NERA
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Review of Ofgem proposed WACC for Competition Proxy Model of delivering new onshore capacity investments

A report for SHET plc and SPT plc

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Contents

List of Tables

List of Figures

Executive Summary

Scottish Hydro Electric Transmission plc (SHET) and SP Transmission plc (SPT) commissioned NERA Economic Consulting (NERA) to review Ofgem's proposed WACC for the Hinkley Seabank (HSB) project under its proposed Competition Proxy model.[1]

Ofgem proposes a vanilla WACC (real, RPI-deflated) for HSB of 1.12 to 2.70 per cent for the construction phase (expected to cover a 5-year period starting in 2019) and of 0.6 to 1.75 per cent for the operational phase (expected to cover a 25-year period starting in 2024). Ofgem's proposed WACC is based on recommendations from CEPA on the appropriate WACC for the Competition Proxy model of delivering new onshore capacity investments.[2]

In this report we note that[3] Ofgem's proposed approach of using a Competition Proxy Model to set the WACC for HSB is itself unsound for a number of reasons. It is demonstratively inconsistent with the commitments that Ofgem gave at the start of the RIIO-T1 period not to re-open the WACC for new investments. At the time of the RIIO-T1 Final Proposals, Ofgem stated it would determine the WACC for new large projects under the Strategic Wider Works framework based on the allowed WACC for RIIO-T1.[4] Changing the approach ex-post, through a re-determination of the WACC during RIIO-T1, may affect the perception of regulatory stability and undermine investor confidence in the overall regulatory framework, leading to higher cost of capital for HSB and other investments and higher prices to customers as a result. The Competition Proxy model does not involve actual competition but simply re-setting the WACC based on available benchmarks, making Ofgem's Competition Proxy model no different from a price control review. Ofgem's decision is further questionable, given it does not appear to demonstrate that the RIIO-T1 mechanism for delivering SWW investments, as set out in the RIIO-T1 Final Proposals, has failed to deliver the intended outcomes.

Notwithstanding these comments that Ofgem's proposed re-opening of the WACC for the HSB project is unsound, in this report we demonstrate that even if Ofgem were to re-open the WACC, it should not rely on CEPA's analysis.

CEPA's proposed construction and operational WACCs for HSB are both substantially understated, due to a number of errors and data inaccuracies. We present alternative estimates of the construction and operational WACCs for HSB under the Competition Proxy model, correcting for CEPA's errors, even though we strongly advise that the RIIO-T1 WACC should be the WACC used for the HSB investment.

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1 Ofgem (January 2018), Hinkley-Seabank project: minded-to consultation on the delivery model, p.7.

2 CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's network division.

3 Leaving aside legal considerations, which fall outside of our expertise.

4 As set out in the Initial Proposals for NGET (Ofgem (July 2012), RIIO-T1: Initial Proposals for National Grid Electricity Transmission and National Grid Gas: Cost assessment and uncertainty Supporting Document, Appendix 2, p. 171 para 1.14) and confirmed at Final Determinations (Ofgem (December 2012), RIIO_T1: Final Proposals for National grid Electricity Transmission and National Grid Gas, Cost assessment and uncertainty Supporting Document, p.61, para 4.146). Ofgem made similar statements in the Final Proposals for SHET and SPT (Ofgem (April 2012), RIIO-T1: Final Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd, Final decision – Supporting document, Appendix 2, p.58, para 1.5.).

NERA present a corrected construction vanilla WACC of 4.0 to 4.4 per cent (real, RPI-deflated) for HSB, by comparison to CEPA's calculation of 1.12 to 2.70 per cent.

CEPA estimates a vanilla WACC for HSB of 1.12 to 2.70 per cent (real, RPI-deflated), based on cost of equity (CoE) derived using a CAPM and cost of debt based on benchmark indices with short maturity.

