assets and transfers them to the competitively appointed OFTO once the assets are complete and financial close is reached. In the OFTO build model, the competitively appointed OFTO will design, build, own and operate the OFTO. Currently, all OFTOs have been completed through the generator build model.

Ofgem has run this regime under five separate tender rounds since 2009, with several future rounds under development, and it is now considered a well-established regime and asset class.

2.2. Interconnectors

Interconnectors provide the transmission of electricity across borders and as such, are often impacted by the different regulatory regimes of two countries. On the GB side of the interconnector, Ofgem operates a cap and floor regime for interconnectors applying to be regulated under this regime, which limits both downside and upside to the investor.

The interconnector cap and floor regime provides for a minimum revenue at the floor, and returns revenues above the cap to consumers. This leaves the interconnector developer subject to revenue risk between these bounds – meaning that an interconnector faces merchant risk not witnessed to the same extent as other new assets. The cap and floor is flat in real terms and is in place for 25 years. There is a Regulated Asset Base (RAB), which includes a provision for a return on capital during the construction phase, with separate allowances for opex, decommissioning and tax. Cap and floor revenues are annuitised based on the cap and floor rates of return.

There have been two interconnector windows to date, for which the levels of the cap and floor are established based on the current Ofgem approach. Our proposals on interconnector cap and floor returns would produce an approach for the third interconnector cap and floor window that is consistent with the treatment of other new assets and could be adopted as an enduring regime.

2.3. Competition Proxy model

Regulators such as Ofgem and Ofwat have successfully implemented competitively tendered projects in the UK which have delivered measurable benefits to consumers. Ofgem is also currently working with the government to introduce the Competitively Appointed Transmission Owner (CATO) regime – in which a licence would be awarded to an entity to deliver a new, separable and high value onshore transmission project following a competitive tender – though the implementation of the CATO regime has been paused due to lack of enabling legislation.

In the interim period until the CATO regime can be established, Ofgem is currently considering how the principles of competitive tendering could be applied in the case of specific new asset investments. This section introduces the 'Competition Proxy' model currently being considered for the HSB connection, as well as providing further background on competitive tendering in UK regulated sectors.

2.3.1. Competitive tendering in UK regulated sectors

Regulators in GB have been increasingly using competition to bring efficiency to their new, large infrastructure projects. As such, the last few years have seen a range of competitive benchmarks develop. In energy, the OFTO regime has successfully attracted private capital. After eight years of OFTO tendering, investors continue to see the OFTO regime as attractive with the large number of projects and multiple rounds maintaining investor interest.

Competition has also been introduced in the water sector, such as the Thames Tideway Tunnel (TTT) project for which the tender process was completed in 2015 – with separate competitions for three construction packages to build the tunnel, and for the infrastructure provider which would own and finance the tunnel. Ofwat have highlighted that the cost of capital was a large focus of the TTT evaluation. The specified infrastructure project (SIP) regulations allowed TTT to be delivered and regulated under a separate licence, and Ofwat intends to use some of the lessons learned from TTT as the basis for a "Direct Procurement" process to introduce competition for future projects which are new, separable, and large (relative to the relevant water company's size). The Direct Procurement approach is based on a contractual, rather than licence-based approach.

2.3.2. Ofgem's proposed options and Hinkley-Seabank consultation

As noted in the introduction to this section, the development of the CATO regime for awarding licences to specific onshore transmission projects has been put on hold. Ofgem has, however, continued to consider how the potential benefits from competitive tendering could be captured in relation to specific assets. One option considered would be similar to Ofwat's Direct Procurement model, a contractual approach in which the existing licence-holder runs a tender process for the construction and operation of new assets. This is referred to as the Special Purpose Vehicle (SPV) Model.

In an August 2017 consultation, Ofgem reiterated its view that significant benefits for consumers could be realised by introducing competition in the delivery of new, separable and high-value onshore electricity transmission projects, such as the HSB connection of a new nuclear power station in Somerset to the main transmission network.[1] National Grid Electricity Transmission (NGET) submitted a Final Needs Case in early 2017, and Ofgem has been considering potential delivery options, including the SPV model (based on a competitive tender under a contractual approach), and the Competition Proxy model.

Under the Competition Proxy model, Ofgem would be responsible for setting NGET's allowed revenue for HSB, in line with the revenues would have resulted from an efficient competition for construction, financing and operation of the new transmission assets. Ofgem has proposed that these revenues would be set for a 25 year term covering the operational phase of the project. Ofgem's objective in setting the cost of capital for the Competition Proxy model is to achieve a value that is in line with the reasonable expectations of the resulting cost of capital from a competitive tender process. The risks faced by investors under the Competition Proxy model would therefore be (to the extent feasible) the same as those that would be faced by investors under the SPV model.

In the consultation, Ofgem stated that it would consider whether the construction phase cost of capital could utilise benchmarks for interconnector and OFTO developers currently set by Ofgem. These allowances are known as Interest During Construction (IDC). For the operational phase, Ofgem stated it would consider whether the rates of return bid in recent OFTO tender rounds would be broadly comparable to the rate of return required under the Competition Proxy model. We understand that one of Ofgem's objectives in designing the regime has been to maintain comparability between the operations phases of the OFTO and Competition Proxy regime.

Despite the benefits witnessed from competitive tendering of projects, there are associated transaction costs, and the need for a well-run tendering process may impact on delivery timescales. Indeed, NGET, in its response to Ofgem's HSB Consultation, suggest that the overarching priority should be the timely connection of Hinkley Point C and that introducing the SPV model would increase the risk of delay.[2] In setting up a tendering exercise, a regulator would also need to take steps to ensure that appropriate incentives exist on the party running the tender exercise (if not the regulator itself). As an alternative, a regulator could choose to mimic the results of a competitive tendering process without running the exercise, saving on transaction costs, but drawing on the results of similar projects where the pool of investors is closely matched. This is consistent with the development of the Competitive Proxy model.

[1] Ofgem (2017). Hinkley-Seabank – Consultation on Final Needs Case and potential delivery models.
[2] NGET (2017). Response to Hinkley-Seabank – Consultation on Final Needs Case and potential delivery models.

3. KEY METHODOLOGICAL ISSUES

There are many different methodological considerations applicable to all cost of capital estimates. The weighted average cost of capital (WACC) requires estimates for both the cost of equity and cost of debt. While the cost of debt is largely observable, the cost of equity requires many asset-specific risk assumptions and estimation of equity market parameters.

This section concerns the development of estimation approaches and estimated ranges based on current evidence. Once appropriate sources have been identified and risk levels have been determined, practical questions around the implementation of the proposed approach must be considered – such as how to select a point estimate from the evidence and the approach to updating parameter estimates over time in a consistent manner. These more practical issues are discussed in later sections, notably Sections 7.6, 9.2 and 9.3.

3.1. The Capital Asset Pricing Model (CAPM)

Most regulators in the UK adopt the CAPM framework as the primary approach in estimating cost of equity, or the expected return on the equity investment. Under the CAPM, the cost of equity is estimated as follows:

$$R_e = R_f + \beta * MRP$$

cost of equity = risk-free rate + (equity beta x market risk premium)

Under the CAPM framework, investors are only compensated for bearing market or systematic risk – that is, risks that cannot be diversified away through portfolio holdings. Per this equation, the CAPM framework assumes that investors demand a return on their investment equal to the risk-free rate (R_f), plus a premium for the degree of systematic risk involved in a particular equity investment. This premium is calculated as the product of the equity beta (β) and the market risk premium (*MRP*). The equity beta measures the volatility between the returns of a particular equity investment and the returns of the market as a whole. The market risk premium is the measure of expected return, beyond the risk-free rate, that an investor requires when holding the market portfolio. The market risk premium can also be expressed as total equity market returns less the risk-free rate.

Put simply, the CAPM framework assumes the expected excess return on the equity investment to be a fixed proportion of the expected total market return (TMR), with the particular investment's degree of systematic risk (β) determining the proportionality.

The CAPM framework is essentially a model of expectations and therefore inherently forward-looking in nature. This means that in practice, a number of judgement calls need to be made in estimating each component using proxies, and hence the quality of the proxies determines the reliability of the estimated cost of equity. For example, the proxies can be based on historic or forecast data, on short-run or long-run data, on arithmetic or geometric averages, and on UK-specific or international-level data. These issues are discussed further in Sections 3.4 and 3.5.

3.2. Defining the 'project'

As discussed, the CAPM is a common method of estimating the cost of equity. However, the output of the CAPM model applies only to the risk profile of one specific asset or project. More complicated projects in which certain elements of the risk profile change over time, may require separate estimates of the cost of capital. These projects may be thought of as portfolios, where each project phase has a distinct:

- time horizon;
- starting point; and
- inherent asset risk.

In order to maintain consistency, where the above elements vary between projects or project phases, separate cost of capital estimates should be applied.

New asset investment projects can be thought of as having two distinct phases: the construction phase and the operational phase. These two phases will likely cover differing time horizons and will begin at different points in time. Further, the risks inherent in these two separate phases are not analogous.

In estimating various parameters, we consider it most appropriate to look at the UK market, given that this is the basis for our risk-free rate estimate and that the asset generating cashflows is based in the UK. Our approach in estimating the equity beta is relative to the UK market, so this is consistent across the cost of equity as well.

3.3. Benchmarking the cost of debt

While the cost of debt is generally observable, there are several different benchmarking options that may represent the efficiently incurred cost of debt for the company or project in question. In order to provide an incentive to incur efficient debt costs and to avoid over-specificity, regulators commonly apply a benchmark index to the estimation of the cost of debt instead of taking the actually incurred cost of debt.

With respect to the cost of debt, the two different project phases for new asset investments, construction and operations, have differing time periods for which the debt is held, different dates for which debt is issued, and different underlying risk profiles (which may be indicated through different credit ratings). As such, we must apply two separate benchmarks to determine the cost of debt under these two phases. This section considers the main methodological options for developing these benchmarks.

3.3.1. Choice of benchmark indices

We propose to focus on notional indices, primarily the iBoxx non-financial corporate family of indices, as used by Ofgem in their onshore network price controls. For the RIIO Strategy Decision on Financial Issues stakeholders indicated a preference for utilising the iBoxx indices rather than alternatives such as Bloomberg indices.[3] The iBoxx non-financial corporate indices were seen to be:

- broader in the number of bonds considered within the index;
- inclusive of a greater proportion of utility debt than the Bloomberg indices;
- transparent in how they are calculated; and
- inclusive of debt with a longer time horizon, e.g. the longer 10yr+ index.

An additional benefit of the iBoxx indices is that different families of indices provide information by both tenor and by credit rating. This allows us to focus on debt with similar characteristics to the asset we are looking to set the cost of debt for.

We consider that their use for onshore network price controls has further strengthened the arguments behind using these indices.

We use a cross-check to the iBoxx GBP infrastructure indices. These are not broken down into a credit rating, but we consider that these would provide comfort in using the non-financial corporate indices as the basis for setting the cost of debt if the figures are aligned between different indices of the same tenor.

3.3.2. Trailing average period

Broadly speaking, where debt is raised as a one-off exercise for a specific asset investment, we propose to consider the prevailing cost of debt at the point it is raised. The spot rate represents the most up-to-date estimate of the cost of debt, however a trailing average can smooth out some of the volatility.

The choice will depend on how the rate is applied; if it is set at financial close for a project, a spot rate or short (e.g. 20-day) trailing average can minimise differences in the timing of debt being taken out and an allowance being set. If an annual rate is being set for all projects reaching financial close in that time period, rather than one particular date, it may be appropriate to consider a slightly longer trailing average, such as one year.

3.3.3. Transaction and carry costs

The iBoxx indices provide an overall yield, but we also include an allowance for transaction costs. Good regulatory practice dictates the need to include an allowance for efficient costs, and we recognise that the transaction costs for acquiring debt will not be zero, even for the most efficient regulated company. To avoid double counting transaction costs, if an allowance is made within the cost of debt, no additional transaction costs allowance should be included in other building blocks.

[3] Ofgem (2011). Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues.

We also consider the cost of carry, namely the cost of incurring debt before it is required due to the nature of debt raising. As Ofgem uses a RAB model, there is no allowance for interest on debt that has not been used. We include an allowance for the cost of carry under debt transaction costs (discussed in Section 6.1). The cost of carry will be affected by the assumed profiling of raising debt and what is assumed as the interest that can be earned on unused cash.

3.4. Estimating cost of equity market parameters

Two components of the CAPM-based cost of equity are common to all assets with a common start date and time horizon: the risk-free rate and the MRP. These two components are typically assumed to be related, and they may therefore be estimated jointly. This section summarises the main methodological considerations.

3.4.1. Approaches

Recent regulatory precedent assumes some sort of relationship between the risk-free rate and MRP. There is no consensus on what the precise relationship is, although UK regulators have historically placed weight on the view that the TMR is more stable than the risk-free rate.

This focus on the TMR has increased since the Competition Commission (CC)[4] published its interim findings on the Northern Ireland Electricity (NIE) price control in 2014.[5] Our approach similarly focuses on estimating a suitable TMR and risk free rate, and thus inferring the MRP from the other two parameters i.e. subtracting the risk-free rate from the TMR.

3.4.2. Estimating the risk-free rate

The risk-free rate is a theoretical rate of return on an instrument which has zero risk of default. UK government bonds (gilts) tend to be the accepted proxy to represent the risk-free rate (either in nominal or index-linked form). We consider it appropriate to match the term of the gilts to the length of the investment horizon to estimate the appropriate risk-free rate.

In determining the appropriate proxy for the risk-free rate, we must also consider whether to use nominal gilts or inflation indexed gilts. Nominal gilts are most often used as certain biases may be present in the yields of inflation-indexed gilts. Using nominal gilts allows for inflation to be explicitly estimated in a manner that is consistent with other parameters.

3.4.3. Estimating equity market returns

We focus on estimating the expected TMR first, rather than an approach than looks to calculate the MRP and derive the TMR from adding the risk-free rate and MRP parameters.

[4] Competition Commission, now Competition and Markets Authority (CMA).

[5] Competition Commission (2014). Northern Ireland Electricity Limited price determination. A reference under Article 15 of the Electricity (Northern Ireland) Order 1992. Final determination.

Market expectations can be inferred from a variety of different sources and methodologies, each with strengths, drawbacks, and their own intricacies.

Market expectations can be ascertained through averaging historically observed returns and applying the assumption that this represents future expectations, or through applying forward looking frameworks. Our preferred approach, described below, is to combine these two sources of information based on the investment horizon of the project in question.

Forward-looking approaches

There are different sources of forward-looking evidence that can be utilised when estimating the TMR such as the Dividend Growth Model (DGM)[6] and survey evidence.

One of the most commonly used sources of forward-looking return expectations, and the one that we focus on, is the DGM. Survey evidence is often considered unreliable and drawing conclusive expectations from these surveys is difficult.

A DGM can be used to estimate expected returns for individual firms or for the market as a whole. We use the DGM to estimate TMR as an input to CAPM. The model estimates a TMR based on the current dividend yield and expectations of macroeconomic growth. A single-stage model involves one fixed macroeconomic growth assumption, while multi-stage models involve varying macroeconomic growth assumptions. Full details of our approach are provided in Annex A.

Ofwat's final PR19 methodology in December 2017 notes the importance of forward-looking analysis in underpinning their TMR estimate.[7] Ofwat utilises estimates provided by two separate consultants, PwC and Europe Economics. PwC's updated real RPI TMR range for Ofwat was 4.9% to 5.4%, compared to 5.2% to 6.0% for Europe Economics – based on a 3.0% RPI estimate, this gives a broad range of 7.9% to 9.0% in nominal terms. In terms of the DDM outputs itself, the estimates quoted by Ofwat are shown in Table 3.1 below.

[6] This looks to analyse future changes in dividends. A dividend discount model (DDM) is very similar and aims to establish the value of a company from the discounted value of all future expected dividends. The models are very similar and so can be considered interchangeable for the purposes of our analysis.

[7] Ofwat (2017) Delivering Water 2020: Our methodology for the 2019 price review, Appendix 12: Aligning risk and return.

Table 3.1: Nominal TMR estimates derived for Ofwat PR19 price control

Model and date of estimate	Nominal TMR	Description
1. PwC multi-stage GDP-based DGM (Oct 2017)	8.4-8.7%	Based on FTSE All Share Index, including buybacks Dividend Growth Assumptions based on OBR and Consensus Economics UK GDP forecasts Use short-term (<5yr) and long-term (>5yr) assumptions
2a. Europe Economics multi-stage GDP-based DDM (Mar 2017)	8.0-9.0%	Based on FTSE All Share Index, including buybacks Dividend Growth Assumptions based on IMF UK GDP forecasts Use short-term (<5yr) and long-term (>5yr) assumptions
2b. Europe Economics multi-stage GDP-based DDM (Mar 2017)	8.3-8.9%	As above, but deflated using expected inflation, rather than outturn inflation
3. Europe Economics multi-stage historic dividend growth-based DDM (Mar 2017)	7.3-8.3%	Based on FTSE All Share Index, including buybacks Dividend Growth Assumptions based on historic FTSE All Share Index dividend yields and growth

Source: Ofwat[8]

The approach used by Ofwat's appointed consultants involves the use of a multi-stage model, whereby the macroeconomic growth rate for five years is based on short-term forecasts, with a long-term growth estimate used thereafter.

We note that any DGM is sensitive to input assumptions, which change based on prevailing forecasts, causing differing DGM results at different points in time. Therefore, when using a DGM approach, care needs to be taken that the estimates are appropriate.[9]

The Bank of England has recently updated its approach to estimating the DGM.[10] The change incorporates share buybacks, and is aimed at improving the ability of the DGM to capture variation in risk-free rates across different maturities and reflect variation in long-term growth expectations.

[8] Ofwat (2017) Delivering Water 2020: Our methodology for the 2019 price review, Appendix 12: Aligning risk and return.

[9] For example, a key difference between the DGM specification used by CEPA, PwC and Europe Economics, as opposed to the Bank of England relates to the basis for growth assumptions. The former organisations used GDP-growth as the basis for forward looking expectations, while the Bank of England uses analyst forecasts for the market.

[10] W. Dison and A. Rattan, Bank of England (2017). An improved model for understanding equity prices.

Historic average approaches

When looking at the TMR based on historic averages for network decisions, recent UK regulators have typically referred to the longest available time period (since 1900), as published in the annual Credit Suisse Global Investment Returns Yearbook, authored by Dimson, Marsh and Staunton (DMS). The most recent update based on this dataset indicates an arithmetic average of 7.3 per cent and a geometric average of 5.5 per cent.

Geometric averages are lower than arithmetic averages as they do not take into account the volatility of annual excess returns over the averaging period. The more volatile the sequence of returns, the greater the extent to which the arithmetic mean will exceed the geometric mean. In practice, a blended measure should be preferred. For example, the Blume (1974) formula below, where T= number of historic years of data and N= number of forecast years.

Returns(T) = geometric mean(T-1)/(N-1) + arithmetic mean*(N-T)/(N-1)*

The main drawback of historic evidence is that it may not be reflective of current and future market conditions. In periods when we do not consider that long-term historic averages are able to provide a good indication of future returns, adjustments may be made to this historic evidence, or forward-looking evidence may be used instead, or in addition to, the historic evidence.

The rationale for using historic evidence is that outturn returns represent a good proxy for future expected returns. This evidence may be used without adjustment ('ex post' approach), or adjusted ('ex ante' approach). The ex ante approach could reflect positive or negative distortions, luck, or specific circumstances that are not expected to be repeated in future. DMS suggest that equity investors in the twentieth century benefited from higher than expected returns. This means that historic realised returns could overstate expectations of future returns, as noted by Ofgem in RIIO ED1.[11]

If using nominal historic returns, the calculation of RPI inflation may indicate the need for an adjustment, given the 'formula effect' is seen to have increased the difference between CPI and RPI inflation. In their PR19 final methodology document, Ofwat adjust down historic returns by 33bps to account for this.[12]

Comparing approaches

We consider it appropriate to place different weightings on historic and forward-looking evidence depending on the type of decision that requires the market return input. Table 3.2 assesses the relative merits of using long-run historic versus forward-looking data.

[11] Ofgem (2014) Decision on our methodology for assessing the equity market return for the purpose of setting RIIO-ED1 price controls, February 2014
[12] Ofwat (2017) Delivering Water 2020: Our methodology for the 2019 price review, Appendix 12: Aligning risk and return.

Table 3.2: Comparison of relative merits between using long-run and forward-looking market evidence to estimate market return expectations

Consideration	Long-run historic evidence	Forward-looking market evidence
Considerations of higher significance to decisions relating to shorter-term periods e.g. IDC		
Relevance to current market outlook	Historic data is backward-looking.	By definition, based on current market expectations.
Matching of investment incentives to financing costs	May create incentives for over-investment when the market anticipates lower returns than historic, and deter investment when the market anticipates higher returns than historic.	Better matches investment incentives with current market data.
Considerations of higher significance to decisions relating to longer-term periods		
Stability (minimal volatility) between decisions	Less volatile as based on long-term historic trends.	More volatile as views of the market return is likely to change (although may be offset by the beta term)
Investor confidence	Provides long-term stable returns on their long-run averages.	More uncertainty between each decision, which can be mitigated by a commitment to a certain approach/ methodology.
Considerations of similar significance to shorter- and longer- term decisions		
Degree of interpretation required	Need to assess whether historic figures are appropriate for estimating future equity return expectations, but overall there is limited need for interpretation	Greater number of assumptions are required, for example with DGM analysis.
Intergenerational equity – investors & consumers	May lead to over-rewarding of current investors (or over-charging of current consumers) if these overestimate required equity returns today.	More accurate representation of current business costs to current investors and consumers.

There are merits and drawbacks to both approaches, and the weight placed on these different sources of evidence should depend on the context for a decision.

Historic returns are most suitable for long-term investments where investments are being made on a rolling basis, whereas forward-looking evidence is most appropriate with one-off investments and a short-term investment horizon, such as with the IDC.

3.5. Estimating asset risk

The equity beta measures the systematic, non-diversifiable risk of a levered asset or of a portfolio of levered assets, relative to the market as a whole.[13] The equity beta of a specific company is an input to the CAPM framework in the determination of the expected equity return to investors for that specific company.

3.5.1. Options

As pure-play betas are often unobserved, estimating beta requires a range of techniques, including both quantitative and qualitative analysis. Quantitative analysis comes in the form of comparator beta benchmarking. Qualitative analysis is often undertaken by considering relative risk in relation to the benchmarked comparators or in relation to other regulatory precedent. In order to arrive at an appropriate beta for the IDC phase of new asset investments, we employ both these approaches.

Company equity betas can be determined in several ways:

- Betas can be observed directly from market evidence through an ordinary least squares (OLS) regression (or through comparator benchmarking) and applied mechanistically.
- Discretional adjustments can be applied to observed equity betas to account for varying levels of risk.
- The equity beta can be estimated bottom-up through a more theoretical model that does not require quantitative empirical estimates.

We focus our discussion on the various approaches that use observed equity betas from comparator companies as a benchmark to infer betas for companies who are not publicly traded.

3.5.2. Estimating betas

One approach is to base the equity beta assumption directly on empirical evidence of comparator betas without post-estimation adjustments. In this sub-section we consider how this approach could be applied.

There are a number of options available in estimating beta directly and mechanistically adjusting it to the specific gearing level of the individual company. The adjustments take estimates of the observed raw (levered) equity beta and then translate this into an asset beta and finally re-lever the asset beta to arrive at the re-levered equity beta.

The asset beta, which is not directly observable through market data, represents the equity beta of a company with no debt. In performing comparator equity beta benchmarking, we

[13] Levered assets refer to assets that are funded through both equity and debt.

must remove the impact on the observed company's discretionary gearing decision, to make the beta more easily translatable to other comparator companies whose equity betas we do not observe.[14] Once the asset beta has been calculated, it is necessary to re-lever the asset beta at the company specific (notional or actual) gearing level to arrive at the individual company's equity beta. This re-levered equity beta is the input into the CAPM framework. The mechanics required to arrive at the re-levered equity beta from the observed comparator company raw equity beta are discussed below.

Table 3.3 below discusses various options in the approach for estimating the observed raw equity beta, and for converting this raw equity beta to reflect company specific gearing.

Table 3.3: Options in approach for estimating beta

Option	Description
Estimates of raw equity beta	
Comparator companies	The inclusion of observed comparable companies to benchmark the appropriate equity beta requires careful consideration. Ideally, comparator companies should be pure-play (i.e. publicly traded and focused on only one industry of product), though these are difficult to find. In practice, regulated utility network comparators may have international or non-regulated business areas which distort the equity beta. Benchmarking against companies that are not pure plays may require discretionary adjustments to the equity beta, upward or downward.
Sample size	A larger sample size of comparator companies may be more statistically significant however a smaller, more representative sample size may better reflect the systematic risk of the company in question. Betas can be estimated by averaging the betas of every company within a particular industry (such as a Bloomberg Classification), or through hand-selecting a few specific companies that are particularly relevant in terms of future business risk.
Returns frequency	The returns frequency determines the period over which returns are calculated. Conventional options include daily, weekly, monthly, and annual returns, although theoretically, return frequency can be any discrete period over which prices are recorded. Using higher return frequency (e.g. daily) increases the number of observations in the OLS regression, however this may introduce a non-trading bias. A non-trading bias is introduced when the equity stock in question does not trade every day, but the market does, which systematically reduces correlation with the market index for reasons that do not represent market risk.

[14] The asset beta is also commonly referred to as the unlevered beta.

Option	Description
Returns horizon	In order to calculate beta, we must decide on the horizon for which we wish to calculate returns. There are trade-offs involved in this selection; a longer horizon (such as five years) provides more observations in the OLS regression, but assumes that characteristics of the firm, such as business risk and leverage, have remained constant for the period. Since the beta should estimate forward-looking risk, a longer return horizon may capture information that is weighted too heavily on backward-looking evidence. On the other hand, shorter horizons (such as two years) may be less statistically robust, especially depending on the selected returns frequency, but may better represent the future operations of the business. When estimating beta, it is important to consider whether the observed company has undergone dramatic business changes recently as this will help determine the appropriate returns horizon.
Use of trailing average	After determining the appropriate assumptions for returns frequency, horizon and index, we must then determine from what point in time we wish to consider the calculated equity beta. As with other parameters estimated from historic market data, the equity beta can be set based on the spot rate or based on some trailing average period, and there are trade-offs associated with each approach. Using the spot equity beta may best represent the future expectations for beta, as it will not capture uncharacteristic changes in business risk. However, the spot equity may be more volatile and less predictable than a trailing average. It's important to consider the use of a trailing average in conjunction with the selected returns horizon; if a longer returns horizon is used and a long trailing average period is used, data points included in the sample may not represent the current and future business risk.
Relative index	There are no indices that represent the true market portfolio. Convention is to use an equity index to estimate the equity beta, but what is the appropriate scope of the index? The underlying index used to represent the market portfolio should be consistent with the market used to estimate the risk-free rate and market risk premium. Ensuring that the marginal investor in the index selected is diversified and that the index represents a large selection of equity assets will increase the robustness of the market portfolio assumption. For the purposes of UK regulation, the FTSE All-Share index appears to best fit the criteria.
Currency	Where estimates are used from different markets or jurisdictions, using different currencies to estimate returns can lead to differences in beta estimates.

Option	Description
Estimation adjustments	Bloomberg's adjusted beta calculation adjusts the OLS beta estimate toward one (a Bayesian adjustment), regardless of industry or market.[15] A more sophisticated adjustment, known as the Vasicek Adjustment[16], shifts the OLS beta estimate toward one and the magnitude of the shift is greater when the standard error of the OLS estimate is higher. In other words, the OLS beta estimate is given more weight when it is more precise and less weight when it is less precise. Both adjustments utilize a prior expectation that beta is equal to one. This is to reflect the fact that betas are used to estimate future risk relative to the market and there may be issues with how the beta is estimated. However, the rate of convergence to one will vary greatly across companies and the extent to which this movement towards one is representative of a pure-play regulated utility is uncertain. Given the purposes of estimating an equity beta for use in forward-looking periods defined by price controls, this adjustment is likely not required for regulated utilities.
Conversion between asset betas and (re-levered) equity betas	
Gearing	Gearing, applied to de-lever and re-lever the equity beta, can be calculated either by subtracting cash positions from total interest-bearing debt (net debt) or by including only interest-bearing debt (gross debt). There is also a question of what point in time gearing should be calculated. Gearing measures typically change on a quarterly basis, when companies release quarterly earnings and balance sheets. The levering calculation can utilise gearing calculated from the most recent data point or as an average across the period used to calculate the raw equity beta.
Debt beta	The beta of a portfolio is equal to the weighted average of the betas within that portfolio. As a firm's assets can be considered a portfolio of its debt and equity holdings, the asset beta can be thought of as the weighted average of the equity beta and the debt beta. Debt betas, which measure how the value of cash flows to debtholders changes with market conditions, are often assumed to be zero for several reasons. First, debt betas are likely quite close (almost negligibly close) to zero, especially for the investment-grade companies in question. Next, calculating a precise debt beta is not straightforward and academic research in this area is limited (as opposed to equity betas).
Re-levering of equity beta	The CAPM model implies that the equity beta changes with the level of gearing. Where gearing increases, the equity beta is posited to increase in proportion to the use of debt in the financing structure. The outcome of this is that the post-tax cost of capital tends not to be very sensitive to the level of gearing. A linear relationship is simple, though alternative relationships may be more realistic in practice.

[15] Adjusted beta = (0.67)*OLS Regression Beta + (0.33)*1.00, i.e. the adjusted beta is a weighted average of the OLS regression beta estimate and one. This is known as the Blume Adjustment.
[16] Brooks et al. (2013). The Vasicek adjustment to beta estimates in the Capital Asset Pricing Model.

3.5.3. Applying cost of equity comparators

Competitively tendered assets, such as those in the OFTO regime, provide us with a directly relevant point of comparison to help estimate the cost of equity for the competition proxy model, through the reported internal rate of return (IRR) on invested equity capital. Where regimes are suitably similar we can apply a more holistic approach to the cost of equity and adjust at the overall cost of equity level using a relative risk assessment, rather than build up the cost of equity by estimating individual parameters.

The approach of benchmarking comparators must appropriately adjust for the riskiness of the asset in question and must also take account of any differences in market circumstances since the date of the comparator competition. Generally, only the headline WACC figures from competitively tendered comparators are publicly available, and the IRR is not necessarily explicitly determined through the CAPM approach. Estimating the implied equity beta (or other CAPM parameters) is therefore not possible without knowing certain investor specific assumptions such as their effective tax rate and reference market parameters.

The risk-adjusted IRR evidence can be compared to bottom-up quantitative estimates of the cost of equity and WACC, to ensure that the results of our theoretical approach make sense in the context of the revealed evidence from competitively tendered comparators.

We undertake relative risk analysis to help our understanding of a benchmark level for the cost of equity for new asset investment, to ensure that our approach is appropriate within the wider context.[17] When there are many comparator projects, a relative risk analysis may remove the need to develop a separate bottom-up conceptual estimate using cost of equity parameters.

This relative risk analysis typically complements empirical analysis of asset beta estimates. However, the available comparators for the empirical analysis will always have some differences to the asset which we are focusing on. It can be helpful to undertake a qualitative assessment of the various ways in which they differ, and then to come to a conclusion on the overall impact of these differences. A higher number of benchmarked assets may allow us to better triangulate where the new assets investments fall on the risk scale.

A discussion of our relative risk categories for both the construction and operational phases is contained within Annex B.

3.6. Gearing

A project's gearing is the proportion of debt finance used. Within the CAPM, it determines the balance between the costs of debt and equity in calculating the overall WACC. It is also

[17] For the cost of debt, the credit rating is used to reflect risk, while more risky projects are unlikely to be able to sustain very high levels of gearing.

used as an input into the equity beta calculation, with the equity and asset betas typically being related through the following formula (assuming no debt beta is applied):

$$\beta_a = (1 - g) * \beta_e$$

where the subscripts *a* and *e* denote the asset and equity betas respectively, and *g* denotes the level of gearing.[18]

As a result of the re-levering formula, changes in gearing typically have limited impact on the overall post-tax cost of capital based on a given view of the asset beta, as an increase in the weight placed on cheaper debt is offset by a higher equity beta as a consequence of the increased financing risk.

In general, we would seek to use the same comparators to estimate a suitable level of gearing as for the estimate of beta. Where the gearing of the beta comparator set is adopted directly, there is no need to de-lever the raw equity beta into an asset beta, and then re-lever to an equity beta to account for a different gearing assumption.

However, this approach is not always possible – particularly where no single comparator set can be used to estimate beta. Where multiple comparator sets are possible, we would propose to focus on estimating a suitable asset beta, such that the overall cost of capital is relatively insensitive to the assumed level of gearing. In order to estimate that level of gearing, we would propose to balance evidence of gearing across the different comparator sets.

3.7. Treatment of tax and inflation

Different applications and estimations of tax and inflation may have significant impacts on how the same underlying cost of capital is presented and applied. Inflation should be estimated using an index that is relevant to the costs faced by the company or project and expectations should relate to the investment horizon. Tax allowances can be applied directly within the WACC or through cost building blocks in the allowed revenue formula.

3.7.1. Inflation

Investors' returns should allow for inflation in one form or another. Historically, regulators have used RPI inflation, because for many years it was the only official UK inflation statistic. However, the UK's inflation target was linked to CPI in 2003. In February 2017 CPIH became the headline measure of inflation (this measure includes housing costs and council tax), and RPI was de-designated as a national statistic in 2013.[19]

[18] The above formula assumes a zero debt beta, as proposed in Section 3.5.2.
[19] The Bank of England's 2.0% inflation target continues to be based on CPI inflation.

While regulators have started to move away from RPI (e.g. Ofwat,[20] Water Industry Commission for Scotland,[21] and Ofcom[22]), there is some resistance to moving fully to CPI where companies have embedded debt liabilities, as that debt will be denominated in RPI. Ofwat is moving to 50:50 RPI and CPI (or CPIH) from 2020. Central Government index-linked securities are RPI indexed and the Debt Management Office has not announced plans to issue CPI index-linked securities – however some CPI index-linked securities have been issued in recent years, supporting the move to CPI (or CPIH).

As new assets do not have any pre-existing financing, and in particular no RPI-linked exposures, we consider that there are benefits in utilising CPI or CPIH.

Where we use inflation expectations, these should relate to the investment horizon and be consistent with the approach used in estimating parameter values. For example, were we to consider five-year tenors for the cost of debt, five-year expectations of the rate of inflation are relevant.

The regulator also may choose between applying a nominal or real WACC. If applying a real WACC, inflation is compensated through annual indexation of the asset base for which a return is allowed. If applying a nominal WACC, there is no need to allow for inflation through annual indexation. In UK regulatory precedent, a real WACC is most commonly utilised.

3.7.2. Treatment of tax

Investors must also be compensated for their corporate tax liabilities they face. For the purposes of regulatory price controls, WACC can be calculated in two main forms: vanilla and pre-tax. The vanilla WACC uses the post-tax cost of equity, whereas the pre-tax WACC adjusts the equity side of the equation as highlighted in bold in the two equations below. The pre-tax WACC calculation assumes that the effective tax rate on pre-tax profit is close to the statutory company tax rate.

$$\text{Vanilla WACC} = \left(\boldsymbol{cost\ of\ equity} \times \frac{equity}{equity + debt}\right) + \left(cost\ of\ debt \times \frac{debt}{equity + debt}\right)$$

$$\text{Pre} - \text{tax WACC} = \left(\frac{\boldsymbol{cost\ of\ equity}}{\boldsymbol{1 - tax\ rate}} \times \frac{equity}{equity + debt}\right) + \left(cost\ of\ debt \times \frac{debt}{equity + debt}\right)$$

We present the vanilla WACC throughout this document, as this has historically been the approach taken by Ofgem and Ofwat – though the use of the vanilla WACC is not universal in GB economic regulation. For example, the Civil Aviation Authority (CAA) and Competition Commission (CC)/ Competition and Markets Authority (CMA) have used the pre-tax WACC in recent years.

[20] Ofwat (2016). Water 2020: our regulatory approach for water and wastewater services in England and Wales.
[21] Water Industry Commission for Scotland (2014). The Strategic Review of Charges 2015 – 2021: Draft Determination.
[22] Ofcom (2013). Review of the wholesale broadband access markets.

Vanilla WACC is preferred when the statutory tax rate differs from the effective tax rate, especially across the industry. A vanilla WACC allows the regulator to add the company- or project-specific tax as a cash flow to the cost building block whilst applying a consistent vanilla WACC to all applicable investors in the industry.

4. ASSESSMENT OF CURRENT APPROACHES

This section summarises and assesses current approaches used by Ofgem to set IDC allowances (Section 4.1) and interconnector cap and floor rates of return (Section 4.2). Where appropriate, we indicate which aspects of each approach we consider should be revised. Our proposed revised approaches are set out in Section 6 (for IDC) and Section 8 (for interconnector cap and floor).

4.1. Interest During Construction (IDC)

Ofgem currently adopts the same approach to setting the main IDC parameters for both OFTO developers and interconnectors, with the main difference being in the additional premia that are applied to IDC for interconnectors. We note that the cost of capital figures are quoted in different forms, with a pre-tax nominal WACC used for OFTO developers and a real vanilla WACC quoted for interconnector IDC.

4.1.1. Common aspects of the IDC approach

The main IDC parameters, which Ofgem currently estimates in the same way for both OFTO developers and interconnectors, are:

- **Cost of debt.** Ofgem utilises a two year trailing average yield on A and BBB rated bonds of more than 10 years from iBoxx GBP non-financial corporate series.
- **Risk-free rate.** The risk-free rate is based on a ten-year trailing average of UK ten-year nominal gilts. This is similar to the basis for the risk-free rate in onshore network price controls.
- **MRP and TMR.** Ofgem sets the MRP directly, using a geometric mean of historic worldwide equity risk premia over bonds, based on Credit Suisse Global Investment Returns Sourcebook evidence. There is no specific estimate of TMR, though one can be inferred by adding the risk-free rate and MRP.
- **Equity beta.** This is based on integrated utility comparators. The integrated utility comparators were originally chosen given their involvement with offshore wind projects.

In the remainder of this sub-section, we focus on three different cost of capital estimates based on these common aspects of Ofgem's IDC approach (quoted in pre-tax nominal terms):

- Ofgem's current IDC for OFTOs for 2017/18;
- CEPA's analysis of 2018/19 IDC using Ofgem's 2017/18 approach; and

- an illustrative projection of IDC in five years' time based on forward curves for the risk-free rate and cost of debt[23].

Table 4.1 below presents the results of the current Ofgem approach. It is important to note that the resulting WACC – 6.83% in 2017/18 – has been applied successfully for a number of projects and the methodology for annually determining the WACC has been applied successfully for several years. However, although based on currently available data the estimate of the 2018/19 WACC is similar to the 2017/18 version, there are significant changes to individual parameters. Our projection to 2023/24, while illustrative, highlights the likelihood that individual parameters and the overall WACC will change further.

Table 4.1: Comparison of different approaches to setting the IDC for OFTO developers (nominal)

Parameter	Ofgem 2017/18	Ofgem 2018/19*	Ofgem 2023/24*
Risk-free rate	3.12%	2.76%	1.81%
ERP	4.40%	4.40%	4.40%
TMR (implied)	7.52%	7.16%	6.21%
Equity beta	0.93	0.84	0.84
Gearing	41.2%	24.5%	24.5%
Asset beta	0.93	0.84	0.84
Cost of Debt	3.86%	3.41%	3.85%
Pre-tax nominal WACC[24]	**6.83%**	**6.85%**	**6.06%**

*Source: Ofgem. *Projections estimated based on CEPA analysis of expected market movements.*

These changes indicate that the approach may not be robust to projected future market conditions. We identify two key issues relating to the sensitivity of IDC rates to future changes:

- Forward curve evidence indicates the cost of capital is expected to be on an upward trend to 2023/24, with a rising risk-free rate likely to signify higher costs of debt and equity. However, the projected 2023/24 WACC using this evidence would be nearly 80 bps lower than the 2018/19 WACC.
- Based on current evidence, the 2017/18 implied TMR of 7.52% is at the low end of the range (see Section 6.2.2). Again, though forward curve evidence on the risk-free rate indicates an expectation of an upward trend, the projected 2023/24 TMR using this evidence would be 130 bps lower than in 2017/18.

A decrease in the allowed cost of capital and implied TMR is not consistent with increases in individual parameters for one-off investments raising finance at a set point in time. In addition, the use of a cost of debt index with a relatively long (>10 years) tenor risks over-compensating investors for the actual cost of debt relating to short investment periods (IDC

[23] All parameters other than the risk-free rate and cost of debt are assumed to remain fixed for the purpose our future estimates.

[24] Tax rate assumed to be 19% throughout.

periods are typically 2-5 years) in a time of relatively low prevailing debt costs. A mismatch between rates in the market and that allowed by Ofgem could risk investment not taking place (if rates are too low) or windfall gains for investors (if rates are too high).

Changes in beta and gearing estimates between 2017/18 and 2018/19 were also significant. Such changes may reflect statistical noise in the calculation rather than genuine, underlying changes in asset risk, and may therefore create uncertainty around future values.

We therefore propose to modify the current approach in the following ways:

- For the cost of debt, we will aim to align the tenor of corporate bonds considered with the duration of the construction period, and at the same time place more weight on BBB rated debt to reflect risks during construction. A shorter trailing average or spot rate should be considered, in order to capture the prevailing cost of debt at the point finance is raised.
- For the risk-free rate, we will similarly aim to align the tenor of gilts more closely with the duration of the construction period, and using current evidence rather than a long-term trailing average to reflect the one-off nature of the investment.
- In relation to the MRP, we will estimate an implied figure based on estimates of TMR and the risk-free rate. We propose to draw on a broader evidence base (including both historic and forward-looking approaches) and focus on the UK rather than the world index for consistency with other parameters and to reflect where the asset is generating returns for investors.
- Finally, for the equity beta and gearing, we consider that the comparator set should incorporate both construction and engineering companies, and regulated networks. The construction and engineering companies are undertaking similar activities to the new assets we are setting a cost of capital for, while the presence of the regulatory regime can materially change the risk profile of a firm.