We have identified a number of issues with CEPA's analysis, which result in a substantial understatement of the construction WACC by CEPA:

- **Flawed estimate of the TMR**: CEPA's DGM-based TMR for the Competition Proxy Model is understated, due to implausibly low assumptions around dividend growth rates, a key determinant of their calculated TMR. CEPA's TMR is totally inconsistent with DGM evidence from established institutions such as the Bank of England. We conclude on a real TMR of 6.5 to 7.1 per cent (RPI-deflated) based largely on long run historical data. We also note that CEPA recommends relying on historical evidence to estimate TMR for interconnectors and it is not clear why the Competition Proxy model should be any different.
- **Low asset beta driven by inclusion of illiquid comparators**: CEPA estimates an asset beta of 0.45 to 0.55 based on average empirical betas for construction company comparators and energy network precedent. We show that the majority of construction comparators in CEPA's sample are illiquid, which depresses CEPA's asset beta estimate. We also note that energy networks are subject to less risk than the Competition Proxy model and are therefore not suitable comparators for the WACC for the construction phase of the HSB project. We estimate an asset beta of 0.6, drawing on asset betas for liquid construction comparators included in CEPA's analysis.
- **Understated cost of debt due to high credit rating and low estimates of transaction costs**: CEPA estimates cost of debt based on A/BBB iBoxx indices with 5-years maturity and issuance costs of 15-25 bps and cost of carry of 35 bps, without any supporting evidence. We consider BBB rating for cost of debt is more appropriate, reflecting additional risks during construction and as supported by precedent (e.g. Thames Tideway Tunnel). We estimate higher issuance costs of 60bps, based on regulatory precedent amortised over the 5-year construction period and cost of carry of 100bps, based on bottom-up modelling of carry costs under CEPA's assumption that all debt is issued upfront at the start of the construction period.

We also make other adjustments to CEPA assumptions, applying a lower gearing based on the top end of construction comparator evidence and an adjustment to CEPA's RfR based on spot rate evidence to reflect the expected increase in government bond yields over the construction period.

In summary, we estimate a construction vanilla WACC of 4.0 to 4.4 per cent (real, RPI-deflated) compared to CEPA's estimate of 1.12 to 2.7 per cent, as summarised in Table 1.

Table 1
We estimate a construction vanilla WACC of 4.0 to 4.4 per cent (real, RPI-deflated) for HSB, substantially higher than CEPA 1.12 to 2.70 per cent

	NERA Lower Bound	NERA Upper Bound	CEPA Lower Bound	CEPA Upper Bound
Gearing	30%	30%	37.5%	37.5%
Real TMR	6.5%	7.1%	4.4%	5.3%
Real risk-free rate	-1.7%	-1.4%	-2.4%	-2.2%
ERP	8.2%	8.5%	6.8%	7.5%
Asset Beta	0.60	0.60	0.45	0.55
Equity Beta	0.86	0.86	0.72	0.88
Real cost of equity	5.3%	5.9%	2.5%	4.4%
Real cost of debt	-0.7%	-0.7%	-1.4%	-0.7%
Transaction costs	1.6%	1.6%	0.25%	0.50%
Total real cost of debt	0.8%	0.8%	-1.1%	-0.2%
WACC (real vanilla)	**4.0%**	**4.4%**	**1.12%**	**2.70%**

Source: NERA calculations

We note the above estimates would need to be updated closer to the start of the construction period, in particular for the cost of debt, to take into account changes in credit market conditions.

NERA present a corrected operational vanilla WACC of 3.1 to 3.7 per cent (real, RPI-deflated) for HSB, by comparison to CEPA's calculation of 0.6 to 1.75 per cent

CEPA estimates an operational vanilla WACC for HSB of 0.6 to 1.75 per cent (real, RPI-deflated), with cost of equity based on equity IRR evidence for OFTO licences and cost of debt derived from benchmark indices with long maturity.

We have identified a number of issues with CEPA's analysis, which result in a substantial understatement of the operational WACC by CEPA:

- **Sole reliance on unsubstantiated equity IRR for OFTOs and a flawed methodology of deriving an onshore CoE**: CEPA estimates the cost of equity for the operational phase of HSB of 3.5 to 5.8 per cent (real, RPI-deflated), based on nominal equity IRRs for OFTO licenses of 8-9 per cent from 2013-2016, adjusted downwards to reflect changes in equity market returns and deflated using current forward looking inflation. CEPA's cost of equity is calculated assuming a gearing of 80 to 85 per cent. CEPA fails to provide any reference for the alleged equity IRRs for OFTOs or indeed any explanation under what assumptions the equity IRRs were derived. Without this information, it is impossible to use the OFTO IRRs to determine CoE for onshore networks. In addition, CEPA's conversion of the nominal IRRs for OFTOs to real cost of equity for onshore networks is flawed due to: i) CEPA's 100bps downward adjustment to the bottom end of the IRR range which is unjustified; ii) CEPA's assumption of a highly leveraged financial

structure (80-85 per cent) which does not reflect gearing of National Grid and other onshore TOs (around 60 per cent) and iii) CEPA's use of current inflation forecasts to derive the real CoE from nominal IRRs for OFTOs which overstate inflation expectations at the time when the OFTO projects were awarded.

- **Understated cost of debt due to a number of errors and inconsistencies in CEPA's analysis**: CEPA estimates cost of debt of 0.1 to 0.73 per cent (real, RPI-deflated) based current yields on A and A/BBB iBoxx indices with 10+ years maturity, a 50bps uplift to reflect expected increase in yields by 2024 and deflated to real using 10 and 20-year breakeven inflation. CEPA's cost of debt is substantially understated due to: i) implausible assumptions of A (and A/BBB) rating given CEPA's highly leveraged structure with 80-85 per cent gearing; ii) understating the tenor of the benchmark index (20 years) relative to the 25-year operational period; iii) overstating inflation due to use of 20-year breakeven which is affected by distortions in the ILD market and substantially above alternative evidence (e.g. OBR, as used by the CMA) and iv) understating the uplift due to use of 20 year forward rate evidence which relies on illiquid long end of the yield curve.

In contrast to CEPA, we estimate the operational WACC using a bottom-up CAPM to estimate the cost of equity and a corporate financed structure, given Ofgem's proposals under the Competition Proxy model envisage that National Grid, a corporate financed TO, will be delivering the HSB project.

- We estimate a bottom-up cost of equity of 6.0 to 7.4 per cent (real, RPI-deflated), based on a bottom-up CAPM, relying on long-run historical evidence on the TMR (6.5 to 7.1 per cent, as per operational WACC), asset beta of 0.36 to 0.42 based on energy network comparator betas and 60 per cent gearing in line with onshore TO evidence.
- We estimate a cost of debt of 1.2 per cent (real, RPI-deflated), based on A/BBB iBoxx index with 15+ years maturity (matching the tenor of the index with the length of the operational period and rating with the assumed gearing), an uplift based on 10-year forward evidence and inflation based on HMT/OBR long-run forecasts (consistent with CMA precedent).

In summary, we estimate an operational vanilla WACC of 3.1 to 3.7 per cent (real, RPI-deflated) compared to CEPA's estimate of 0.6 to 1.75 per cent, as summarised in Table 2.

Table 2
We estimate an operational vanilla WACC of 3.1 to 3.7 per cent (real, RPI-deflated) for HSB, substantially higher than CEPA 0.6 to 1.75 per cent

	NERA Lower Bound	NERA Upper Bound	CEPA Lower Bound	CEPA Upper Bound
Gearing	60%	60%	85%	85%
Real TMR	6.5%	7.1%	N/A	N/A
Real risk-free rate	1.3%	2.0%	N/A	N/A
ERP	5.3%	5.1%	N/A	N/A
Asset Beta	0.36	0.42	N/A	N/A
Equity Beta	0.90	1.05	N/A	N/A
Real cost of equity	6.0%	7.4%	3.48%	5.83%
Real cost of debt	1.0%	0.9%	0.00%	0.63%
Transaction costs	0.2%	0.3%	0.10%	0.10%
Total real cost of debt	1.2%	1.2%	0.10%	0.73%
WACC (real vanilla)	**3.1%**	**3.7%**	**0.60%**	**1.75%**

Source: NERA calculations

1. Introduction

NERA Economic Consulting (NERA) has been commissioned by SHET plc and SPT plc to review Ofgem's proposed WACC for the Hinkley Seabank (HSB) project, based on the recommendations by CEPA on the appropriate WACC for the Competition Proxy model of delivering new onshore capacity investments.[5]

In particular, we have been asked to:

- Review the methodology and analysis set out in the CEPA report; and
- Provide evidence on the WACC for the construction and operational phases for an infrastructure investment akin to that proposed by Ofgem's Competition Proxy model.