Further detail on how we propose to apply these adjustments to the approach is contained in Section 6.

4.1.2. IDC uplifts for interconnectors

As noted previously, the difference to the OFTO developer IDC is that, historically, two additional risk premia have been added to the IDC rate for interconnectors:

- construction risk; and
- development risk.

The combined effect of these premia is a 1.45% adjustment to the real cost of capital for interconnectors: this is equivalent to an increase in the asset beta of around 0.3, a very large increase. This is clearly particularly material for setting the cost of capital.

Part of the rationale for the uplifts concerns the degree of construction risk. Our view is that this is better captured through the asset beta, as it concerns the underlying riskiness of an interconnector construction project. We consider the appropriate degree of weight to be placed on construction and engineering comparators relative to other comparators in Section 6.3.

The premium for development risk was originally proposed by Grant Thornton in order to reflect potential "development phase risk in the context of the regulatory regime"[25]. The premium was proposed by Grant Thornton specifically in the context of the Nemo interconnector, which represented a pilot project for Ofgem's proposed cap and floor regime. This regime is now relatively mature, with six interconnectors having received approval for the cap and floor regime, and Ofgem having set out a minded-to position to grant a further three approval in principle. With greater clarity over Ofgem's approach to interconnector project assessment, our view is that the development risk uplift should no longer be required.

4.2. Interconnector cap and floor

For the interconnector cap and floor, the current approach for the second interconnector cap and floor window is set out below. This is for the operational phase, rather than the construction phase that has been discussed earlier within this section.

4.2.1. Floor returns

The presence of the floor is intended to ensure an interconnector that meets a minimum threshold on availability is able to finance its debt, irrespective of the level of gearing.

The return for the floor assumes 100% debt financing, estimated using a 20-day trailing average of the iBoxx non-financial corporate A and BBB rated 10yr+ index at the time of the Final Investment Decision.[26] This gives a nominal yield which is deflated using 10yr breakeven inflation. We refer to this regime as the default option as a potential variation was introduced by Ofgem as described below.

In a December 2015 letter by Ofgem on enabling financing solutions, a variation on the default option was raised that involved the use of an actual cost of debt to ensure financeability and increase transparency and certainty.[27] However, Ofgem requires evidence that the actual cost of debt would represent an efficient overall outcome for consumers. Evidence would take the form of a fully transparent funding competition and assurance that the project is structured efficiently.

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[25] Grant Thornton: *'A review of IDC for generator build offshore transmission projects and Project NEMO – Stage 2 report'. (2013)*

[26] As of 1 November 2017, the average time to maturity of the non-financial corporate 10yr+ indices is 23.26yrs for broad A rated bonds, and 19.30yrs for broad BBB rated bonds.

[27] https://www.ofgem.gov.uk/sites/default/files/docs/cap_and_floor_regime_variations_open_letter.pdf

4.2.2. Cap returns

The rate of return used to calculate the cap is intended to permit returns up to and including a level broadly similar to those earned over the long term by peaking generators[28], as this represents a reference point for an alternative source of electricity in the absence of the interconnector. Ofgem estimates this rate of return on the following basis:

- The overall approach follows the CAPM in estimating individual components of the cost of equity:
  - The risk-free rate is set based on a long-term estimate of the real risk-free rate.
  - Total market returns are set based on long-term evidence leading to a figure of 6.8%.
  - The equity risk premium is defined as the residual between total market returns and the risk-free rate.
  - The equity beta is set at 1.25 based on analysis of Drax, at the time a publicly traded peaking electricity generator.
- The return is then applied as though calculated on a pure equity financed basis, i.e. assuming 0% gearing. This means only a cost of equity is required.

We consider that this approach – estimating a long-term rate of return similar to that earned through electricity generation at the margin – remains appropriate given the objectives of the interconnector cap and floor regime. However, two aspects of the approach warrant further consideration as part of this review.

First, at the time of setting allowances for the Nemo interconnector, Ofgem noted that Drax was, in the future, expected to pursue a strategy that involved a greater proportion of biomass generation, and so future movements in Drax's asset beta were considered potentially less relevant to the level of the cap. No future approach was discussed. We propose to investigate whether an equity beta of 1.25 remains a reasonable reflection of rates of return for peaking electricity generators or similar asset classes.

Second, new evidence and continued trends in market indicators suggest that Ofgem may wish to update its view of the representative long-term risk-free rate and total market returns.

[28] Peaking power generation runs only when there is high demand and represents a marginal source of electricity.

5. COMPETITION PROXY COST OF CAPITAL: OPTIONS

Ofgem has not previously set out an approach for determining the cost of capital for a separable, new and high value onshore investment. This section sets out the main high level options for such an approach, taking into consideration the objectives Ofgem has set out.

There are two main decisions Ofgem must make. First, how should the two distinct phases of the investment – construction and operations – be treated? This is discussed in Section 5.1. Second, at what point(s) should allowances be set and finalised? This is discussed in Section 5.2.

Once these high-level options have been decided, further detail is required on how a fair and reasonable rate of return is calculated. This rate of return should reflect the prevailing cost of capital at the time the investment is made, taking into account the investment horizon and the nature of the risks investors would assume. Estimating the relevant rates of return is the subject of Sections 6 and 7.

5.1. Treatment of project phases

As noted in Section 3, two distinct phases can be identified for investments in separable, new and high value onshore assets: the construction phase and the operations phase. There are two key differences between these two phases that are relevant to estimating the cost of capital:

- Non-diversifiable risks relating to the nature of the activities undertaken will differ, with the construction phase generally associated with greater risks than during the operations phase.
- The time horizon for each phase will differ, with the construction phase being significantly shorter than the operations phase.

In principle it may be possible to abstract away from these differences and set an overall cost of capital covering the full investment cycle. Indeed, for onshore network companies in general, regulators typically estimate a single cost of capital. The outcome of a competition for such projects would also likely be a single cost of capital.

However, our view is that the differences between phases would be factored in by investors in such a competition, even if the ultimate outcome is a single number. Considering each phase separately would add transparency to the process. It also expands the range of evidence available. Ofgem already estimates a cost of capital for construction, and the OFTO assets are a natural benchmark against which to assess the required cost of capital for operating new electricity transmission assets. Evidence from onshore networks may be harder to interpret, as those networks have differing blends of construction and operations, have large portfolios of existing assets, and operate under a different regulatory regime.

We therefore propose to consider each phase separately. We set out an approach to estimating the cost of capital in the construction phase in Section 6, covering IDC. We set out an approach to estimating the cost of capital in the operations phase in Section 7. The two key differences in the nature of the two phases identified above drive the main differences in the cost of capital estimates. The two phases have different risk profiles, and we propose to use benchmarks tailored to each.

The two phases also have different time horizons. The construction phase cost of capital should reflect a relatively short horizon covering the period of construction. The operations phase cost of capital should reflect the expected opportunity cost of locking in funds during the operations phase, which begins later and lasts longer than the construction phase.

5.2. Timing of allowances

The fact that the operations phase begins only upon construction completion means that there are two points in time at which Ofgem could finalise a specific operations phase allowance. Ofgem may decide to set an approach to cost of capital determination for both construction and operational phases at the outset of the project, but only provide a specific point estimate at the beginning of the operational phase. Alternatively, Ofgem might finalise both parameters at the project outset.

Similarly, investors in a competitive tender process might finalise their view of the operations phase cost of capital at two different points in time. Investors may intend to refinance following construction completion, at which point the risk profile of the asset would be expected to change, with an expected step-down in the cost of capital after the riskier construction phase is completed. Alternatively, investors might seek to fix the cost of capital for the entire project duration at financial close, effectively factoring in the expected step-down in risk post-construction.

Under an efficient competitive tender process in which refinancing is possible, a debt refinancing gain share mechanism is likely to be in place. Such a mechanism would incentivise the company to secure a low cost of debt, passing some of these benefits through to consumers. Under a Competition Proxy model, however, an index value is used for setting the cost of debt (rather than actual debt costs). This incentivises the project developer to obtain the lowest actual cost of debt. The incentive properties are therefore similar in this case.

In expectation and in theory, the two timing options should be equivalent. Both would reflect the expected opportunity cost of locking in capital during the operations phase. Both would therefore factor in the risk related to market movements in the cost of capital prior to the operations phase commencing.

We propose to consider each option in our analysis of the Competition Proxy operations phase cost of capital. Sections 7.1-7.5 set out our proposed approach and estimates based on current evidence. Section 7.6 then sets out our views on how future allowances would be determined. Our approach for IDC is unaffected by choice of timing for operations.

6. PROPOSED APPROACH FOR IDC

Our approach for IDC at the overall level involves the following changes from the current Ofgem approach, as discussed in Section 4. These changes include:

- shorter trailing average periods for cost of debt and risk-free rate to support a contemporary estimate of the cost of capital;
- aligning all parameter horizons with investment horizons, reflecting differences between asset categories to the extent permitted by the evidence;
- a focus on TMR, with the MRP implicitly defined as the difference between TMR and the risk-free rate; and
- linking the assessment of asset risk (beta) more directly to comparators that reflect the profile of risks faced – i.e. construction of varying complexity, with varying degrees of regulatory protection.

The following sections set out approaches for each parameter and our proposed ranges.

6.1. Cost of debt

In this section we seek to estimate ranges for the prevailing cost of debt applying to construction phase projects of relatively short duration. Given that different asset categories are expected to have different construction phase durations, we present estimates for each regime separately.

6.1.1. Approach

The cost of debt is comprised of a yield and efficient transaction costs. In estimating a suitable yield, we utilise benchmark indices. The use of benchmark indices helps provide clear incentives for outperforming the cost of debt allowance, which can in turn be used to set more accurate allowances in future.

Estimating the yield to maturity

As noted in Section 3.3.1, we consider the iBoxx GBP series are appropriate to use for setting the allowed cost of debt. We consider two families of indices here, namely non-financial corporates and GBP infrastructure indices. We primarily rely on the non-financial corporate indices as this gives us the ability to differentiate between credit ratings and tenors to a greater degree than the GBP infrastructure indices. Having reference to the GBP infrastructure indices does however provide comfort that the sector characteristics do not drive significant differences in debt costs.

Further information on our proposed approach is contained below:

- **Tenor**: we consider that typical projects across our regulatory regimes would have different length construction periods.

  - For OFTOs, we consider that the typical length of construction is c.2yrs, while for interconnectors this is c.4yrs. We consider the 1-3yr and 3-5yr indices respectively.
  - For the Construction Proxy model, there is more uncertainty as it has not been used to date, but based on the HSB transmission link (for which the construction period is expected to be 5 years), we utilise both the 3-5yr index and the 5-7yr index.
- **Credit rating**: we consider that for all asset classes, the low end of the range should reflect a combination of A and BBB rated debt, while the upper end of the range should be based on BBB rated debt. This reflects our view that the qualitative features of each regulatory regime would provide a reasonable basis for assuming a cost of debt equivalent with an investment grade rating during the construction period.
- **Trailing averages**: as we are setting the cost of debt for single assets, we consider prevailing estimates for the cost of debt (from spot rates to 1yr averages), rather than longer term trailing averages.

The use of investment grade benchmarks for assessing the cost of debt is a key feature of our approach. For construction phase projects within a regulatory context, such as these, key credit rating factors include the allocation of risk and the strength and clarity of future regulatory arrangements. We expect that the use of ex post assessment of efficient costs and a RAB would provide significant comfort for debt investors. Investment grade benchmarks have historically been used in Ofgem's assessment of IDC, and Scottish Hydro Electric Transmission Limited was able to obtain an investment grade rating (A3) in 2011 for debt raised to support a large, capital-intensive expenditure programme in a regulatory context. For these reasons, we consider an investment grade benchmark to be an appropriate basis for estimation, subject to clear evidence being provided to the contrary.

Estimating transaction costs and cost of carry

We consider that it is appropriate to include an allowance to reflect efficient transaction costs linked to debt financing. We consider that the level of transaction costs, all things being equal, should be higher than for onshore network price controls for two main reasons:

- the shorter time horizon over which fixed costs are recovered under the new asset regimes; and
- a higher cost of carry as the proportion of debt being carried is likely to be significantly higher.

Very little information is available in the public domain on the level of transaction costs, so there is a limited evidence based to draw upon. We seek to adjust assumptions typically applied in the context of onshore regulation for the shorter time horizon.

We also consider potential carry costs. Carry costs arise due to the difference between the cost of debt that has been drawn down but not spent and the deposit rates that can be earned on that balance. Such costs may be material if the profiling of expenditure and debt raising means that a significant amount of debt may need to be carried, and there is a significant mismatch between the cost of debt and deposit rates. These conditions may be fulfilled in the context of a relatively long construction project for which debt is assumed to be drawn down up-front. We have therefore carried out our own analysis of potential carry costs.

6.1.2. Analysis and estimate

The tables below show spot yields and one-year average yields at the time of writing, for the different benchmark indices we are considering across different regulatory regimes.

OFTO developers – yield to maturity

Table 6.1 below shows the yield to maturity of 1-3yr indices that we consider suitable for setting the yield to maturity for OFTO developers. This is based on our understanding that a typical OFTO project would have a construction period towards the shorter end of the spectrum, around 1-3 years.

Table 6.1: Relevant yields from indices used in estimating IDC cost of debt – OFTO developers

iBoxx GBP series	Spot (29/9/17)	1yr avg
GBP non-financial corporate indices		
Non-financial corporates A 1-3yr	1.15%	0.96%
Non-financial corporates BBB 1-3yr	1.37%	1.70%
GBP infrastructure indices		
Infrastructure 1-3yr	1.25%	1.19%

Source: Markit iBoxx. Note: these do not include transaction costs.

Based on this evidence, we consider that a yield to maturity of **1.25-1.50%** is appropriate for OFTO developers before the application of transaction costs.

Interconnectors – yield to maturity

Table 6.2 below shows the yield to maturity of 3-5yr indices that we consider suitable for setting the yield to maturity for interconnectors. This is based on our understanding that a typical interconnector project would have a longer construction period, around 3-5 years.

Table 6.2: Relevant yields from indices used in estimating IDC cost of debt - interconnectors

iBoxx GBP series	Spot (29/9/17)	1yr avg
GBP non-financial corporate indices		

iBoxx GBP series	Spot (29/9/17)	1yr avg
Non-financial corporates A 3-5yr	1.40%	1.24%
Non-financial corporates BBB 3-5yr	1.84%	1.87%
GBP infrastructure indices		
Infrastructure 3-5yr	1.57%	1.51%

Source: Markit iBoxx. Note: these do not include transaction costs.

Based on this evidence, we consider that a yield to maturity of **1.60-1.85%** is appropriate for interconnectors before the application of transaction costs.

Competition Proxy – yield to maturity

Table 6.3 below shows the yield to maturity of 5-7yr indices that we consider suitable for setting the yield to maturity for the Competition Proxy model for HSB. We also utilise the 3-5yr indices noted for interconnectors as above.

This is based on our understanding that the construction period for HSB is expected to be five years in length. Were the expected construction period for HSB (or indeed any future project proceeding under the Competition Proxy model) to be shorter, we would expect to incorporate evidence from shorter term indices.

Table 6.3: Relevant yields from indices used in estimating IDC cost of debt – Competition Proxy

iBoxx GBP series	Spot (29/9/17)	1yr avg
GBP non-financial corporate indices		
Non-financial corporates A 3-5yr	1.40%	1.24%
Non-financial corporates BBB 3-5yr	1.84%	1.87%
Non-financial corporates A 5-7yr	1.67%	1.53%
Non-financial corporates BBB 5-7yr	2.28%	2.30%
GBP infrastructure indices		
Infrastructure 3-5yr	1.57%	1.51%
Infrastructure 5-7yr	2.11%	1.93%

Source: Markit iBoxx. Note: these do not include transaction costs.

Based on this evidence, we consider that a yield to maturity of **1.60-2.30%** is appropriate for the Competition Proxy model before the application of transaction costs. Unlike OFTOs and interconnectors, there is no direct historical precedent for the use of investment grade debt cost benchmarks, since this is a new regulatory model. However, the proposed regulatory arrangements applying to the construction phase share many similarities with the well-established OFTO regime, in particular in relation to the use of ex post assessment of efficient costs to be entered into a RAB. In addition to these general features, the Competition Proxy model provides further comfort to debt investors through the ability to recover some revenue during construction, the ability to earn IDC during delays for which the developer is not responsible, and the fact that consents and permissions will have been obtained prior to the construction phase.

Transaction costs and cost of carry

In setting our ranges, we consider two types of additional cost: direct debt financing transaction costs and the cost of carry.

Direct debt financing transaction costs

We use a range of direct debt financing transaction costs of 15-25 bps across all asset classes. This is higher than the 10bps typically assumed for network price controls, reflecting the need to amortise costs over a shorter period of time, although further evidence on actual costs from developers would be useful to build the evidence base on appropriate transaction costs.

Cost of carry

Based on a five-year construction period, if we make a simplifying assumption that debt is drawn down up-front and then spent (and therefore added to the RAB) uniformly over the construction period itself, our analysis suggests the cost of carry could be as high as 35bps. This would be in addition to the debt financing transaction costs noted above.

This assumes that unused deposits earn a rate of return similar to relatively short term deposit rates. However, there are a range of factors potentially limiting the applicability of this estimate, including the scope for managing costs and deposits more effectively than assumed in our modelling and the inclusion of carry costs in the risk profile of our cost of equity comparators.

Total transaction costs

Combining these two components of transaction costs (debt financing transaction costs and the cost of carry), we use 25-50bps for a transaction cost allowance for each of our asset classes[29]. These costs are added to our yield to maturity estimates for each of the asset classes.

Overall cost of debt estimates

Table 6.4 below shows our proposals for the overall cost of debt, i.e. yield to maturity plus transaction costs, for our three different regulatory regimes. If projects differ in characteristics to what we have assumed, it would be appropriate to change the allowance

[29] A longer construction period is likely to be associated with a higher cost of carry (reflecting the time period over which debt financing is required) but lower debt financing transaction costs (as fixed costs are spread over a greater number of years). This means that we do not adjust transaction costs across asset classes.

to reflect this, for example, using a different benchmark tenor (a blend of tenors could be used for example 3-5yr and 5-7yr indices for a 5yr construction period).

Table 6.4: Overall nominal cost of debt for different asset classes

	Low	High
OFTO developers	1.50%	2.00%
Interconnectors	1.85%	2.35%
Competition Proxy	1.85%	2.80%

6.2. Cost of equity: market parameters

In this section we seek to estimate ranges for the prevailing market cost of equity (and its components, the risk-free rate and the equity risk premium) over a relatively short time period. Unlike for the cost of debt, we do not distinguish between different tenors when setting the risk-free rate, as it creates unnecessary complexity when looking at the cost of equity, with the impact muted anyway given our focus on the TMR rather than ERP.

6.2.1. Risk-free rate

We focus on five-year gilts as a representative measure of the risk-free rate pertaining to relatively short duration equity investments.[30]

Figure 6.1 below displays the spot, 20-day rolling average, and one-year rolling average for UK five-year nominal gilts. As we are setting the risk-free rate for new assets as one-off investments, it is appropriate to consider only very short trailing averages (as we have done with the cost of debt).

[30] As with the cost of debt, if the length of the investment horizon was in excess of five years, Ofgem could consider a different tenor of UK government bond e.g. using a ten-year bond if the expected construction period is ten years.

Figure 6.1: UK five-year nominal gilts, spot, 20-day rolling average, and one year rolling average

Source: Bloomberg

The risk-free rate estimates fall within a span of around 25bps. This reflects that we are setting the risk-free rate for a one-off investment and this allows us to focus on prevailing estimates of the risk-free rate. Table 6.5 summarises our proposed range.

Table 6.5: Range for the nominal risk-free rate

Parameter	Low	High
Risk-free rate	0.50%	0.75%

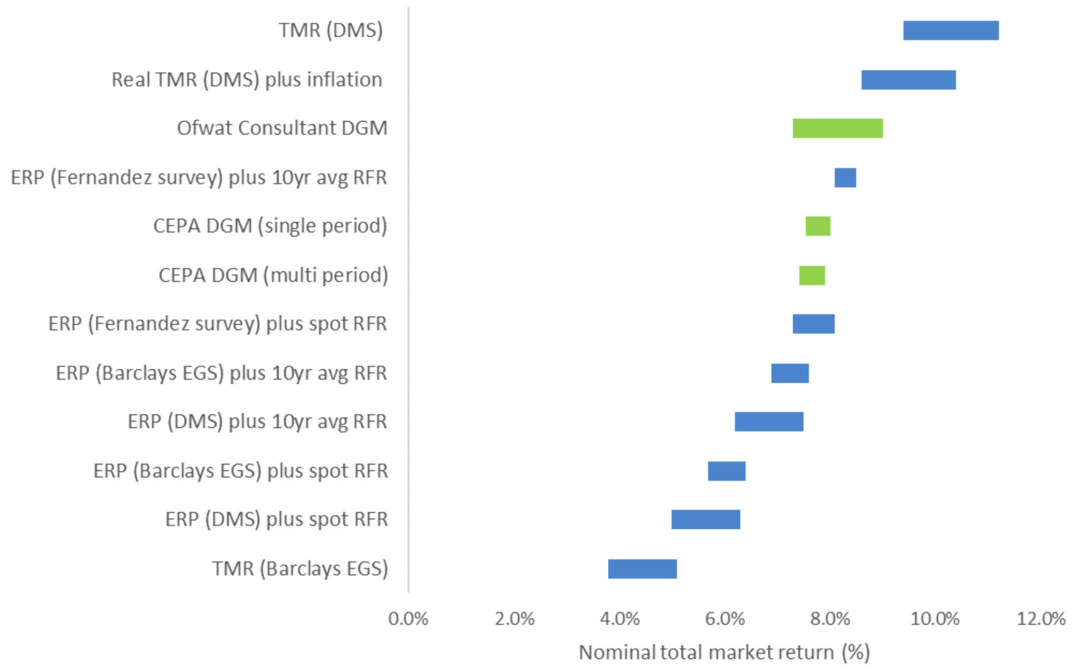
6.2.2. Total Market Returns (& Equity Risk Premium)

In this sub-section, we look at different estimates of the TMR and how we can interpret this evidence to come up with a suitable estimate for IDC.

Overview of available evidence

The discussion in Section 3 alluded to the fact that there are several different approaches to determining market expectations for the TMR. We present a number of these approaches and their corresponding values in Figure 6.2 below. These approaches incorporate both long term historic evidence of equity returns and forward-looking market expectations (presented on a nominal basis).

Figure 6.2: Approaches for estimating the nominal TMR



Source: CEPA analysis of Bloomberg, PwC, DMS, Fernandez, and Bank of England data

Note: Green bars reflect the use of DGM evidence

The figure above highlights the DGM models as particularly relevant for Ofgem's future determinations of TMR as part of a prevailing IDC assessment. Details around the TMR estimates set out in Figure 6.2 are set out in Table 6.6 below.

Table 6.6: Description of total market return approaches

Approach	Description
TMR (DMS)	TMR sourced from the DMS Credit Suisse Global Investment Returns Yearbook 2017 for nominal equities from 1900 to 2016. The geometric mean forms the lower bound at 9.4% and the arithmetic mean forms the upper bound at 11.2%.
Real TMR (DMS) plus inflation	Total market returns sourced from the Dimson Marsh and Staunton Credit Suisse Global Investment Returns Yearbook 2017 for real equities, plus an inflation assumption of 3.1%. The geometric mean plus inflation assumption forms the lower bound at 8.6% and the arithmetic mean plus inflation assumption forms the upper bound at 10.4%. This is lower that the nominal TMR above, for which historic inflation over this period has been 4.1%.
Ofwat Consultant DGM estimates	Range of DGM estimates produced by PwC and Europe Economics for Ofwat for their PR19 Final Methodology decision.
ERP (Fernandez survey) plus 10 year avg RFR	The Fernandez study surveys finance and economics professors, analysts and managers from 41 countries on their expectations for risk free rate and market risk premium. The lower bound of 8.1% is taken directly from the survey results for MRP and risk free rate of 5.9% and 2.2%, respectively while the upper bound of 8.5% is taken from the survey results of the MRP of 5.9% and the 1 year average gilt yield of 2.6%.

Approach	Description
CEPA DGM (single period)	A single-stage dividend growth model that captures expectations of constant future dividend growth, including a provision for share buybacks. The lower bound of 7.5% uses current dividend growth and an expected constant growth rate. The upper bound uses a two-year average of dividend growth derived TMR estimates.
CEPA DGM (multi period)	A multi-stage dividend growth model that captures both short-term expectations of future dividend growth and long-term expectations of future dividend growth, including a provision for buybacks. The lower bound of 7.4% reflects the latest spot rate estimate while the 7.9% upper bound of represents the two-year average DGM output.
ERP (Fernandez survey) plus spot RFR	The Fernandez study surveys finance and economics professors, analysts and managers from 41 countries on their expectations for risk free rate and market risk premium. The lower bound of 7.3% is taken from the survey MRP plus the spot gilt yield of 1.4% while the upper bound of 8.1% is taken directly from the survey results for MRP and risk free rate of 5.9% and 2.2%, respectively.
ERP (DMS) plus 10yr avg RFR	Nominal premiums of equities vs. bonds sourced from the Dimson, Marsh and Staunton Credit Suisse Global Investment Returns Yearbook 2017 for real equities. The geometric mean of 3.6% plus 10 year average gilt yield of 2.6% forms the lower bound at 6.2% and the arithmetic mean of 4.9% plus 10 year average gilt yield of 2.6% forms the upper bound of 7.5%.
ERP (DMS) plus spot RFR	Nominal premiums of equities vs. bonds sourced from the Dimson, Marsh and Staunton Credit Suisse Global Investment Returns Yearbook 2017 for real equities. The geometric mean of 3.6% plus the spot gilt yield of 1.4% forms the lower bound at 6.2% and the arithmetic mean of 4.9% plus the spot gilt yield of 2.6% forms the upper bound of 7.5%.

Source: CEPA analysis of Bloomberg, PwC, DMS, Fernandez, and Bank of England data

Different combinations of these approaches may be used for various regime decisions depending on their specific characteristics.

As noted previously, DGM estimates depend on the specification assumed i.e. differences in the current dividend yield or growth rate assumptions will lead to different estimates. Ofgem may consider that having its own DGM specification could help predictability in future cost of capital decisions, and could be used if mechanistically setting the TMR.

Analysis and proposed range

Given the relatively short construction period assumed of up to five years, we focus on prevailing market evidence, placing more weight on forward-looking measures of expected return, such as the DGM, rather than long-term historic averages such as those calculated by DMS that have been a mainstay of estimating equity returns in network price controls.

Triangulating different sources of evidence to determine an appropriate range for the TMR, and applying this to an appropriate risk-free rate, permits us to determine the appropriate MRP. As discussed in Section 3, there are suggestions that long-term historic averages provide a less accurate estimate of future returns, but we have to be careful when applying forward-looking approaches as these are subject to more volatility and subjectivity.

Section 3.4 presents a range of different options for calculating the TMR. Given that we are looking to set a prevailing estimate for the cost of equity for a five-year horizon, we focus on the more forward-looking pieces of evidence (such as the DGM estimates produced by ourselves and those produced for Ofwat by PwC and Europe Economics) and would place greater weight on geometric averages when considering historic evidence.

We consider it most appropriate to look at the UK market, given that this is the basis for our risk-free rate estimate and that the asset generating cashflows is based in the UK. Our approach in estimating the equity beta is relative to the UK market, so this is consistent across the cost of equity as well.

The low end of our range is based on the CEPA DGM outputs, while the upper end is broadly aligned with the PwC DGM outputs and the real geometric return produced by DMS. These reflect the nature of the investment, and therefore for longer investment horizons and where there is a portfolio of assets, we would place relatively more weight on historic averages.

Table 6.7 summarises our proposed ranges.

Table 6.7: Range for the nominal total market return and its components

Component	Low	High
TMR	7.50%	8.50%
Risk-free rate	0.50%	0.75%
MRP	7.00%	7.75%

6.3. Cost of equity: asset risk

In this section we seek to estimate ranges for the asset beta applying to construction phase projects of the kind carried out under the Competition Proxy, OFTO and interconnector cap and floor regimes. There are no directly relevant listed comparator companies and so we must draw inferences from indirect comparators. The following sections set out our approach, evidence, analysis and conclusions.

6.3.1. Approach

The ideal approach to setting an asset beta would be to estimate it directly for the company or project concerned, or to estimate it directly for a closely related comparator with a similar mix of activities, and therefore a similar risk profile. This is not possible for any of the three regimes – there are no listed transmission or interconnector construction pure play companies – and so this sub-section presents our approach to balancing evidence from a range of comparators.

The asset risk for each of the regimes reflects the following broad factors:

- Companies under each regime are required to construct new, large, high value transmission assets. We consider that, at a high level, **construction and engineering** firms undertake activities that are most closely linked to the nature of the construction phase of these projects.
- The **marine environment** creates specific challenges during construction for both the OFTO and interconnector assets. These are unlikely to be faced by representative construction and engineering firms, which typically have more activities onshore.
- All three asset types are constructed under a **regulatory regime**, which mitigates some risks – including efficiently incurred cost overruns, and to some extent the specific risks relating to the marine environment. The extent of risk mitigation may vary between regimes.

The analysis is perhaps simplest for the Competition Proxy model, for which the specific challenges associated with the marine environment are not a consideration.[31] Absent the protections and risk mitigation provided by the regulatory regime, our view is that comparator firms in the construction and engineering sector would provide a natural starting point for the analysis. Similarly, other than the inclusion of activities related to asset operation and maintenance, regulated networks would provide a natural starting point. We consider that the Competition Proxy asset beta should fall in the range between asset betas for construction and engineering firms, and those for regulated networks.

We therefore set out our proposed asset beta range for the Competition Proxy model first, ahead of the OFTO developer and interconnector regimes, based on the evidence for the two comparator groups set out in Section 6.3.2. We then consider differences in risk between the Competition Proxy regime and both OFTO developers and interconnectors. Section 6.3.3 presents a relative risk analysis between the three regimes, focusing on two key issues:

- first, to what extent do the specific challenges posed by the marine environment increase the systematic risk faced by OFTO and interconnector investors during the construction phase, relative to investors in the Competition Proxy model?
- second, to what extent do the regulatory protections under each regime affect the systematic risk faced by investors?

In this section, we set out the asset beta ranges for our different regulatory regimes for IDC.

6.3.2. Comparator evidence

As noted above, we look at two sources of comparator evidence – construction and engineering companies and regulated companies. In the following sections, we then use this

[31] We assume that assets proceeding under the Competition Proxy model are constructed onshore. Were future offshore assets to proceed under this model, the analysis may need to be reviewed.

evidence together with relative risk analysis to determine a suitable range for the three different regimes, starting with the Competition Proxy model.

We would expect regulated networks to exhibit lower betas than our construction and engineering sample, given the lower risks associated with the operational phase and the regulatory protections in place. As such, we would expect the construction and engineering comparator analysis to inform the setting of the upper end of the range, with regulated networks more relevant for the lower end of our range.

Construction and engineering

Selection of comparators

We have selected a sample of 30 comparator companies. This is based on UK-listed engineering and construction firms, using the Bloomberg BICS grouping. We consider that use of a broader sample is more robust than a smaller sample and the use of the Bloomberg BICS group avoids cherry picking individual companies where no pure play comparator exists.

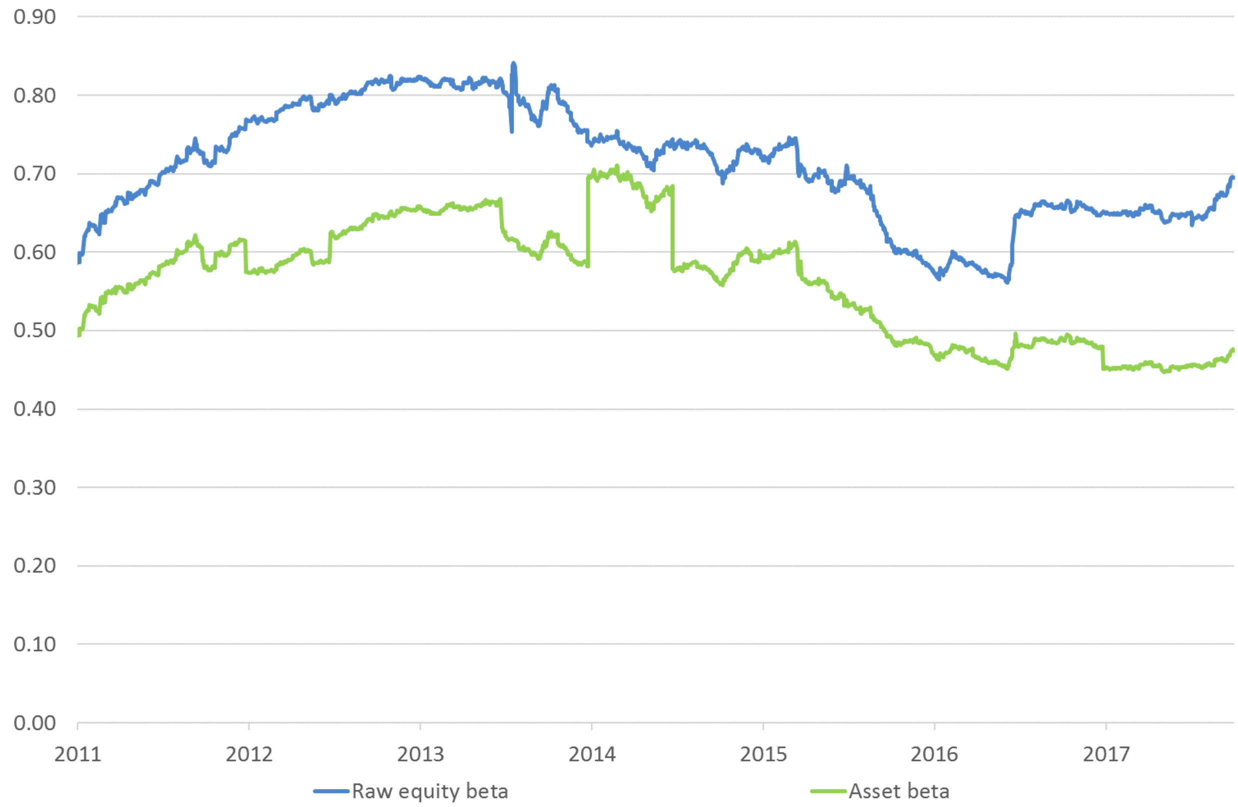
Empirical evidence on comparators

As noted in Section 3.5, there are a number of different methodological choices when obtaining empirical estimates of beta for a broad sample. Our preferred approach is to use the following choices:

- daily returns based on a two-year returns horizon;
- relative index is the FTSE All-Share index and with figures expressed in GBP;
- no adjustments to the raw equity beta estimate, with no debt beta assumed or use of a tax shield adjustment;
- net debt gearing used for un-levering and re-levering; and
- market capitalisation weights used to average betas across our sample.

The results obtained under this approach are shown below in Figure 6..

Figure 6.3: Two-year raw equity beta and asset beta daily estimates for listed engineering construction companies



Source: Bloomberg and CEPA analysis

Beta estimates move over time. Given these significant fluctuations, we consider that it is appropriate to look at medium-term averages rather than short-term or spot evidence unless we consider that there has been a structural break in the level of risk.

At the upper end of the range, values as high as 0.70 were briefly recorded around 2014, while at the lower end of the range values below 0.50 have been recorded for the past two years. A range of 0.45-0.65 appears an appropriate summary of the evidence, with the five-year average of 0.55 being reasonably representative of the period.

We consider that this empirical evidence should represent the upper end of our range for the Competition Proxy model.

Regulated networks

There is no single directly-relevant comparator for regulated networks. In the UK, listed pure networks are found only in the water sector, while the energy sector's sole listed entity (National Grid) has significant non-UK operations. Ofgem and other sector regulators have typically utilised evidence on onshore utility networks alongside a degree of judgement and relative risk analysis in determining an appropriate asset beta for network price controls. These have generally resulted in asset beta estimates (whether explicit or implied) in the region of 0.3-0.4, though as with all beta estimates the evidence has tended to fluctuate.

These network betas reflect a blend of construction and operation activities. Construction is higher risk than operations, so we expect the asset beta for IDC is higher than for a blended construction and operation phase project, all other things being equal. In its RIIO-T1 price controls, Ofgem specifically sought to estimate an asset beta for the Scottish Transmission Operators (TOs), which had a much greater investment programme relative to the size of their operational assets than typical networks. Ofgem's applied an estimate of 0.42 for the asset beta relating to a network with a particularly high focus on construction of new assets.

The Competition Proxy model and the onshore network price control regulatory regimes are not identical. We acknowledge this limits the direct applicability of the comparison, although it can be used in broad terms. We consider that a beta similar to the Scottish TOs RIIO-T1 decision would represent the low end of our range for the Competition Proxy model.

Summary of Competition Proxy asset beta

In estimating a suitable asset beta range for the Competition Proxy regime, there is no single direct listed comparator for us to use. As such, we draw upon both construction and engineering comparators to reflect the nature of the activities undertaken, and regulatory precedent in assessing the framework under which the activities are undertaken.

For our low end estimate, we consider that the Scottish TO asset beta is broadly appropriate and adopt an asset beta of 0.45[32]. For our upper end estimate, we rely on the five-year average of the construction and engineering comparators, namely 0.55. This gives an asset beta for the Competition Proxy model of 0.45-0.55, as summarised in Table 6.8

Table 6.8: Range for asset beta for Competition Proxy IDC

Parameter	Low	High
Asset beta	0.45	0.55

6.3.3. Relative risk analysis

Having established a suitable range for the Competition Proxy beta, we look at differences in risk between the Competition Proxy model and our other two regulatory regimes during the construction phase. In making this assessment, care is required to ensure that there is no double counting of risks, if protections exist elsewhere within the regulatory regime.

This is done on a purely qualitative basis across a range of different risk categories, with our views set out in Annex B.3. Our assessment is based on Ofgem's current proposals for the Competition Proxy model, and under this model, if systematic risk changes, this should be reflected in the cost of capital. Our assumptions for the Competition Proxy relate to a typical

[32] We note that the asset beta assumes that the regulatory regime utilises efficiency incentives (in this case ex-post); if Ofgem chose to adopt a model that was closer to cost pass-through (subject to an efficient process), this would make the model closer to a rate of return model, with a lower asset beta appropriate in this case.

project we might expect to be delivered through this route – for example, we assume the projects are onshore.

OFTO developer model versus Competition Proxy model

Based on our risk assessment in Annex B, the two models are broadly comparable, with scores being similar in most categories. The OFTO model is seen as being slightly more risky than the Competition Proxy model in four areas:

- capex risk;
- investment intensity;
- financing risk; and
- design risk.

The risks are mitigated by the regulatory regime in place, and so at the low end of the range the marine environment and small differences in the application of incentives could be assumed not to change our range. For the upper end of the range, we consider that there is scope to increase the asset beta relative to the Competition Proxy model to reflect the differences noted above. While determining the appropriate size of any adjustment is challenging, we consider that a 0.05 increase in the asset beta to 0.60 is appropriate.

This gives a range for the OFTO developer IDC phase of 0.45-0.60, as summarised in Table 6.9

Table 6.9: Range for asset beta for OFTO developer IDC

Parameter	Low	High
Asset beta	0.45	0.60

Interconnectors versus Competition Proxy model

For interconnectors, as highlighted in Annex B, there is greater scope to assume that the marine environment affects risk more significantly than for OFTO developers, given relatively more complicated projects. To some extent this project execution risk can be passed on by interconnector developers to the supply chain through their contractual arrangements. Where such costs are accepted as efficient, the residual risk faced by developers may be relatively modest. As such we would expect any adjustment of the Competition Proxy IDC for this reason to be small.

There are also small differences in the regulatory regime (alongside many similar features). The final RAB is applied in a different way for interconnectors compared with the Competition Proxy model, as it does not underpin a regulatory allowed revenue but rather sets the limits within which revenues (and hence the asset's value) may fluctuate. Whilst this may be considered part of the merchant risk to which Ofgem intends developers to remain exposed, it could also be argued that it increases construction phase risk.

Overall, we consider that an increase in the asset beta relative to the Competition Proxy model is justified, although the overall level of risk is unlikely to be higher than the range observed for the construction and engineering comparators.

At the lower end of the range, equal weights are afforded to the construction comparators and regulatory precedent, while at the upper end the majority of weight is placed on construction comparator evidence. This gives a range of 0.50-0.65 for the interconnector asset beta during the construction phase, as summarised in Table 6.10.

Table 6.10: Range for asset beta for interconnector IDC

Parameter	Low	High
Asset beta	0.50	0.65

6.4. Cost of equity: transaction costs

Raising equity finance entails costs on the company or entity raising the money. These include a mix of direct costs (including advisory and banking fees) and, in some cases, indirect costs (such as pricing the equity to be attractive to investors). As discussed in some detail in our 2010 note for Ofgem's RPI-X@20 review, many of these costs are unobservable and vary according to market conditions and the amount of money being raised.[33]

It may be appropriate to allow up to 3% of the required equity amount in the form of transaction costs, provided that such costs cannot be recovered elsewhere in the process. This is reflective of an OFT report on equity issuance fees[34]. This could be achieved through an uplift to the RAB, allowing the cost to be recovered over the full asset life[35]. Given that these costs are not readily observable, and so limited benchmarks are available, further evidence on actual costs from developers would be useful to build the evidence base on appropriate transaction costs.

6.5. Gearing

Our construction comparator set represents the upper end of our risk spectrum for beta. The same concept holds for gearing estimates; in the case of gearing, additional risk leads to lower levels of gearing being possible.