In this report, we do not address other aspects of Ofgem's proposed Competition Proxy model for the delivery of the HSB project and other Strategic Wider Works (SWW) investments or indeed any alternative models for introducing competition for onshore networks. However, we note that[6] Ofgem's minded to position to introduce a Competition Proxy model for HSB appears unsound for a number of reasons:

- The introduction of the Competition Proxy model for delivering the HSB (or indeed other SWW projects during RIIO-T1) is inconsistent with the commitments Ofgem gave at RIIO-T1. Specifically, at the time of RIIO-T1 Final Proposals, Ofgem stated it would determine the WACC for new large projects under the SWW framework, such as HSB, based on the allowed WACC for RIIO-T1.[7, 8]
- If Ofgem were to change its approach ex-post through a re-determination of the WACC during RIIO-T1, as it proposes under the Competition Proxy model, this may affect the perception of regulatory stability and undermine investor confidence in the overall regulatory framework, leading to higher cost of capital for HSB and other investments

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5 CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's network division. We note the CEPA report also includes recommendations to Ofgem on the appropriate approach for calculating interest during construction for OFTPOs as well as for calculating the cap and floor for interconnectors, which are not covered by our report.

6 Leaving aside legal considerations, which fall outside of our expertise.

7 In the Initial Proposals for NGET, Ofgem noted: *"We propose to apply the same financial parameters for NGET"s overall price control package (set out in Financial Issues Supporting Document) to projects approved under SWW during RIIO-T1. This is consistent with the principles in our Strategy Document."* (Source: Ofgem (July 2012), RIIO-T1: Initial Proposals for National Grid Electricity Transmission and National Grid Gas: Cost assessment and uncertainty Supporting Document, Appendix 2, p. 171 para 1.14). This was further confirmed in Final Proposals for NGET: "*We included guidance in Initial Proposals on the SWW arrangements that would apply for NGET seeking within period determination from the Authority on additional funding and outputs to deliver wider system reinforcements. We have not made any further amendments to this guidance for Final Proposals."* (Source: Ofgem (December 2012), RIIO_T1: Final proposals for National grid Electricity Transmission and National Grid Gas, Cost assessment and uncertainty Supporting Document, p.61, para 4.146). Similarly, in the Final proposals for SHET, Ofgem stated: *"The same financial parameters for their overall price control package (set out in Chapter 5) will apply to projects approved under SWW during RIIO-T1. This is consistent with the principles in our Strategy Decision document."* (Source: Ofgem (April 2012), RIIO-T1: Final Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd, Final decision – Supporting document, Appendix 2, p.58, para 1.5.

8 The same comment applies to re-opening other financial parameters, e.g. asset lives.

and higher prices to customers as a result. There is strong regulatory and CMA precedent to support this position.[9]

- We note that the Competition Proxy model does not represent the effect of actual competition, whereby potential investors would bid for the delivery of the HSB project to reveal the true cost (capital, operating and financing) of the project. In contrast, all these costs will be set by Ofgem using available benchmarks (including those from competitive markets) and the project will be delivered by NGET, making Ofgem's Competition Proxy model no different from a price control review.
- Ofgem's decision to effectively re-open the RIIO-T1 price control for HSB (and potentially other SWW investments) is further questionable, given it does not appear to demonstrate that the RIIO-T1 mechanism for delivering SWW investments, as set out in the Final Proposals, has failed to deliver the intended outcomes.

Notwithstanding the above comments that Ofgem's proposed re-opening of the WACC for the HSB project is unsound, in this report we demonstrate that even if Ofgem were to re-open the WACC, it should not rely on CEPA's analysis.

The rest of this report is structured as follows:

- Section 2 sets out CEPA's proposed WACC for the construction phase of the Competition Proxy model for HSB, our review and critique of CEPA's estimates and our own WACC estimate for the construction phase correcting for CEPA's errors;
- Section 3 sets out CEPA's proposed WACC for the operational phase of the Competition Proxy model for HSB starting in 2024, our review and critique of CEPA's estimates and our own WACC estimate for the operational phase correcting for CEPA's errors; and
- Appendices provide supporting evidence.

[9] The impact of retrospective changes to regulatory rules on cost of capital has been extensively discussed in the 2012 CMA appeal by Phoenix Natural Gas (PNG) of the UREG's decision to introduce ex-post changes to regulatory rules. The CMA upheld the appeal, recognising that retroactive changes to regulatory rules could damage investor confidence in the regulatory framework and lead to higher cost of capital and higher prices to customers. (See e.g. CC (November 2012), A reference under Article 15 of the Gas (Northern Ireland) Order 1996 Phoenix natural gas Limited price determination, p.9 para 33.)