We have also drawn on evidence of gearing for new assets, for example on interconnectors, where regulatory protections appear to have permitted projects to gear up significantly beyond the levels of gearing witnessed for our construction company comparators.

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[33] *'Cost of raising equity'*, a July 2010 note prepared for Ofgem by CEPA. Available from the RPI-X@20 section of Ofgem's website.

[34] Office of Fair Trading (2011) Equity underwriting and associated services: An OFT market study, January 2011.

[35] We consider that this is more transparent for the cost of equity, where the selection of a point estimate involves more application of judgement, rather than apply this directly as per the cost of debt.

6.5.1. Comparator evidence

Figure 6.4 below presents the average of construction companies' gearing. This suggest a very low gearing estimate of 10% or below.

Figure 6.3: Average construction companies' gearing

At the other end of our spectrum of evidence, we can use values from a range of example projects, such as the interconnectors' outturn and expected gearing during construction for the FAB Link and the North Sea Link (NSL) interconnectors.[36] This could indicate that the role of the regulatory regime permits the projects to gear up during the construction phase to an extent not explained by the construction activities undertaken.

For FAB Link, an Inframation News article discusses the project targeting 70% gearing. For the NSL interconnector from GB to Norway, involving National Grid and Statnett as project partners, the overall project is valued at €2bn and National Grid North America has been able to secure $752m in senior unsecured term loans against their half of the interconnector asset – this implies 75% gearing for the GB side of the connection[37].

High levels of gearing are also observed during PPP projects; the extent to which companies are geared will depend on the revenues available during construction to reduce the risk placed on the private party and to provide cashflows to provide cover ratios.

The national importance of these connections and the role of EIB in providing loans for standalone regulated electricity transmission assets may help explain the high levels of

[36] https://www.inframationnews.com/news/2410486/interconnector-developers-in-major-capital-raise.thtml
[37] https://www.gtreview.com/news/europe/sace-and-simest-back-worlds-longest-subsea-cable/

gearing witnessed – though the extent to which this holds going forward is less certain with the impacts of Brexit.

6.5.2. Proposed range

This gives us a very broad range for gearing. If pure construction and engineering comparators were relevant, we would expect to see very low gearing in the region of 10%. The more that regulatory protections mitigate risks, the more we would expect to see highly leveraged structures of 65% or more, as with onshore networks.

For the new assets that represent the focus of this report e.g. interconnectors and offshore transmission lines, gearing is typically higher than the 10% we observe from the selected beta comparators (in construction and engineering). This would seem to confirm that these projects may not be exposed to full construction and engineering risks, and suggests that 10% is probably too low as a gearing estimate.

The evidence on gearing is therefore highly varied. Given our approach to estimating beta, in which we re-lever an estimated asset beta to our chosen gearing assumption, the cost of capital is not especially sensitive to changes in the level of gearing.[38] While there are other estimates possible, we use the mid-point of our wide range, i.e. 37.5% in both our low and high cases, as summarised in Table 6.11. By using a point estimate, this makes comparison between cost of equity estimates easier (and more meaningful), as they are at the same level of gearing.

Table 6.11: Range of gearing for IDC phase

Parameter	Low	High
Gearing	37.5%	37.5%

6.6. Inflation

We consider inflation to ensure that where the cost of capital is utilised in real terms that the approach taken is equivalent to the expected nominal return. For estimating inflation in a consistent way, market-derived estimates of inflation must match the characteristics of the underlying financial instruments considered, for example when converting a nominal risk-free rate into a real risk-free rate, the tenor of the nominal gilt should match the tenor of the inflation product under consideration.

6.6.1. RPI inflation

We look at RPI inflation first – this is because market evidence exists on RPI inflation (with the vast majority of UK index-linked debt linked to RPI inflation). Implied inflation from index-linked debt relative to nominal debt (‘breakeven inflation’) is our preferred source of RPI

[38] For example, a significant change from our chosen 37.5% to the top end of our broad range, 65%, leads to a change in the pre-tax nominal WACC of c.10bps.

estimates as these inflation expectations will be priced into the nominal yields that we are using for setting parameters within our cost of capital estimate.

We focus on five-year breakeven inflation to arrive at a suitable estimate for RPI inflation[39]. For the operational phase, where the investment horizon is longer, we will focus on longer-dated inflation estimates relative to IDC. Figure 6.5 below shows five-year breakeven inflation, used in deflating nominal estimates into real RPI estimates (or vice-versa).

Figure 6.4: Five-year breakeven (RPI) inflation

Source: Bloomberg

Table 6.12 summarises averages for breakeven inflation over different time periods. We use a **3.0%** point estimate for RPI based on this evidence.

Table 6.12: Five-year breakeven inflation (as of 29/9/17)

Parameter	Spot	1y avg	2y avg
Five-year breakeven inflation	2.99%	3.05%	2.68%

6.6.2. CPI inflation

For CPI inflation, there are two main routes in arriving at a suitable inflation estimate: i) using direct forecasts of CPI inflation itself, or ii) using market-based RPI estimates and using an estimate of the RPI-CPI 'wedge'.

[39] Breakeven inflation refers to the inflation rate that would lead to equivalence between nominal and index-linked debt of the same tenor. This may not be used directly if using CPI-linked revenues, but provides comparability between estimates.

Inflation forecasts

One source of direct inflation estimates is from the Office of Budget Responsibility (OBR). The latest available OBR forecasts for CPI inflation (March 2017) average 2.08% for the 2018-21 period[40].

The Bank of England (November 2017) Inflation Report has inflation slightly higher than this level, albeit going out a year less in their projections. Over the 2018-20 period, CPI estimates equate to 2.30%.

An additional source is the HM Treasury Survey of Forecasters. The November 2017 survey includes short-term and medium-term estimates of inflation. Medium term CPI estimates for 2018-21 average 2.20%[41].

RPI-CPI wedge

There are a number of estimates for the size of this wedge, which, as Ofgem has previously acknowledged in the RIIO-ED1 determination, has increased. This change took place around 2010 with a change in the formula effect.

Estimates of the formula effect include:

- Bank of England[42], 2014 = 1.3 percentage points
- Pension Protection Fund[43], 2015 = 1.1 percentage points
- Moody's[44], 2016 = 1.3 percentage points

While CPI swaps may not be as liquid as their RPI equivalent, the implied wedge can be estimated from inflation swaps of a suitable maturity (for new assets, this will be five years for consistency with other parameters). The latest spot estimate for this differential is 1.10% (as of 29/9/17), which is higher than the five-year average difference of 0.73%.

This RPI-CPI wedge would be relative to our RPI inflation expectations of 3.0%, so we would need to subtract the wedge to arrive at a suitable CPI forecast. The advantage of using this wedge is that up-to-date market expectations can be derived for RPI (whereas this is not possible for CPI). These can be used to reflect the expected difference between CPI and RPI to get a CPI inflation forecast (although this is more complex where the formula effect changes over time).

If the size of the RPI-CPI wedge is expected to be constant, this approach is likely to be more reflective of current CPI inflation expectations than relying on more dated inflation forecasts.

[40] This is as far as the inflation projections go out. Latest available version at the time of writing.
[41] We note that the RPI estimate for the same time horizon is 3.15%, implying a wedge of 0.95%.
[42] Bank of England (2014). February Inflation Report.
[43] Pension Protection Fund (2015). Funding Strategy Review.
[44] Moody's (2016). UK Transition to CPI: redefining real.

However, if the RPI-CPI wedge is expected to change over time, the approach brings less of a benefit.

It is unclear whether the size of the RPI-CPI wedge does vary materially over time. The size of the wedge would be expected to change where the methodology for calculating RPI or CPI also changes. Where estimates of the RPI-CPI wedge do change however, if this is considered to be ‘noise’, for the purpose of setting forward-looking expectations a relatively stable RPI-CPI wedge may be assumed.

In light of this uncertainty, for new assets we place weight on both direct CPI forecasts and CPI forecasts derived through use of a RPI-CPI wedge.

Proposed estimate

If we were to use an RPI-CPI wedge of 1.1-1.3%, this would lead to a current CPI estimate of 1.7-1.9%. Using direct CPI forecasts point to a higher figure of 2.1-2.3%. For arriving at an inflation forecast we give equal weight to both methods to arrive at a **2.0%** point estimate for CPI.

6.7. Proposed IDC ranges

We present in Table 6.13 below a summary of the headline IDC cost of capital ranges based on our proposals, with a summary of the parameters and calculations on the following page, in Table 6.14.

Table 6.13: Headline values for the IDC cost of capital

Specification	Competition proxy		OFTO developer		Interconnector	
	Low	High	Low	High	Low	High
Pre-tax nominal WACC	4.97%	6.89%	4.84%	7.07%	5.40%	7.68%
Pre-tax RPI real WACC	1.91%	3.78%	1.78%	3.95%	2.33%	4.54%
Pre-tax CPI/H real WACC	2.91%	4.80%	2.78%	4.97%	3.33%	5.57%
Vanilla nominal WACC	4.16%	5.78%	4.03%	5.87%	4.51%	6.39%
Vanilla RPI real WACC	1.12%	2.70%	1.00%	2.79%	1.46%	3.29%
Vanilla CPI/H real WACC	2.11%	3.71%	1.99%	3.79%	2.46%	4.30%

Table 6.14: Parameter values for the IDC cost of capital

Parameter	Ref	Competition proxy		OFTO developer		Interconnector	
		Low	High	Low	High	Low	High
Gearing	A	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Nominal cost of debt	B	1.85%	2.80%	1.50%	2.00%	1.85%	2.35%
Nominal risk-free rate	C	0.50%	0.75%	0.50%	0.75%	0.50%	0.75%
Nominal post-tax TMR	D	7.50%	8.50%	7.50%	8.50%	7.50%	8.50%
ERP	E = D – C	7.00%	7.75%	7.00%	7.75%	7.00%	7.75%
Asset beta	F	0.45	0.55	0.45	0.60	0.50	0.65
Equity beta	H = (F / (1-A))[45]	0.72	0.88	0.72	0.96	0.80	1.04
Post-tax nominal cost of equity	I = C + E*H	5.54%	7.57%	5.54%	8.19%	6.10%	8.81%
Tax	J	19%	19%	19%	19%	19%	19%
Pre-tax nominal cost of equity	K = I / (1-J)	6.84%	9.35%	6.84%	10.11%	7.53%	10.88%
RPI inflation	L	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Post-tax RPI real cost of equity	M = (1+I) / (1+L) - 1	2.47%	4.44%	2.47%	5.04%	3.01%	5.64%
Pre-tax RPI real cost of equity	N = (1+K) / (1+L) - 1	3.73%	6.16%	3.73%	6.90%	4.40%	7.65%
CPI inflation	O	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Post-tax CPI real cost of equity	P = (1+I) / (1+O) - 1	3.47%	5.46%	3.47%	6.07%	4.02%	6.68%
Pre-tax CPI real cost of equity	Q = (1+K) / (1+O) - 1	4.74%	7.20%	4.74%	7.95%	5.42%	8.70%

Source: CEPA analysis

[45] Note that this approach does not make an adjustment for tax. An adjustment for tax would give a lower equity beta for a given asset beta. We have also assumed a zero debt beta.

7. PROPOSED APPROACH FOR COMPETITION PROXY OPERATIONS PHASE

In this section, we set out our proposed approach for the competition proxy operations phase. For estimating the cost of debt, we use benchmark indices, similar to the approach used for determining a suitable IDC range. For the cost of equity, given the similarities in risk profile, we utilise OFTO market evidence and cross-check this against estimates that could be applied through a more theoretical CAPM approach.

7.1. Cost of debt

The operational phase under the Competition Proxy model is expected to be 25 years. As such, using a short-dated tenor for debt as with IDC would not be appropriate as re-financing would be required multiple times. We consider that issuing debt to cover the operational period would represent an efficient financing strategy and as such we look to match the tenor with the length of the operational period.

7.1.1. Approach

We use the iBoxx 10yr+ non-financial corporate A and BBB rated indices.[46] The 10yr+ indices average around 19 (BBB) to 23 years (A) to maturity (as of 29/09/2017), while the operational period we are considering for these assets is generally expected to be 25 years.

Evidence on OFTOs may also inform the setting of a suitable cost of debt under the Competition Proxy model. There is a relatively small sample size available to us for bonds issued by OFTOs, with the majority preferring to rely on bank finance.

As with IDC, it is good regulatory practice to include an allowance for efficient costs incurred, such as transaction costs. Our proposed approach to IDC includes transaction costs for an initial debt raising, and so an additional allowance is required for the operations phase only on the incremental amount of debt raised. As the operational phase is significantly longer than the construction phase, this allowance can be a smaller annual add-on to cover the total transaction costs involved in issuing debt. There is also no cost of carry associated with debt used in full to rebalance the financial structure at the beginning of the operational period. For a 25-year operational period we will apply approximately 10bps (compared to 25-50bps for our IDC allowance).

7.1.2. Analysis and evidence

OFTO bond evidence

The three OFTO bonds have outperformed the equivalent A rated non-financial corporate index for tenors of 10yrs+ by an average of 56bps, as shown in Table 7.1 below.

[46] Debt must have a minimum of ten years' time to maturity to be included in the index.

Table 7.1: Cost of Debt for OFTO bonds

OFTO bond	Issuance date	Nominal yield on bond	Non-financial corporate A 10yr+ yield to maturity	Difference
Gabbard	29/11/2013	4.14%	4.53%	-0.39%
Gwynt y Mor	17/02/2015	2.78%	3.56%	-0.79%
WODS	25/08/2015	3.45%	3.94%	-0.50%

Source: Markit iBoxx, Bloomberg, CEPA analysis

Note: negative difference represents outperformance

iBoxx benchmark indices

The A rated 10yr+ non-financial corporate index is not perfectly equivalent to the OFTO bonds for two primary reasons:

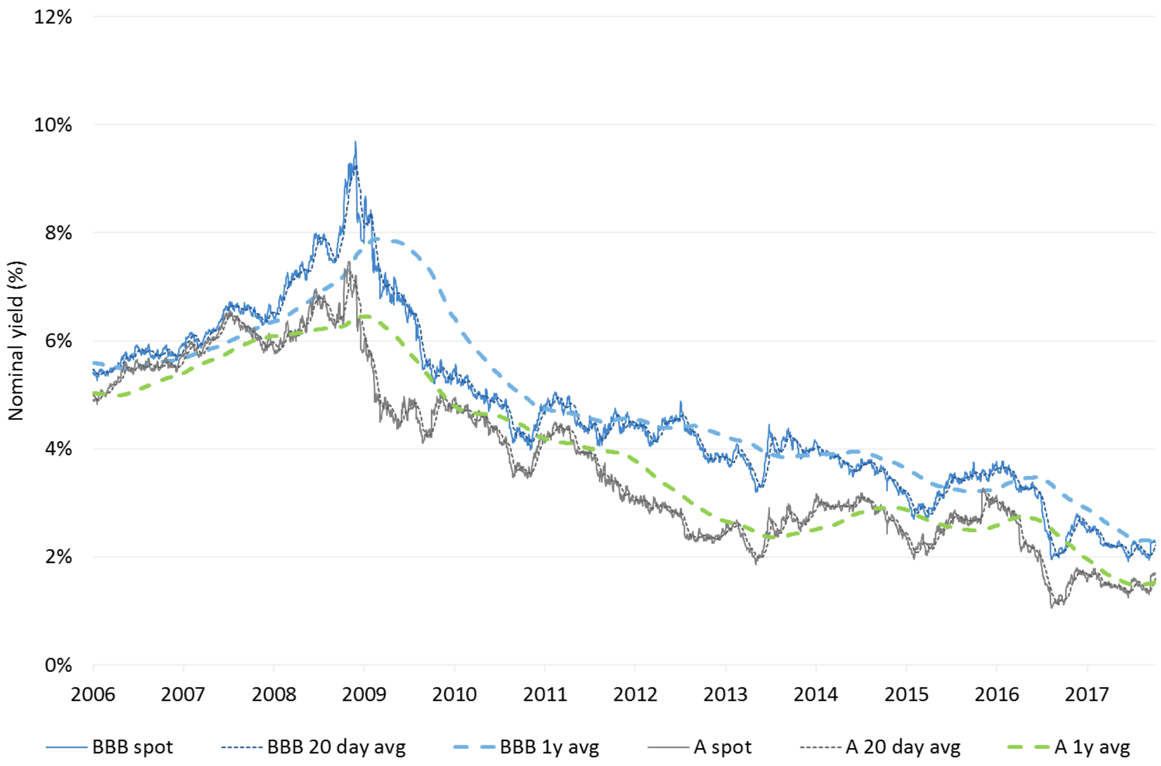
- The time to maturity on the A rated index is slightly higher than the OFTO bonds at c.23yrs and c.19yrs respectively – this should lead to a slightly lower cost of debt for the OFTO bonds relative to the iBoxx index.
- The credit rating for the iBoxx index is broad A rated, while OFTOs have not achieved better than an A- credit rating – this should lead to a slightly higher cost of debt for the OFTO bonds relative to the iBoxx indices.

This means outperformance by the OFTO bonds is being driven by something other than credit rating and tenor. For the Competition Proxy model, we would expect a slightly longer tenor than for the OFTO bonds, given the 25-year operational period. With an upward sloping yield curve, this increases the yield. However, offsetting this is the slightly higher risk we perceive for OFTOs relative to the Competition Proxy model.

We choose to rely on the A rated non-financial corporate 10yr+ index for establishing our low estimate for the Competition Proxy model – given the presence of headroom for OFTO bonds, we are conscious not to overcompensate the regulated entity by being overly conservative in the estimate chosen.

Figure 7.1 below sets out the one-year rolling average nominal yields for non-financial corporates (A and BBB) for tenors of 10yrs+.

Figure 7.1: Non-financial corporates (10yr+) spot and trailing averages



Source: Markit iBoxx

The averages of these indices have been computed in Table 7.2 below.

Table 7.2: Relevant indices for HSB operations cost of debt – nominal yields

Benchmark index	Spot	1y avg
Non-financial corporates 10yr+ (A)	2.99%	2.92%
Non-financial corporates 10yr+ (BBB)	3.22%	3.19%

Source: Markit iBoxx

While our narrow range for the construction phase placed more focus on the BBB ratings than the A ratings, reflecting the high riskiness of the construction phase, the operational phase carries less inherent risk.

For our low estimate we use the one year average of the A rated 10yr+ index, with a small allowance of up to 10bps for transaction costs (for both ends of the range). Our high estimate places weight on a blended A and BBB rating, with transaction costs added on top of this. Table 7.3 summarises the resulting cost of debt range.

Table 7.3: Range for the operational phase nominal cost of debt (HSB)

Component	Low	High
Cost of Debt	3.00%	3.25%

7.2. Cost of equity

Rather than build up the cost of equity using a CAPM approach and assessing individual parameters, we instead take OFTO data on the cost of equity and use this as a starting point. Our adjustment is based on an assessment of risks faced under the Competition Proxy model relative to the OFTO regime, together with an adjustment to reflect the timing of the OFTO tender rounds and the likely market movements since these decisions. Where possible, we would propose to focus on the most recently available evidence – though this will be dependent upon the available sample size and subject to any confidentiality restrictions.

As noted previously, the assumptions for the Competition Proxy model are based on our understanding of the proposals contained within the Ofgem consultation, and so if this changes, the cost of capital would need to change to reflect this. Our assumptions for the Competition Proxy relate to a typical project we might expect to be delivered through this route – for example, we assume the projects are onshore.

7.2.1. Relative risk analysis

By comparing relative risk of the OFTO approach to the Competition Proxy model, this allows us to adjust the OFTO data to reflect any possible differences in risk.

Annex B contains our full assessment of relative risk. This analysis indicates that the Competition Proxy model is broadly similar in risk to the OFTO regime. There are three areas where we find the Competition Proxy model is slightly less risky than the OFTO operational phase:

- a lower proportion of the equity return is at risk for Competition Proxy incentives, relative to the OFTO regime;
- there is less scope for latent defect risks to be a problem for the Competition Proxy model; and
- Ofgem may consider tax reopeners for Competition Proxy similar to the RIIO regime.

7.2.2. Analysis and evidence

There have been five OFTO tender rounds to date, with TR4 and TR5 being the most recent, but not having completed yet. Other things being equal, we would propose to focus on evidence from these two tender rounds. However, as they have not yet reached financial close, and as there is currently only one project in each round the sample is limited. We therefore make use of evidence from earlier tender rounds, adjusted for recent market movements, with TR4 and TR5 evidence applied as a cross-check.

In 2012, the NAO quoted the winning OFTO bidders' equity IRRs for TR1, at 9-11% nominal post-tax returns.[47] For TR2 and TR3, the cost of equity bid by successful bidders fell to 8-9%

[47] NAO (2012): 'Offshore electricity transmission: a new model for delivering infrastructure'

nominal post-tax returns. We consider that TR2 and TR3 are likely to be better comparators than TR1 with more recent financial market conditions and the absence of uncertainty relating to the first tender round. However, the rates applying in TR2 and TR3 would still need to be adjusted for market movements since then, and potentially for relative risk and regime maturity. The following two sections summarise our analysis, noting that it is inherently judgement-based.