2. Construction Phase WACC

2.1. Summary of CEPA proposed WACC[10]

CEPA estimates a vanilla WACC of 1.12 to 2.70 per cent (real, RPI-deflated) for the construction phase of the Competition Proxy model starting in 2019 and covering a period of 5 years. The individual components of CEPA's proposed WACC are summarised in Table 2.1 below.

Table 2.1
CEPA estimates a vanilla WACC of 1.12 to 2.70 per cent (real, RPI-deflated) for the construction phase of the Competition Proxy model starting in 2019

	CEPA Lower Bound	CEPA Upper Bound
Gearing	37.5%	37.5%
Real TMR	4.4%	5.3%
Real risk-free rate	-2.4%	-2.2%
ERP	6.8%	7. 5%
Asset Beta	0.45	0.55
Equity Beta	0.72	0.88
Real cost of equity	2.5%	4.4%
Real cost of debt	-1.4%	-0.7%
Transaction costs	0.25%	0.50%
Total real cost of debt	-1.1%	-0.2%
WACC (real, vanilla)	**1.12%**	**2.70%**

Source: CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, section 6

CEPA adopts a TMR approach, with TMR estimate based on evidence provided by the Dividend Growth Model (DGM) in the range of 7.5 to 8.5 per cent nominal (4.4 to 5.3 per cent real, RPI-deflated). For the risk-free rate, it relies on short trailing average (spot, 20-day and 1-year) of five-year gilts of between 0.5 and 0.75 per cent nominal (-2.4 to -2.2 per cent real, RPI-deflated), and derives the ERP as the residual.

CEPA proposes an asset beta of 0.45 to 0.55, drawing on Scottish Transmission Operators' (TOs) beta decisions for RIIO-T1 as the lower bound, and the average asset beta for UK construction comparator companies (following Bloomberg classification) as the upper-bound. It proposes a gearing of 37.5 per cent, based on the average gearing of UK construction comparators and gearing for other onshore and offshore construction projects e.g. interconnectors.

[10] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, section 6.

CEPA calculates the cost of debt using the iBoxx corporate non-financial indices for A and BBB rated companies using 3-5 and 5-7 years maturities. CEPA also includes an issuance cost allowance of 0.15 to 0.25 per cent and cost of carry allowance of 0.10 and 0.25 per cent.

CEPA deflates the nominal WACC parameters using a 3.0 per cent RPI inflation estimate, based on 5-year breakeven inflation evidence.

We have identified a number of issues with CEPA's estimates, which lead to a substantial understatement of the construction WACC, as we discuss in section 2.2. We also present alternative estimates of the construction phase WACC in section 2.3, correcting for CEPA's errors.

2.2. Issues with CEPA's calculations

2.2.1. Total market return assumption is implausibly low

CEPA estimates a total market return of 4.4 to 5.3 per cent real (RPI-deflated)[11], based on forward-looking evidence from the dividend growth model (DGM). CEPA argues a "current" (forward-looking) estimate of TMR is preferred relative to long-run evidence, given the relatively short length of the construction period (5 years for HSB). CEPA's forward looking TMR is based on its own application of the DGM model (lower bound) as well as PwC's DGM analysis for Ofwat (upper bound), while CEPA also notes that its upper bound is consistent with long-run historical geometric average returns. Both CEPA and PwC estimate the DGM for the UK stock market using UK nominal GDP growth forecasts as a basis of short-term and long-term dividend growth projections for FTSE companies.[12, 13]

There are a number of issues with CEPA's (and PwC's) application of the DGM which we believe lead to a substantial understatement of the TMR by CEPA compared to independent DGM estimates e.g. provided by the Bank of England.

2.2.1.1. CEPA's DGM TMR is understated due to incorrect reliance on UK GDP growth as a basis of dividend forecasts

CEPA's (and PwC's) DGM is understated, due to implausibly low assumptions around dividend growth rates, when compared to independent estimates from the Bank of England. CEPA (and PwC) assume that FTSE dividends grow in line with short-term and long-term nominal growth in UK GDP, but provide no basis for the assumption that UK GDP forecast growth rates are a good proxy for investors' expectations of dividend growth rates. CEPA's (and PwC's) assumption is flawed, for a number of reasons. First, FTSE companies derive over 70 per cent of their earnings from outside of the UK, which have higher forecasts of

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[11] Calculated using CEPA's nominal TMR of 7.5 to 8.5 per cent and CEPA and RPI inflation of 3 per cent using the Fisher equation.

[12] CEPA and PwC appear to use different sources for their UK GDP growth forecasts, with CEPA relying on Office of Budget Responsibility's (OBR) projections while PwC uses Consensus Economics. However, it is not clear whether the difference in data sources for UK GDP growth can explain the c. 100bps difference between the CEPA and PwC TMR estimates.

[13] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's network division, p.35-38 and PwC (June 2017), Refining the balance of incentives for PR19, Appendix D.

GDP growth than assumed by CEPA (and PwC) for the UK.[14] Second, short-term UK GDP forecast growth rates are somewhat depressed (e.g. due to Brexit) and are substantially lower than independent analyst forecasts of dividend growth rates for FTSE stocks, which are used by the Bank of England as a basis of forecasting short-term dividend growth in its DGM.[15] As a result of understating dividend forecasts for both the short-term and the long-term relative to the independent estimates by the Bank of England (as summarised in Table 2.2), CEPA's and PwC's DGM substantially understate the TMR.[16]

Table 2.2
CEPA's and PwC's nominal dividend growth assumptions are understated compared to Bank of England (October 2016 assumptions)

	Bank of England	CEPA	PWC
Short-term dividend growth (nominal)	Around 8% (analyst forecasts)	Around 4% (UK GDP growth)	3.7% (UK GDP growth)
Long-term dividend growth (nominal)	Around 6% (weighted average GDP growth for countries from which FTSE companies derive earnings)	4.5% (UK GDP growth)	4.0% (UK GDP growth)

Source: Bank of England (2017), An improved model for understanding equity prices, Quarterly Bulletin 2017Q2, p.90-91, Chart 3 and 7, (approximate values based on BoE summary charts); CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's network division, p. 77 Figure A.2 and PwC (June 2017), Refining the balance of incentives for PR19, Appendix D, Table 24, p.102
Note: Reflects forecasts for October 2016 DGM results.

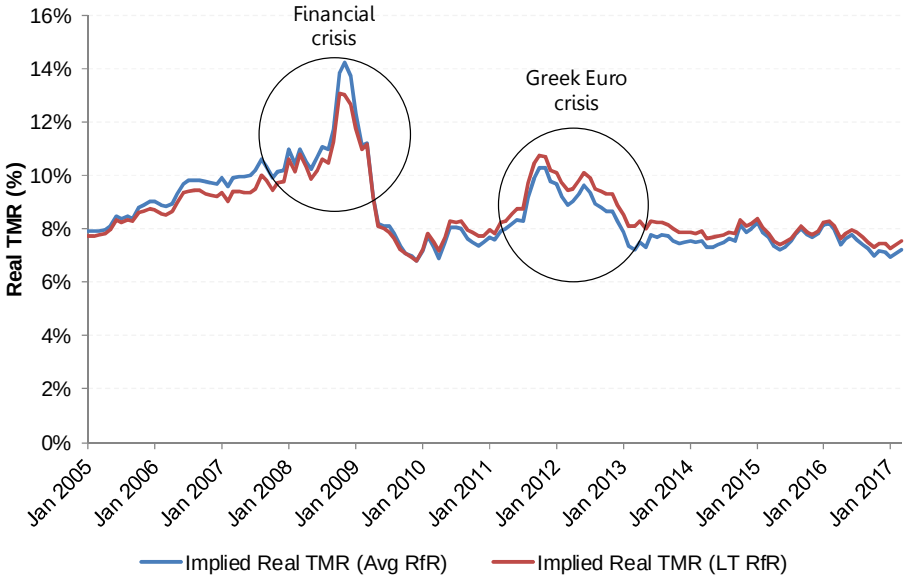
CEPA's understatement of the TMR based on its own and PwC's DGM is evident when compared to independent estimates of the TMR based on the Bank of England's DGM (as summarised in Figure 2.1 below).