Adjustments for market movements

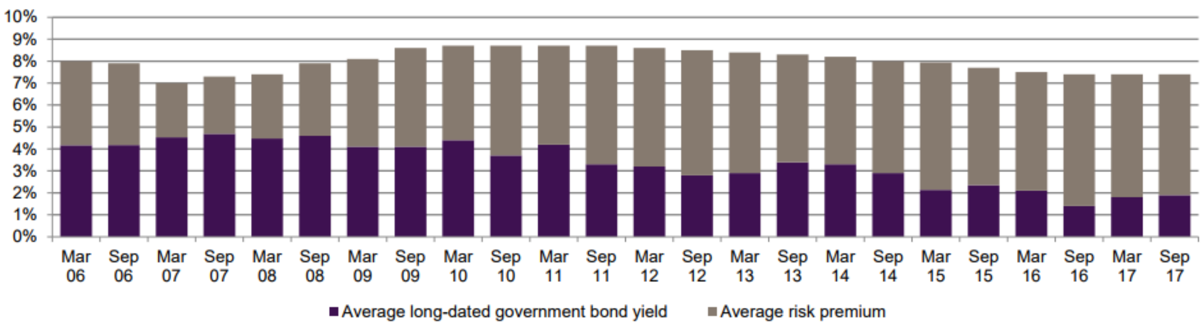
TR2 and TR3 projects reached financial close between 2013 and 2016. We consider three pieces of evidence for the purposes of making an adjustment to reflect changes in financial market conditions since then:

- changes in the discount rate used by equity investor, HICL Infrastructure, for the UK (as utilised by Ofwat);
- movements in nominal gilts (i.e. in the risk-free rate); and
- movements in DGM evidence.

HICL infrastructure discount rate

HICL Infrastructure is an equity investor in infrastructure. In semi-annual presentations, they present a discount rate by country. Figure 7.2 below shows the discount rate used by HICL for equity investments in the UK.[48]

Figure 7.2: HICL Infrastructure quoted UK discount rate



Source: HICL Infrastructure

Since 2013, the risk-free rate has fallen by over 1% and the TMR has fallen by almost 1%. This would indicate that a decrease of up to 1% would be justified for translating OFTO TR2 and TR3 returns into a suitable operational cost of equity today for the Competition Proxy model.

The movement in the risk-free rate is likely to represent an upper bound for any adjustment, given that discussion of the relationship between the risk-free rate and MRP suggests a negative correlation between the two parameters. We discuss each approach in turn.

[48] HICL Infrastructure (2017) Interim Results presentation, 22 November 2017.

Movements in nominal gilts

We focus on the differences in the risk-free rate, based on twenty-year nominal gilts, comparing average yields across a year for 2013-16 compared to today. Table 7.4 summarises these differences over time.

Table 7.4: 20yr nominal gilt yields across TR2 and TR3

Time period	Nominal yield	Difference to today
Spot yield (29/9/17)	**1.92%**	**-**
2016 calendar year average	1.85%	-0.07%
2015 calendar year average	2.37%	0.45%
2014 calendar year average	3.09%	1.17%
2013 calendar year average	3.11%	1.19%
Average 2013-16 calendar years	**2.61%**	**0.69%**

Source: Bloomberg

Based on changes in twenty-year nominal gilt yields, the size of the adjustment for changes in market movements could be from -7bps to 119bps. A simple average over 2013-16 gives a difference to today's spot yield of 69bps.

Movements in DGM estimates of the TMR

A further source of evidence on changes in market movements is forward-looking TMR evidence, such as our DGM.

The average DGM estimates between 2013 and 2016 using the CEPA DGM specification is 53bps higher than the current cost of equity generated by this model for H1 2017. The maximum difference in this period is 81bps.

Overall adjustment

Based on the risk-free rate and TMR evidence, we consider that an adjustment of up to c.100bps could be appropriate, though there are arguments for a more limited adjustment. At the lower end of our range, we do not consider it plausible that required equity returns have remained unchanged since 2013. An adjustment of around 50 bps – the approximate difference between recent and 2013-16 DGM-based estimates of TMR – is around the lowest that we consider would be justified.

This suggests that the cost of equity range of 8-9% implied by TR2 and TR3 evidence would currently translate to an implied cost of equity of 7.0-8.5%. This is consistent with returns for TR4 and TR5 being lower than those observed for TR2 and TR3, with the lower end of this range being most consistent with the recent observations.

Considerations relating to relative risk and regime maturity

Based on our analysis of relative risk, a downwards adjustment to the OFTO data may be appropriate, though the size of this adjustment is likely to be small.

This adjustment may be offset by differences in regime maturity. The OFTO regime – particularly the most recent tender rounds – is mature and well-understood. The Competition Proxy model has yet to be implemented. However, it has been designed to be similar in most respects to the OFTO regime, and we consider that any investor uncertainty over its application should be very limited. It is plausible that recent OFTO data can be used without adjustment for regime maturity.

7.2.3. Summary and proposed ranges

Our proposed range, in Table 7.5 below, reflects a combination of evidence from TR2 and TR3, updated for market movements, and more recent evidence from TR4 and TR5. We view this as a plausible overall range, with considerations relating to the emphasis to be placed on recent evidence, relative risk and regime maturity guiding the selection of a point estimate within this range. These issues are considered further in Section 9.2.

Table 7.5: range for the post-tax nominal cost of equity for HSB

Component	Low	High
Range for Competition Proxy post-tax cost of equity (operations)	7.00%	8.50%

7.3. Gearing

Our gearing estimates are based predominantly on what has been witnessed for the OFTO regime for TR1 to TR3, as sourced through public information. Evidence available on TR4 and TR5, provided to us by Ofgem, indicates that gearing levels are broadly similar to earlier tender rounds. The gearing evidence for projects under the first three tender rounds is contained in Table 7.6 below.

Table 7.6: OFTO gearing estimates from publicly available sources

OFTO project (round)	Gearing level
Greater Gabbard (1)	86%
Robin Rigg (1)	84%
Walney Phase 1 (1)	85%
Sheringham Shoal (1)	91%
Barrow (1)	81%
Gunfleet Sands (1)	82%
Ormonde (1)	87%
Walney Phase 2 (1)	87%

OFTO project (round)	Gearing level
Gwynt y Mor (2)	90%
West of Duddon Sands (2)	84% (on acquisition)
Lincs (2)	50%
Westermost Rough (3)	85%
Humber Gateway (3)	84%

Source: IJ Global, Inframation news, Moody's analysis, Ofgem publication – OFTO; an investor perspective - Update

We consider that the risk profile of the Competition Proxy model is such that a highly leveraged financing structure could be operated during the operational phase. We use a range of 80-85%, based on the OFTO levels noted above, as summarised in Table 7.7 below.[49]

The 'low' and 'high' ends of the range relate to the cost of capital. Therefore, the 85% gearing is included as the low estimate, and the 80% gearing as the high.

Table 7.7: range for the operational gearing for Competition Proxy

Parameter	Low	High
Gearing	85%	80%

Source: Ofgem

7.4. Inflation

In estimating the cost of capital, we have considered spot rate and one-year averages of UK nominal 10yr and 20yr gilts in estimating the risk-free rate and looked at 10yr+ debt indices (average years to maturity of 19 (BBB) to 23 (A) years as of 29/09/2017) – as such we consider it appropriate to look at 10yr and 20yr breakeven inflation to estimate historic RPI inflation. This is equivalent to looking at index-linked gilts to determine a real RPI cost of equity/ capital.

This approach is equivalent to our approach set out in Section 6.6, whereby we consider shorter dated nominal gilts and focus on shorter dated inflation indices.

7.4.1. RPI inflation

Figure 7.3 below shows both 10yr and 20yr (RPI) breakeven inflation evidence.

[49] We consider that the Lincs gearing estimate represents an outlier and as such, we place limited weight on this.

Figure 7.3: Breakeven inflation (RPI)

Source: Bloomberg

Table 7.8 below summarises spot rates and one year trailing averages for breakeven inflation over two time horizons.

Table 7.8: UK breakeven inflation (as of 29/9/17)

Series	Spot	1y avg
UK 10yr RPI breakeven	3.10%	3.07%
UK 20yr RPI breakeven	3.36%	3.40%

Source: Bloomberg

For RPI inflation, we use forecasts of 3.0-3.4% to derive real RPI cost of capital estimates.

7.4.2. CPI inflation

For CPI or CPIH inflation, market evidence does not exist to the same extent.[50] As discussed in Section 6.6, there are different ways in which CPI inflation expectations can be determined, for example in establishing a set size of an inflation wedge between CPI and RPI and use adjusted market inflation expectations. Other approaches include using direct CPI forecasts of inflation or using the Bank of England's CPI target.

Forecasts do not typically extend beyond five years and estimates of the wedge do not specify over what time horizon this difference is expected.

[50] Our working assumption is that no directional bias exists between CPI and CPIH inflation, and as such we assume real CPI figures are equivalent to real CPIH figures.

Our analysis in Section 6.6 indicates that 2.0% is an appropriate choice of deflator for establishing real CPI (or CPIH) cost of capital estimates for short term time horizons e.g. up to five years. Given the Bank of England's 2.0% CPI target for the medium term, we consider that 2.0% CPI is also appropriate for the operations phase.

7.5. Proposed ranges (current evidence)

Based on the inflation estimates above, we arrive at the following estimates of the cost of capital for the Competition Proxy model during the operational phase, based on current evidence[51]. We have used an approach on the cost of equity that makes an assessment at the overall cost of equity level, so do not set out the individual cost of equity parameters. Table 7.9 summarises our proposed ranges based on this approach; Section 7.6 details the cost of capital we would set today for an operational phase beginning in 2024.

Table 7.9: Ranges for Competition Proxy operational phase WACC[52]

Specification	Low	High
Pre-tax nominal WACC	3.85%	4.70%
Pre-tax RPI real WACC	0.43%	1.65%
Pre-tax CPI/H real WACC	1.81%	2.65%
Vanilla nominal WACC	3.60%	4.30%
Vanilla RPI real WACC	0.19%	1.26%
Vanilla CPI/H real WACC	1.57%	2.25%

7.6. Potential future ranges

The figures presented in Section 7.5 represent our proposed ranges if the operational cost of capital was set today. However, in practice no project under the Competition Proxy regime would be entering the operational phase today. As noted in Section 5.2, we have considered two options for the timing of the operations phase estimate:

- A simple approach is to finalise the allowance upon completion of the construction phase. Under this approach, evidence would be updated once the construction phase is complete and before the operational cost of capital is finalised. Within such an approach, Ofgem could retain an element of discretion to ensure that the cost of capital presented is appropriate, or adopt a more mechanistic approach (e.g. through indexation) to provide greater clarity and transparency.
- An alternative approach is to finalise the cost of capital for the operational phase up-front, i.e. ahead of the construction phase starting. For a project with a five-year construction period and a twenty-five year operational life, Ofgem would then be

[51] The figures represent the costs of capital that would be set if the operational period was beginning immediately and we are using current evidence to set the cost of capital.

[52] Note as per Section 7.3, 85% gearing is used for our low estimate and 80% gearing for our high estimate.

setting the opportunity cost of investing capital during years 5-30. In this case, we would need to adjust our analysis to take account of potential market movements during the construction period, as we would expect investors to factor in their expectation of such movements.

Under the former approach, the approach is relatively straightforward and it is up to Ofgem the degree to which the setting of the operational cost of capital is mechanistic or not.

Under the latter approach, we would not consider there to be a need to adjust the gearing level, but there is the potential for adjusting the cost of debt and cost of equity.

7.6.1. Cost of Debt

For the cost of debt, it is possible to estimate based on forward curves what the cost of debt will be after the construction period is complete. For the risk-free rate component of the cost of debt, it should be possible to hedge the future rate, although the debt premium would be less possible to hedge. Forward evidence on the risk-free rate has not been reliable in recent years and without hedging, there could be a material difference between outturn rates and the rates expected today.

Based on changes in 20yr nominal gilt forwards, yields are expected to increase by c. 50bps by 2024. We would expect this to represent a suitable estimate of the rate for the operational phase, based on market evidence. Table 7.10 summarises our current estimated ranges for an operational period beginning in 2024.

Table 7.10: Operational cost of debt applicable for 2024

	Low	High
Cost of Debt on current evidence	3.00%	3.25%
Cost of Debt adjustment for 2024	+0.50%	+0.50%
Cost of Debt applicable for 2024	**3.50%**	**3.75%**

7.6.2. Cost of Equity

For the cost of equity, the same principle would apply in setting a rate today to apply for the operational period, although this is harder to observe than for the cost of debt. For the risk-free rate, a similar approach is possible to the cost of debt, whereby forward curves can be used and in a way that an investor can hedge future yields. Based on analysis set out above, the ERP is unlikely to be fixed and an adjustment would be required.

Our approach for the Competition Proxy is based on OFTO Tender Round evidence for the cost of equity, which we use to set an overall cost of equity rather than individual components. As such, the size of any adjustment is sensitive to what is assumed for the underlying cost of equity components – especially so, given the high level of gearing assumed.

We consider that a zero adjustment for the cost of equity could be suitable as a low-end estimate, given there is no clear-cut, established method for estimating future movements in the cost of equity. With the poor predictive power of forward rate evidence over the past decade, current rates may be seen as the best estimation of future rates. We would consider it reasonable to assume that a winning bidder may have similar expectations over 25yr and 30yr horizons.

For our high-end adjustment, we consider that the adjustment is likely to be at most half a percentage point, based on forward curve evidence for the risk-free rate. This is due to the likely offsetting effect of the MRP.

Table 7.11 summarises our current estimated ranges for an operational period beginning in 2024. We note that although current market conditions suggest an upwards adjustment, there is no inherent upwards tendency in the adjustment. In different market conditions, there may be no adjustment required, or the adjustment may even be downwards.

Table 7.11: Operational cost of equity (post-tax, nominal) applicable for 2024

	Low	High
Cost of Equity on current evidence	7.00%	8.50%
Cost of Equity adjustment for 2024	+0.00%	+0.50%
Cost of Equity applicable for 2024	**7.00%**	**9.00%**

7.6.3. Cost of Capital for operational phase starting in 2024

For HSB, the operational phase is not expected to begin until 2024. As such, the range presented in Table 7.9 does not capture expected future changes in the cost of capital up until this period. Based on the discussion in Sections 7.6.1 and 7.6.2, we can estimate the cost of capital applicable for an operational phase starting in 2024. This is shown in Table 7.12 below.

Table 7.12: Operational WACC applicable for 2024

	Low	High
Pre-tax nominal WACC	4.27%	5.22%
Pre-tax RPI real WACC	0.84%	2.16%
Pre-tax CPI/H real WACC	2.23%	3.16%
Vanilla nominal WACC	4.03%	4.80%
Vanilla RPI real WACC	0.60%	1.75%
Vanilla CPI/H real WACC	1.99%	2.75%

8. PROPOSED APPROACH FOR INTERCONNECTOR CAP AND FLOOR

The cost of capital is fixed for the first two interconnector windows. As such, proposed changes to the interconnector cap and floor would only be applied to the third interconnector cap and floor window and beyond.

8.1. Floor

We consider that continuing the current approach for setting the floor returns is appropriate and consistent with our proposed approach for the operational phase cost of capital for the Competition Proxy model.

We therefore base our proposed ranges on a 20-day trailing average of the iBoxx non-financial corporate A and BBB rated 10yr+ index[53]. This gives a range for the nominal cost of debt, if set today, of 3.0-3.25%. We use estimates of 10yr breakeven inflation to convert these nominal levels into real terms, as summarised in Table 8.1 below.

Table 8.1: Proposed ranges for interconnector floor rate of return

Component	Low	High
Nominal cost of debt	3.00%	3.25%
RPI real cost of debt	-0.39%	0.24%
CPI/H real cost of debt	0.98%	1.23%

8.2. Cap

As noted in Section 4.2, the cap ensures that maximum interconnector returns are at a reasonable level. There is an assumed fully equity funded gearing structure, with the risk profile set equal to peak generator returns.

8.2.1. Market parameters

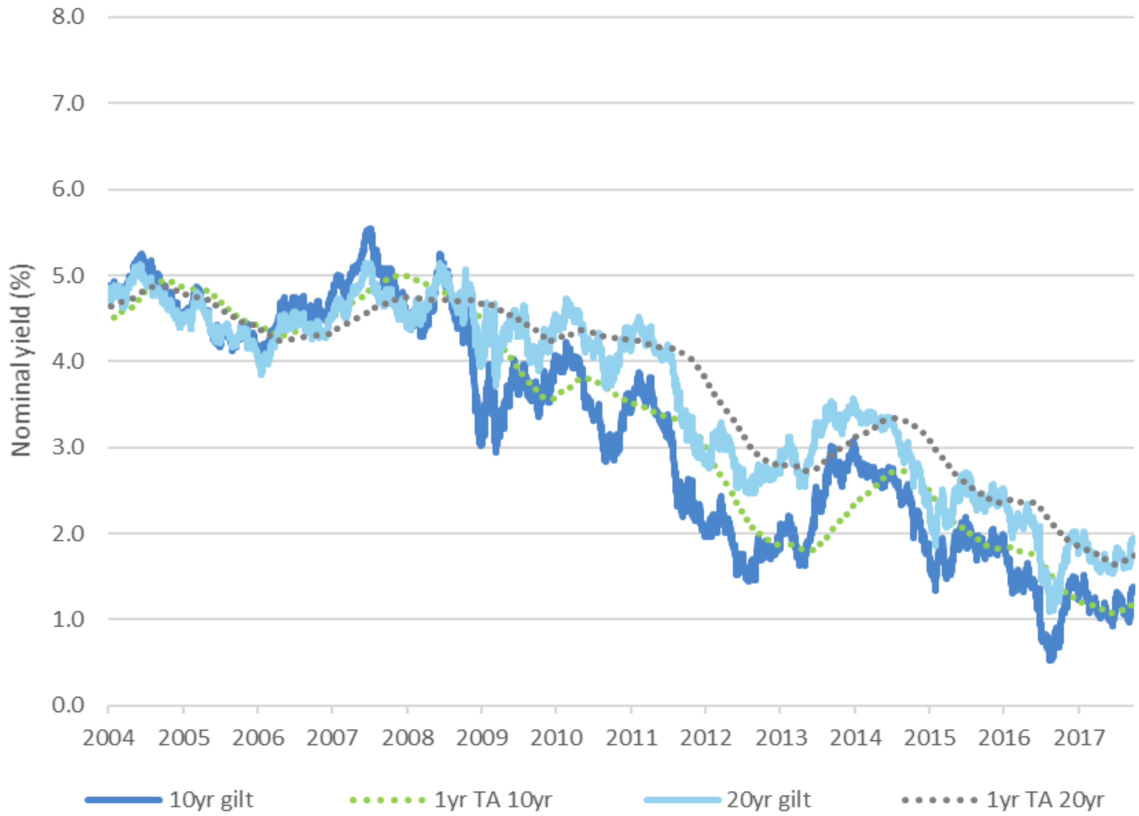
In this sub-section, we consider the different parameters for the cost of equity that go into the calculation of the cap (there is no weight placed on debt).

Risk-free rate

As per our approach for the Competition Proxy model operational phase and for IDC, we consider that using a prevailing estimate of cost of capital parameters is most appropriate. For the risk-free rate we use yields on government bonds. The tenor of these government bonds should reflect the investment horizon and so we consider it appropriate to look at 20-year UK government bonds as the primary source of evidence, shown in Figure 8.1 below. We also present 10-year yields for comparison.

[53] As of 1 November 2017, the average time to maturity of the non-financial corporate 10yr+ indices is 23.26yrs for broad A rated bonds, and 19.30yrs for broad BBB rated bonds.

Figure 8.1: UK nominal government bond yields



Source: Bloomberg

Table 8.2 below sets out the latest values for both 10yr and 20yr UK government nominal bonds.

Table 8.2: UK nominal government bond yields (as of 29/9/17)

Benchmark	Spot	1y avg
UK nominal 10yr	1.37%	1.19%
UK nominal 20yr	1.92%	1.74%

Source: Bloomberg

Our narrow range focuses on the short-term evidence on the nominal 20yr bond, giving a range of 1.75-2.00% for the nominal risk-free rate, as summarised in Table 8.3 below.

Table 8.3: range for nominal risk-free rate

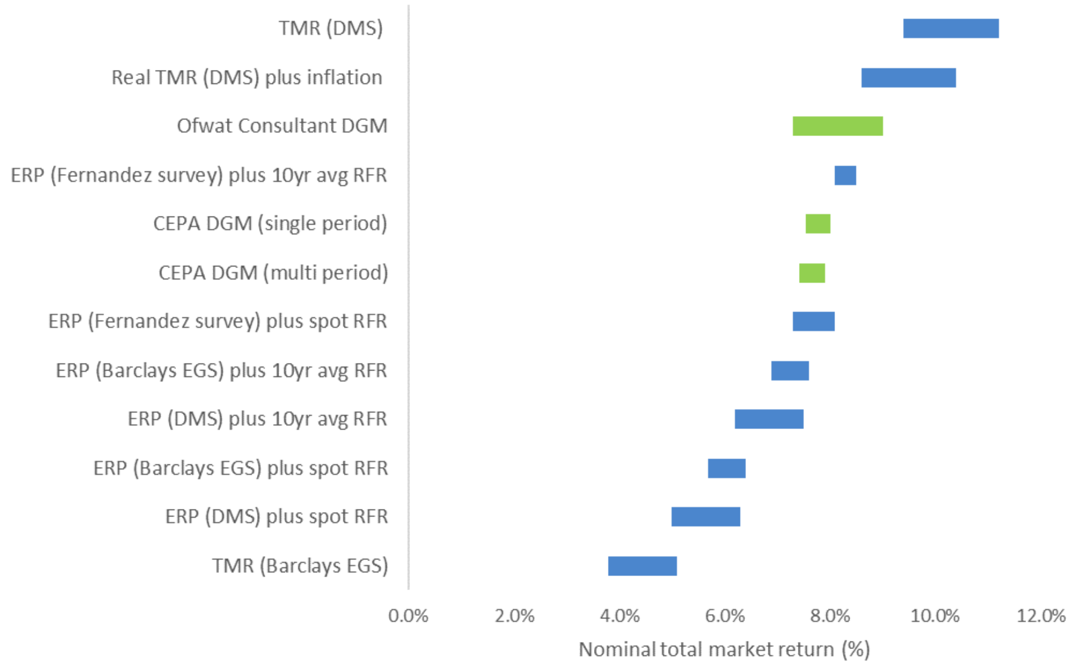
Parameter	Low	High
IC cap - Risk-free rate	1.75%	2.00%

Total market returns and equity risk premium

For the interconnector cap, we propose to use a prevailing view of long-term returns given we are setting a cost of equity today. Our approach involves estimating a TMR and then subtracting the assumed risk-free rate to determine the ERP.

The sources of evidence are the same as noted for calculating the TMR for IDC (Section 6), albeit with different weight placed on different sources of evidence to reflect the longer investment horizon we are considering for the operational phase relative to the construction phase. We have reproduced our summary of different approaches in Figure 8.2 below.

Figure 8.2: Approaches for estimating the nominal TMR



Source: CEPA analysis of Bloomberg, PwC, DMS, Fernandez, and Bank of England data
Note: Green bars reflect the use of DGM evidence

We place more weight on the TMR historic evidence from DMS rather than forward-looking DGM evidence in arriving at our estimate than with IDC, giving a nominal TMR of 8.5-10.0% for our narrow range. With our risk-free rate, this implies an MRP of 6.75-8.00%, as summarised in Table 8.4 below.

Table 8.4: Range for nominal TMR and MRP

Parameter	Low	High
IC cap - Total Market Return	8.50%	10.00%
IC cap - Risk-free rate	1.75%	2.00%
IC cap - Market Risk Premium	6.75%	8.00%

8.2.2. Asset risk

The approach seeks to limit excess returns above the level earned by a peaking generator or other marginal (rather than baseload) generator. The original analysis was based on the Drax equity beta analysis, which was relatively stable over a number of years before the activities undertaken by the company changed. Figure 8.3 summarises evidence on Drax's equity beta, re-levered to 50% gearing in line with Ofgem's notional gearing assumption. An equity beta of 1.25 at 50% gearing was consistent with the evidence from 2010-14, but the implied equity beta has since risen significantly.

Figure 8.3: Drax re-levered equity beta evidence

Source: Bloomberg, CEPA analysis

The key question is whether this change reflects a fundamental change in the risk of peaking generation, or Drax's changing business mix. Our view is that it reflects the latter. The implied equity beta had been relatively stable over the preceding eight years, with the degree of fluctuation being as expected for a statistical measure. There is a marked inflection point around 2015, consistent with the timing of Drax's changes in business mix.

We have sought to compare Drax's beta with betas for other listed companies with a relevant business mix. However, there are now no listed peaking generators that we are aware of, and evidence from listed renewable generators (which may provide a cross-check on Drax's changing beta) is not robust.

We are therefore inclined to take the evidence from 2010-14, which Ofgem used to set an equity beta of 1.25 at 50% gearing, as the best available evidence, and do not propose a change to the equity beta parameter.

8.2.3. Summary and proposed ranges

Bringing together the risk-free rate, MRP and equity beta gives a post-tax nominal cost of equity of 10.2-12.0%. Ofgem's current approach applies this cost of equity across the whole RAB, meaning it also corresponds to the post-tax nominal rate of return. Based on a tax rate of 19%, this would give a 12.6-14.8% nominal pre-tax cost of equity and nominal rate of return.

Our approach to inflation for the operational phase of new assets is discussed in Section 7.4. The resulting estimates for the rate of return for the interconnector cap are show in Table 8.5

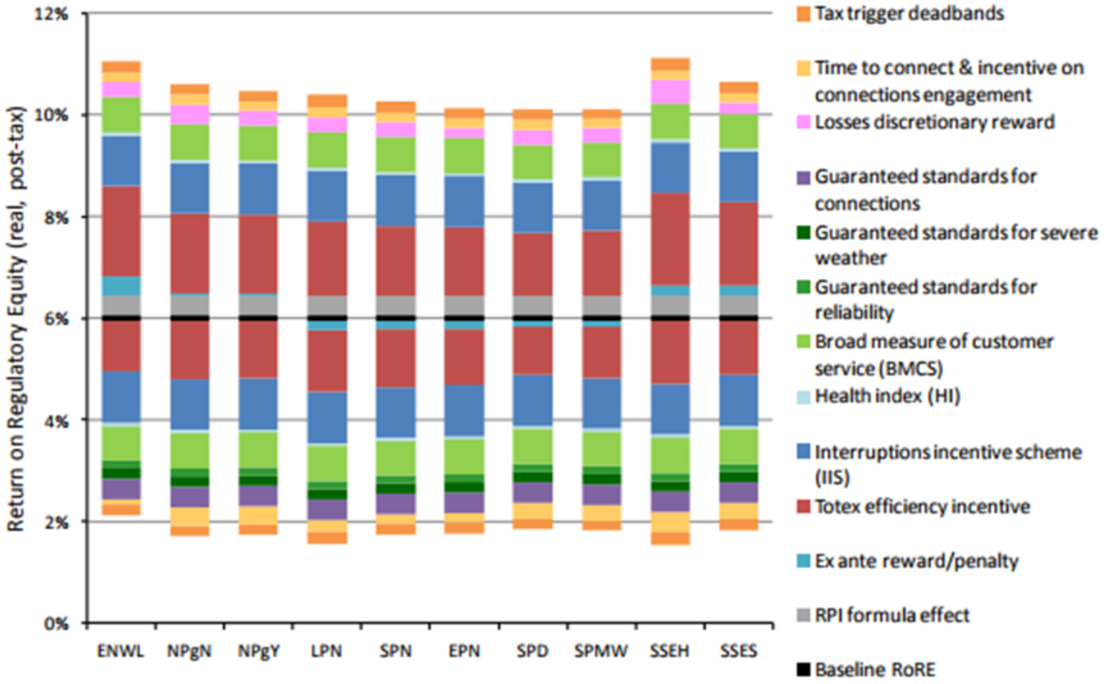
Table 8.5: Ranges for interconnector cap rate of return

Specification	Low	High
Pre-tax nominal return	12.58%	14.81%
Pre-tax RPI real return	8.88%	11.47%
Pre-tax CPI/H real return	10.37%	12.56%
Vanilla nominal return	10.19%	12.00%
Vanilla RPI real return	6.56%	8.74%
Vanilla CPI/H real return	8.03%	9.80%

8.2.4. Implied range of returns

The above ranges assume that Ofgem continues with its approach of applying a cost of equity re-levered to 50% gearing across the whole RAB. As a comparison to the range of equity returns this produces, we have also considered evidence from onshore network price controls regarding the appropriate range of equity returns. Under these price controls, Ofgem seeks to set an appropriate range of Returns on Regulated Equity (RORE). Figure 8.4 below sets out Ofgem's proposals for RIIO-ED1.

Figure 8.4: RIIO-ED1 real RoRE range



Source: Ofgem

The chart implies that a 900bps range in post-tax returns on regulated equity has been considered reasonable for onshore networks. The implied range of potential returns on notional equity for the interconnector cap and floor regime is wider than this, at around 1,040-1,350bps.[54] However, the comparison, though illustrative, is not a straightforward one, as the risk profile for the two asset categories is different. In particular, the range of returns for onshore networks reflects controllable performance incentives, while the range of returns for interconnectors largely reflects market risk relating to interconnector utilisation.

[54] Based on the difference between cap and floor post-tax rates of return, adjusted to reflect a 50% notional gearing assumption in line with the cap cost of equity calculation.

9. SUMMARY AND KEY DISCUSSION POINTS

In this report, we have set out six separate cost of capital estimates:

- We have set out proposals for IDC for three different regulatory regimes, those applying to:
    - OFTO developers;
    - interconnectors; and
    - Ofgem's proposed Competition Proxy model.
- We have set out a proposed cost of capital applying for the operational phase of the Competition Proxy model.
- Finally, we have proposed rates of return to apply at the cap and floor of the interconnector regulatory regime for window 3.

Section 9.1 below presents our proposals relative to the current Ofgem approach where one exists. This would be the first time a cost of capital is being set for both phases of a Competition Proxy model, so there is no comparison to be made.

In the following sections, we focus on two key discussion points following on from our proposed approaches and ranges. In Section 9.2, we discuss how Ofgem might select a point estimate with the proposed ranges. In Section 9.3, we discuss how parameter estimates might be updated in the future.

9.1. Impact of proposed changes

In presenting current Ofgem evidence, we show the figures set by Ofgem for 2017/18, together with our own analysis of what the evidence would indicate for 2018/19 based on the same approach. We note that this has not been quoted by Ofgem, so the figure is hypothetical. It does however utilise more up-to-date evidence (up to end-October 2017), which means that it is arguably more comparable to our proposals (up to end-September 2017).

9.1.1. IDC for OFTO developers

Table 9.1 below compares the IDC rate under Ofgem's current approach for 2017/18 and our forecast for 2018/19 for OFTO developers, relative to our proposed range.

Table 9.1: Comparison of different approaches to setting the IDC for OFTO developers (nominal)

Parameter	Ofgem 17/18	Ofgem 18/19 (CEPA estimate)	CEPA proposed low	CEPA proposed high
Risk-free rate	3.12%	2.76%	0.50%	0.75%
ERP	4.40%	4.40%	7.00%	7.75%
TMR	7.52%	7.16%	7.50%	8.50%
Equity beta	0.93	0.84	0.72	0.96
Gearing	41.2%	24.5%	37.5%	37.5%
Asset beta	0.55	0.63	0.45	0.60
Post-tax Cost of Equity	7.21%	6.46%	5.54%	8.19%
Cost of Debt	3.86%	3.41%	1.50%	2.00%
Pre-tax nominal WACC	**6.83%**	**6.85%**	**4.84%**	**7.07%**

Source: Ofgem, CEPA analysis

Both the 2017/18 and 2018/19 cost of capital estimates under Ofgem's current approach sit within our range, albeit towards the upper end.

The main differences are with the cost of debt and the risk-free rate, where we use both a shorter tenor and a more prevailing estimate, which at present works to lower the cost of capital.

By using a TMR-based approach, however, the MRP estimate is significantly higher than under the current Ofgem approach, given our much lower risk-free rate estimate. Our estimate of the implied TMR based on 2018/19 data under the current approach is 7.16% – outside the range of 7.5-8.5% that we view as a plausible reflection of the evidence. We therefore view the offsetting effect of a higher MRP estimate as an important aspect of the revised approach.

We also consider that our approach would result in more appropriate future movements in parameters, with estimates of the cost of debt and risk-free rate responding in a timely way to movements in government and corporate debt yields. Under the current approach, the risk-free rate may continue its downward trend for several years even if evidence begins to trend upward.

By contrast, our approach treats beta and gearing as more stable, enduring parameters. Having taken a balanced, medium-term view we would not necessarily see these as needing to be updated on an annual basis – though we discuss this more fully in Section 9.3.

9.1.2. IDC for interconnectors

Table 9.2 below compares the IDC rate under Ofgem's current approach for 2017/18 and our forecast for 2018/19 for interconnectors, relative to our proposed range.

Table 9.2: Comparison of different approaches to setting the IDC for interconnectors

Parameter	Ofgem 17/18	Ofgem 18/19 (CEPA estimate)	CEPA proposed low	CEPA proposed high
Nominal risk-free rate	3.12%	2.76%	0.50%	0.75%
ERP	4.40%	4.40%	7.00%	7.75%
TMR	7.52%	7.16%	7.50%	8.50%
Equity beta	0.93	0.84	0.80	1.04
Gearing	41.2%	24.5%	37.5%	37.5%
Asset beta	0.55	0.63	0.50	0.65
Post-tax Cost of Equity	7.21%	6.46%	6.10%	8.81%
Nominal Cost of Debt	3.86%	3.41%	1.85%	2.35%
RPI inflation	2.78%	3.10%	3.00%	3.00%
Real vanilla WACC, pre-uplift	**2.97%**	**2.53%**	**1.46%**	**3.29%**
Additional uplifts	1.45%	1.45%	n/a	n/a
Real vanilla WACC, post-uplift	**4.42%**	**3.98%**	**1.46%**	**3.29%**

Source: Ofgem, CEPA analysis

Before the application of the uplifts, both the 2017/18 and 2018/19 cost of capital estimates under Ofgem's current approach sit within our range, albeit towards the upper end. The main differences are similar to those for OFTO IDC, though our approach incorporates slightly wider ranges for the cost of debt and asset beta.

However, following the application of the uplifts under Ofgem's current approach, our cost of capital is materially below the current allowed cost of capital in real vanilla terms. Though our asset beta range is broadly aligned with the current Ofgem approach, as we noted in Section 4.1 the implied 2017/18 asset beta (were the WACC uplift applied through the asset beta term) is 0.88 – significantly above our proposed asset beta. This value also far exceeds the evidence on asset betas for construction and engineering comparators.

We consider it more appropriate to consider the risks faced in estimating the asset beta, rather than through a separate uplift. As noted in Annex B, although there are some differences between interconnectors and OFTO developers, we do not consider that these are as material as implied under the current Ofgem approach.

9.1.3. Interconnector floor rate of return

While our estimated floor rate of return has been updated for new evidence, we are not proposing a change in methodology for how the interconnector floor returns are set for future interconnector windows. As such, our approach is equivalent to that set by Ofgem.

9.1.4. Interconnector cap rate of return

We have proposed a series of adjustments to Ofgem's parameter estimates while remaining within the existing approach of applying a cost of equity to the full RAB:

- For the risk-free rate, we consider that using a long-term real RPI-linked risk-free rate is no longer suitable. We propose using a long-dated government bond to set this rate, and use a prevailing estimate of the risk-free rate, in this case 1.75-2.00% nominal. This is 160-185bps lower than the last estimated risk-free rate under the cap.
- We also consider that the TMR evidence points to a similar or lower figure than under the most recent Ofgem decision of 6.8% real (RPI). Our proposed range is equivalent to 5.5-7.0% real (RPI).
- On the equity beta, our interpretation of the Ofgem position is that an equity beta of 1.25 remains appropriate. For our proposed range, we have utilised this point estimate, however further analysis could be undertaken on generator betas if Ofgem wished to depart from this approach.

9.2. How might Ofgem select a point within each range?

For this study, we have been asked to estimate ranges, not point estimates, for appropriate rates of return. However, we have given consideration to the decisions Ofgem must take, and the way in which it might reach a point estimate. The relevant considerations are different for observable market-based parameters than for those parameters requiring a degree of judgement.

For market-based parameters – i.e. the cost of debt and risk-free rate – a small number of factors can be used to compute an estimate in a mechanistic way. These include the relevant tenor, trailing average period and (for the cost of debt) credit rating. We would recommend finalising a view for each factor in order to compute a final point estimate. If necessary, these point estimates may reflect a blend of different sources: for example, a construction project with a duration of five years may require a cost of debt based on the average of the 3-5 and 5-7 year indices (as we have used for our Competition Proxy IDC cost of debt).

Our approach to the TMR inevitably requires the application of judgement. Though this would limit Ofgem's ability to compute a mechanistic estimate relative to the current approach for IDC, we think this offers an important degree of flexibility in responding to changing evidence. For IDC in particular, which is a rate of return required for a one-off capital raising over a relatively short time horizon, the prevailing TMR may differ quite significantly from longer-term historical averages. Our proposed range is intended to provide a balanced view of the available evidence within the context of a prevailing, forward-looking estimate.

The exercise of judgement is also required in estimating betas. For IDC, the judgement required is to assess the appropriate weight to place on different comparator groups (as well as more generally the interpretation of statistical uncertainty around beta evidence). Our proposed ranges are intended to capture the range of potential estimates from lower beta regulated networks at one end of the spectrum to higher beta construction and engineering comparators at the other. Whilst the midpoint of each range would be a natural starting point for considering a point estimate, our view is that a suitable estimate in each case is more likely to fall in the lower part of the range, given the likelihood that the protections afforded to investors through each regulatory regime have a greater influence on the risk profile than the nature of the activities to be undertaken.

Finally, although we view the OFTO operational regime as a direct comparator for the Competition Proxy operational regime, a degree of judgement is required in interpreting that evidence, too. Other things being equal, we would tend to place most weight on the more recent OFTO evidence, which would indicate an estimate in the lower part of the range – though we note the relatively small sample size of recent tender rounds.

9.3. How might Ofgem update parameter estimates?

Our proposed ranges represent estimates for a specific point in time. However, we expect that Ofgem will wish to provide clarity over how parameter estimates might be updated in the future. In this section we set out our thoughts on the key issues related to updating parameter estimates.

9.3.1. IDC (for OFTOs, interconnectors and Competition Proxy) and interconnector cap and floor

For IDC and interconnector cap and floor rates of return, our proposed approach would make mechanistic updates of parts of the calculation more challenging. The need to provide visibility and predictability must be balanced against the need to reserve judgement for parameters requiring interpretation, in particular the TMR.

For the cost of debt and the risk-free rate, the challenges are limited. Once a preferred set of characteristics (i.e. tenor, trailing average period and, for the cost of debt, credit rating) has been determined, these components of the cost of capital can be updated mechanistically at Ofgem's chosen frequency. This may involve annual updates (for which a longer trailing average period may be appropriate) or updates shortly prior to financial close for specific projects (for which a shorter trailing average period would be appropriate).

Estimates of the TMR (and so the MRP) could also be re-calculated periodically, though there is not a single established method for achieving this in a regulatory context. We suggest that Ofgem consider the following three options:

- The implied MRP could be set initially based on estimated TMR, and subsequently adjusted automatically based on changes in the risk-free rate and a pre-defined adjustment factor. This would enable the MRP to be updated as often as the risk-free rate, without a need to re-estimate TMR.
- Ofgem's estimated TMR could be re-calculated based on a pre-specified mechanistic approach. A clear methodology for determining sources of evidence (e.g. in constructing a DGM output) would be required as well as an approach for weighting different TMR estimates.[55]
- Alternatively, if Ofgem did not wish to set TMR based on a mechanistic approach, it could be set initially based on Ofgem's judgement, with future *changes* to the TMR being calculated based on a pre-specified mechanistic approach.

Over time, each of these approaches could result in the MRP drifting away from Ofgem's initial determination. It would be appropriate for Ofgem to build in a periodic reset of the calculation, for example based on a fresh review of the TMR evidence. One option to consider would be aligning the timing of these resets with the timing of onshore price controls, which in any case require Ofgem to assess the evidence on market returns.

Estimates of beta and gearing could also, in principle, be updated at any frequency Ofgem chooses, as the data is readily available. However, in our view there are two key reasons to avoid frequent updates. First, a degree of judgement is required in balancing different sources of evidence, and the application of this judgement may be difficult to formalise in a mechanistic approach. Second, and most important, evidence on beta is subject to statistical uncertainty. Computed beta estimates tend to fluctuate within a range. In the short-term, it is likely that these fluctuations generally represent noise rather than genuine underlying changes in risk. We would therefore suggest Ofgem considers updating its estimates of beta and gearing infrequently – for example, at the same time as its periodic re-estimation of TMR.

9.3.2. Competition Proxy operational phase WACC

For the cost of debt, the considerations are much as for IDC. A suitable estimate can be computed at any point in time for a given set of characteristics. If the operational cost of debt is to be locked down in advance, the proposed calculation approach should set out how forward curve evidence would be used to update the prevailing cost of debt.

For the cost of equity, we consider as a general point that it is appropriate to utilise the most recent OFTO Tender Round evidence as this is likely to most accurately capture market conditions. Again, if the operational cost of equity is to be locked down in advance, the proposed calculation approach should set out how (if at all) forward curve evidence might be

[55] For example, in New Zealand, the median estimate derived from five different methodologies is used under their Input Methodologies.

used to update the prevailing cost of equity. If the regime changes in terms of risk profile, however, further adjustments may be required.

In order to improve the transparency of future updates, we suggest that Ofgem may wish to consider whether OFTO-based cost of equity estimates can be decomposed into their component parts (i.e. a risk-free rate, MRP and equity beta). This could facilitate clearer updating or indexation of the applicable rate of return.

ANNEX A   Overview of CEPA DGM

The outputs from a DGM approach are sensitive to the inputs used. As such, the development of a DGM only provides an answer based on what is assumed in the first instance. As noted above, both PwC and Europe Economics present DGM evidence in their work for Ofwat on the cost of equity. The CEPA DGM is very similar in its specification to these models, although usually slightly different input assumptions for the model.

A.1.   Framework

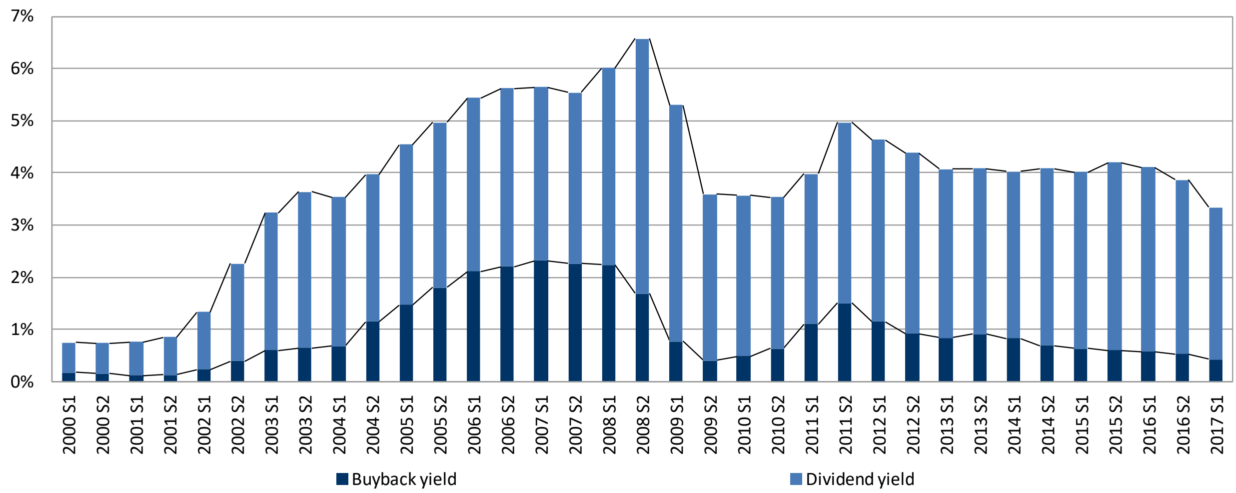
We consider that the framework set out by PwC and Europe Economics, namely using short-term growth rate forecasts for five years and then switching to a long-run growth estimate, is an appropriate starting point. We focus on a UK stock exchange, the FTSE All Share index, together with expectations of GDP growth rate in the UK. This approach is consistent with PwC and Europe Economics. GDP growth is often used as a proxy for dividend growth and are often seen as being better than analyst estimates that are more prone to optimism bias. Our DGM is in nominal terms and the outputs are representative of a TMR, as is the case for the PwC and Europe Economics DGM specifications. The model outputs are semi-annual.

A.2.   Basis for assumptions

There are three inputs used in our multi-stage DGM:

The *current dividend yield* is based on the dividend itself and also the share buyback. This represents a source of additional shareholder returns and is used in the updated Bank of England model[56]. The inputs from Bloomberg are shown below[57].

Figure A.1: Dividend yield used in CEPA model

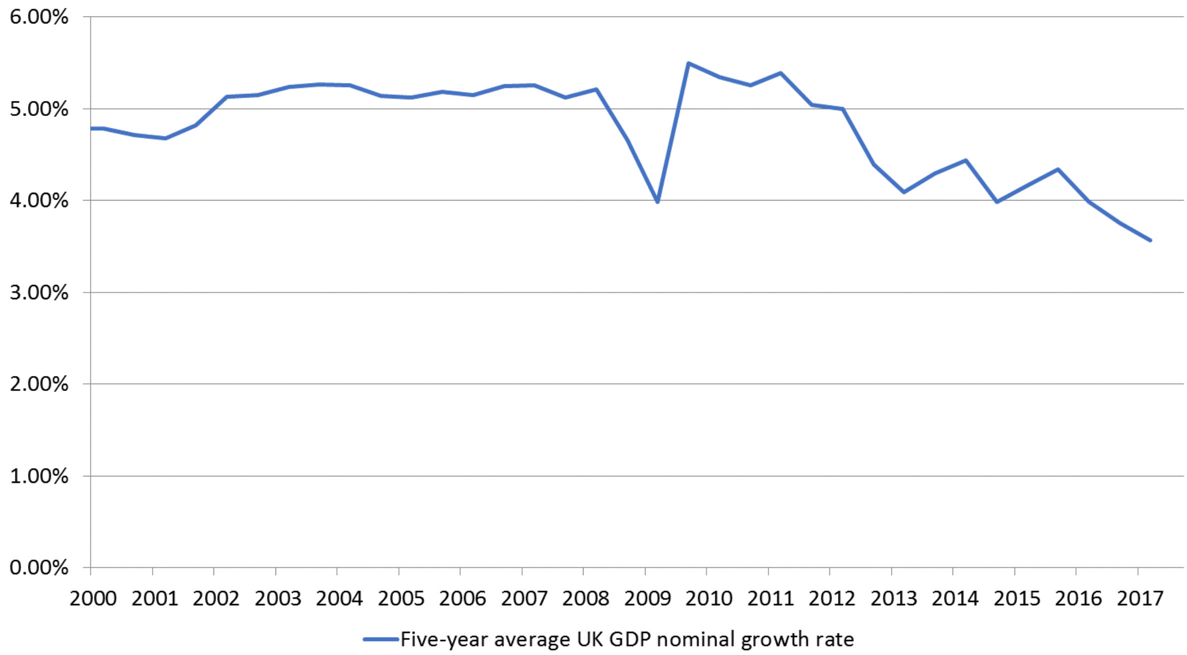


[56] W. Dison and A. Rattan, Bank of England (2017). An improved model for understanding equity prices.

[57] The Bloomberg data used is based on a template that calendarises (i.e. smooths) equity repurchases and dividend yields. This approach maximises data availability and reduces the impact of different companies operating on different financial years.

The *short-term growth rates* are taken from the Office of Budget Responsibility's (OBR) Economic and Fiscal outlook projections. We take the average growth forecasts over the coming five-year period for our short-term growth rate estimate.

Figure A.2: Short-term GDP growth rates used in CEPA DGM analysis



Source: OBR

Finally, the *long-term growth rate* inherently entails a degree of subjectivity. The latest OECD GDP growth rate estimate to 2060 averages just 2.20%[58], while a historic nominal growth estimate since 1949 would give a 7.94% long-term growth rate[59]. Our preference is to utilise a real growth estimate and apply a suitable inflation figure - we consider that historic periods with very high inflation skew the results. We use real UK GDP growth from 1950-2016 to give us a real growth rate of 2.5%[60]. This has been deflated by a mix of Consumer Price Inflation (CPI), Producer Price Inflation (PPI) and Services Price Inflation. We consider that using the Bank of England's 2.0% CPI target is appropriate for arriving at a long-term view of nominal growth. This gives us a long-term nominal growth assumption of 4.5%.

[58] OECD (2017). GDP long-term forecast (indicator). doi: 10.1787/d927bc18-en (Accessed on 25 November 2017)
[59] CEPA analysis of ONS dataset, GDP at market prices, current prices, seasonally adjusted.
[60] CEPA analysis of ONS dataset, GDP, chained volume measure (CVM)

ANNEX B RISK ANALYSIS

B.1. Definition of categories

We undertake a relative risk assessment to determine how the risks associated with a new type of asset (e.g. Competition Proxy model) compares to those of an asset for which we have a reasonable baseline of information (e.g. offshore transmission). Anything that influences investor returns (or the timing of those returns) potentially matters.

Regulated sectors are impacted by risk and uncertainty, which might affect outturn revenues and costs. Risk is assessed by investors on a forward-looking basis. We need to consider not just what risks are at a given point in time, but how they might be perceived to develop over time. Investors assess risk on a forward-looking basis, and therefore we should consider perceived future risks in addition to current risks. Perceived risks might, for example, be informed by the level of expenditure relative to the current asset values (capex intensity). We should also consider how strongly the risk impacts the asset value.

We have outlined our categories in the table below, and indicated the extent to which each is diversifiable. We focus on underlying asset risk. Debt contributes to overall equity risk as well, since fixed payments to debt holders influence the sensitivity of equity returns to cashflow fluctuations. Since the impact of debt can be captured quantitatively through the measure of gearing, we do not include it in this qualitative relative risk assessment. Some of these categories are applicable to both construction and operation, while others are relevant to both phases.

Table B.1: Types of risk

Risk element	Description	Diversifiable?
Both phases		
Volume/ margin risk	Demand risk can be considered as two elements: volume and margin risk. Volume risk is largely determined by whether the revenues change with usage. Margin risk is based on the allowed cost pass-through and whether (any) volume drivers match operational gearing levels.[61] Re-openers may link changes in costs to changes in revenues.	Diversifiable and non-diversifiable elements. In general, a risk category that is more likely to be related to the business cycle and macro-economic factors.

[61] A revenue cap may transfer nearly all volume risk away from companies; however, margin risk will remain as companies' costs are a function of volume. Whether volume terms or other mechanism match a regulated company's fixed and variable costs will affect margin risk.

Risk element	Description	Diversifiable?
Capex risk	Capex risk is affected by two dimensions: treatment of overspend – whether the difference is passed through to consumers or borne by the company; and treatment of benefits – how companies are awarded for efficiency gains.[62]	In principle, diversifiable. Elements may be positively or negatively correlated with macro-economic factors. Scale of capex may affect ability to raise funds but this is a slightly separate issue to systematic risk.
Investment intensity	Investment intensity risk looks at how much investment is taking place in relation to the current asset base. A company trying to increase its asset base by a larger percentage may have a higher risk level.	Non-diversifiable.[63]
Indexation and uncertainty mechanisms	Risk is reduced if allowed returns, expenditure, and price are linked to an appropriate index. Further uncertainty mechanisms can be introduced to adjust or reopen the determination in response to material changes, e.g. tax or volume drivers.	Diversifiable and non-diversifiable elements.
Regime and policy	Regulatory risk primarily refers to the consistency, credibility and predictability of the regime. This relates to how likely it is that the regulatory goal posts will move. Perceptions of this may be affected by the transparency of decisions, how frequently major changes have occurred, and how established the regulator is in its position. Regulated entities may also be exposed to broader policy risk (e.g. tax).	In principle diversifiable, but again elements may be linked to macro factors that might change regulatory or policy decisions.
Construction phase only		
Development risk	Development refers to the preparations for the project, such as achieving the necessary consents – the investor may bear risk if the investment does not go ahead. This also considers the likelihood of the investment not going ahead.	Diversifiable and non-diversifiable elements.
Design and technical risk	Design risk is primarily focused on the feasibility of the design of the asset, for example financeability. Other important aspects of the design might include ensuring minimal environmental impacts.	Primarily non-diversifiable, but some diversifiable elements.

[62] Both of these are functions of the size of the investment programme relative to RAB as it influences the magnitude of any mistakes or judgements.

[63] As most recently discussed by: CMA (Oct 2015) "Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991 Report" available on the GOV.UK website here.

Risk element	Description	Diversifiable?
Financing risk	There may be a risk that the financing costs do not match those permitted by the regulatory regime.	Diversifiable.
Operation phase only		
Opex risk	Operating cost risk is based on the degree to which regulation allows the pass-through of costs to users, and how much these costs vary in practice.	Diversifiable and non-diversifiable elements.
Residual asset value	If the operational life of an asset is longer than the period for which the investor will operate the asset, there will be an expected residual asset value when it is transferred back. The actual residual asset value may differ from this value.	Largely non-diversifiable.
Incentive regime	Performance incentive mechanisms inside the direct price control have become increasingly important in several regulatory regimes. Both their size and the variation of payments can have a material impact on companies' overall risk profiles. There may be some gain-sharing mechanisms in place, e.g. of refinancing or of estimated vs actual costs.	Diversifiable and non-diversifiable elements. In theory, company incentive risk should be diversifiable if incentives are symmetric and investors can diversify within a sector.
Tax risk	If actual tax costs differ to allowances, this creates a mismatch.	Largely non-diversifiable

B.2. IDC

The table below compares the risks during the construction phase for new asset investments, namely OFTO developers, interconnectors and the Competition Proxy model.

Table B.2: Relative risk assessment for the construction phase of new asset investments

Risk element	OFTO developer	Interconnector	Competition proxy
Volume/ margin risk	**Low risk.** Not applicable as construction cost is fully recovered once asset is transferred to OFTO (once asset is operational and project reaches financial close). No stranding risk exists for the construction of the offshore transmission line.	**Low to medium risk.** Construction costs are recovered through revenue over the life of the regime. This may be considered an operational risk. Interconnector developer will face stranding risk if they continue to own the asset during the operational phase.	**Low risk.** Construction costs are recovered through revenue over the life of the regime. Revenue stream is guaranteed where the asset is available. No stranding risk borne by NGET.
Capex risk	**Low to medium risk.** Ex-post capex regulation (economic and efficient costs are recovered) – although this could result in a higher final transfer value (FTV), which is partially passed back to the generator via a higher transmission network use of system (TNUoS) charges. Ofgem publishes clear cost assessment guidance to provide predictability and transparency, with developers able to recover efficiently incurred costs associated with uncontrollable events. Some, not all, construction risk can be passed through to contractor – ability increases with maturity of the regime. Efficiently incurred costs can be passed into the FTV.	**Medium risk.** Ex-post capex regulation so efficient and economic costs are recovered. Ofgem publishes clear cost assessment guidance, with developers able to recover efficiently incurred costs associated with uncontrollable events. Some, not all, construction risk can be passed through to contractor.	**Low to medium risk.** Construction and delivery remains with NGET, with a sharing factor for controllable costs. Uncontrollable costs (e.g. flooding and force majeure) will be subject to ex-post review, with no sharing (expect a materiality threshold to apply). Some, not all, construction risk can be passed through to contractor – ability increases with maturity of the regime. Efficiently incurred costs can be passed into the RAV. Licence protections in place for uncontrollable risks. Scope for foregone revenue with delay (if due to regulator perceptions of controllable error), but limited financial penalties.
Development risk	**Low risk.** Offshore transmission asset development decision is undertaken as part of offshore wind farm	**Low to medium risk.** If project is not undertaken, no compensation for development costs. Although with increasing	**Low risk.** Ofgem has accepted the economic and technical need for the HSB transmission line, and will do so for any future

Risk element	OFTO developer	Interconnector	Competition proxy
	development decision so no separable development risk.	maturity of regime, this is unlikely.	projects before proceeding. Planning consents in place for HSB through DCO approval.
Design and technical risk	**Medium risk.** Several offshore transmission asset projects exist so design can be replicated. However, marine environment is more technically complicated and there have been technical issues with offshore transmission assets in the past (e.g. defects which become apparent during operation).	**Medium to high risk.** Marine environment and length of cables may add technical difficulty to design. Some defects could occur during operation. More complicated design requirements exist when connecting countries.	**Low to medium risk.** TNEI report and Ofgem confirms feasibility of high-level design, but risk remains on the detailed design. Onshore environment brings some reduction in design risk, but also requires the execution of multiple interfaces with other parties' land and assets.
Investment intensity	**Low to medium risk.** Transmission assets are typically 20% of total project costs (for a windfarm developer) meaning that construction delays or cost overruns would not have significant impact on project return (in the developer build case).	**Medium risk.** Transmission assets are almost 100% of total project costs. Project returns are more sensitive to transmission construction costs.	**Low risk.** Transmission assets for HSB would make up small portion of overall NGET RAB. Construction delays or cost overruns would not have material impact on return of NGET.
Indexation and uncertainty mechanisms	**Low risk.** WACC updated annually for IDC projects. No updates to IDC during construction. Assume hedged underlying exposure.	**Low risk.** WACC updated annually for IDC projects (previously updated on a project specific basis for final investment decision (FID)). No updates to IDC during construction.	**Low risk.** Finance is raised at the same time as Ofgem sets the allowance, so little risk of mismatch.
Regime and policy	**Low risk.** Stable, predictable, mature regime. Short construction time frame reduces likelihood of policy changes.	**Low risk.** Regimes may straddle different jurisdictions potentially increasing risk of policy change. For the UK side of the interconnector, this should be relatively low risk however (and this is our focus).	**Low risk.** Stable, predictable, and close to mature onshore networks regime. Policy changes are unlikely, even more so for shorter construction periods – however projects will differ in construction period (HSB expected to be relatively long).
Financing risk	**Low to medium risk.** OFTOs face a cap on their financing costs, with higher levels not being	**Low to medium risk.** Interconnectors face a cap on their financing costs, with higher levels not	**Low risk.** NGET are given an IDC allowance based on benchmarks, keeping

Risk element	OFTO developer	Interconnector	Competition proxy
	compensated through the IDC allowance.	being compensated through the IDC allowance.	outperformance, but facing underperformance. Benefit from NGET's investment grade credit rating and strong balance sheet. Risk could be slightly higher if the allowance is set at a time with materially different financial market conditions to when finance is being obtained.

Source: CEPA analysis

B.3. Competition proxy operations phase

The table below includes our relative risk analysis for these different assets.

Table B.3: Comparison of risk in OFTOs and Competition Proxy models.[64]

Risk category	OFTOs	Competition Proxy
Volume/ margin	**Low to medium risk.** Allowed tender revenue stream (TRS) is set for 20 years. Low counterparty risk as TRS is paid through NETSO, a ring-fenced subsidiary of National Grid.	**Low to medium risk.** Allowed TRS is set for 25 years. Low counterparty risk as NGET recovers revenues directly from NETSO, a ring-fenced subsidiary of National Grid.
Capex (new asset investment during operational period)	**Low to medium risk.** New capex requirements will be reflected in the TRS, but the OFTO can refuse to undertake any that are >20% of the original investment. Expectation is that the capex will be assessed ex-post and a separate cost of capital set.	**Low to medium risk.** During the revenue term, any additional works that don't meet competition criteria, would be funded under prevailing RIIO arrangements. However, there is no explicit cap on the works to be undertaken.
Indexation and uncertainty mechanisms	**Low to medium risk.** Bidders are offered a choice of how much of their allowed revenue they want to be indexed to RPI; all have chosen choose 100% to date - bear the risk of inflation being lower than expected. Some cost-pass through and possibility to get exceptional costs. Market rate adjustment (MRA) adjusts TRS if market interest rates change between bid and financial close. Income Adjusting Event clauses protects the OFTO above a specified threshold level (between £500k and £1m as the threshold).	**Low to medium risk**. Expected to be fully indexed to a measure of inflation. While this offers a potential mismatch between revenue fluctuations and cost fluctuations, it is the level chosen under biddable indexation in OFTOs. Expect some re-openers similar to in OFTO, but without protection for latent defects as NGET would be building the assets. This provides some certainty as NGET will have undertaken construction of the asset and should not come across any hidden surprises. There will be re-opener in the NGET licence to reflect the impact of a force majeure event, subject to a materiality threshold (threshold tbc).
Regime and policy	**Low risk.** No regulatory discretion to change the TRS. OFTOs may be subject to future changes in law, but some planned changes will be passed through to customers e.g. on decommissioning.	**Low risk.** Current uncertainty as regime is under development, but likely to be low once regime is set e.g. no stranding risk. NGET may be subject to future changes in law, but to be confirmed. Regime expected to be consistent across construction and operational periods.

[64] Previous CEPA analysis and Pinsent Masons and Ofgem consultation and KPMG and Allen and Overy

Risk category	OFTOs	Competition Proxy
Opex	**Low to medium risk.** Potential upside for out-performance. Pass through of defined key costs. Marine environment adds an additional challenge for the operational phase of the project, but OFTO can mitigate risk through maintenance contracts and insurance (and due diligence). Operating period is 20yrs.	**Low to medium risk.** NGET can mitigate some risk through maintenance contracts and insurance. No marine environment, but longer operating period (25yrs rather than 20 yrs for OFTO).
Residual asset value	**Low risk.** Revenue stream equals the operational life. Investors can still tactically assume >0 residual value, assuming that they then are able to operate the asset for longer than the 20 years.	**Low risk.** Fully depreciated so no residual value. No asset transfer at end of revenue period.
Incentive risk	**Low to medium risk.** Availability based incentives exist, up to 10% of base revenue.	**Low risk**. TRS guaranteed for the period, based on Energy Not Supplied (ENS) incentive, up to c.3% of base revenue at risk. Other incentives do exist, but these are limited in nature for new assets.
Tax risk	**Medium risk.** OFTO faces any change in government tax policy, with no provision for re-openers.	**Low risk**. A tax allowance (if not a pass-through mechanism) would likely include a re-opener for changes in tax policy.

Source: CEPA analysis