[14] For example, the weighted average long-run GDP growth rate for the different regions from which FTSE companies derive their earnings as of October 2016 is around 5.9% (nominal), while the UK long-run GDP growth rate assumed by CEPA and PwC is 4.5 and 4.0 per cent (nominal). Source: Bank of England (2017), An improved model for understanding equity prices, Quarterly Bulletin 2017Q2, p.91, Chart 7, CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's network division, p. 77 and PwC (June 2017), Refining the balance of incentives for PR19, Appendix D, Table 24, p.102.

[15] Bank of England (2017), An improved model for understanding equity prices, Quarterly Bulletin 2017Q2, p.90, Chart 3, CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's network division, p. 76-77 and PwC (June 2017), Refining the balance of incentives for PR19, Appendix D, Table 24, p.102.

[16] The DGM estimates a discount rate which equates the forecast dividends to the current value of the FTSE all share index, which is observable. If dividend forecasts are understated, the DGM will "compensate" for this by producing a lower discount rate (i.e. TMR) to equate the lower dividend forecasts to the same observed value of the market index.

Figure 2.1
Bank of England DGM supports a real TMR in the range of 7.2 to 8.1 per cent



	Spot (Mar 2017)	1Y average (Mar 2017)	5Y Average (Mar 2017)
BoE TMR (average RfR)	7.2	7.3	7.8
BoE TMR (LT RfR)	7.6	7.6	8.1

Source: NERA analysis of Bank of England (2017), An improved model for understanding equity prices, Quarterly Bulletin 2017Q2, p.94 and Bank of England yield curve data using March 2017 as cut-off date (later data from BoE on the TMR not available)
Note: The Bank of England estimates the DGM using a time varying risk-free rate for all maturities (where available) and a long-run risk-free rate assumption. We calculate a TMR as the sum of the Bank of England's reported ERP and an i) average of the real risk-free rate for all available maturities and ii) the real risk-free rate at the longest maturity available.

Depending on the averaging period, the forward-looking estimates of the TMR based on the Bank of England's DGM lie in a range between 7.2 and 8.1 per cent (real, RPI-deflated).[17]

However, we note that forward looking evidence should be treated with caution, given the relative sensitivity of the results to the long-term dividend growth assumption, for which there are no equity analyst forecasts available (typically for forecasts beyond the next 5 years). The sensitivity of the TMR result to the dividend growth assumptions is one of the key reasons for favouring long-run historical averages of realised returns as a basis of estimating the expected TMR, as we discuss below.

[17] The 5-year average of the BoE TMR is slightly higher than current estimates, due to the inclusion of the 2012-2013 period (Greek euro crisis period), which exhibited elevated levels of the TMR.

2.2.1.2. Long-run historical realised returns are appropriate for estimating the TMR for the construction WACC

The more widely used and recognised approach to setting the TMR is to rely on long-run realised historical returns. The appropriateness of using historical evidence as a basis of setting the TMR depends on whether the TMR is broadly constant over time. Given the risk-free rate (RfR) exhibits considerable volatility over time, the constancy of the TMR depends on whether the observed variations in the RfR are broadly off-set by changes in the ERP, that is, whether ERP and RfR negatively co-vary over time. In general, as we explain below, financial literature supports the negative co-variance of the RfR and ERP over time, and the constancy of the TMR over time.

Finance theory explains that the negative relationship between the RfR and the ERP is associated with increased risk aversion and the so called "flight to safety" effect during periods of economic and financial crisis. At times of economic uncertainty, investors dispose of risky assets such as equity in favour of risk-free assets such as government bonds. This reduces the price of equities and increases the premia for holding risk while reducing yields on risk free assets, giving rise to the negative correlation between the ERP and the RfR.[18] Empirically, a number of studies find a positive relationship between volatility and expected equity returns and a negative relationship between the RfR and ERP while the TMR remains stable over time.[19] As an example, some of the most compelling evidence is provided by Siegel (1998), who analysed 200 years of US stock market data, which shows a remarkable degree of stability in equity returns over time, in contrast to the risk-free rate and by extension the ERP:

"the growth of purchasing power in equities not only dominates all other assets but ***is remarkable for its long-term stability****. […] This remarkable stability of long-term real returns is a* ***characteristic of mean reversion****, a property of a variable to offset its short-term fluctuations so as to produce far more stable long-term returns. […]As stable as the long-term real returns have been for equities, the* ***same cannot be said of fixed-income assets****."*[20]

Consistent with financial literature, prominent economic institutions such as the Bank of England have recognised that low interest rates and economic uncertainty have led to

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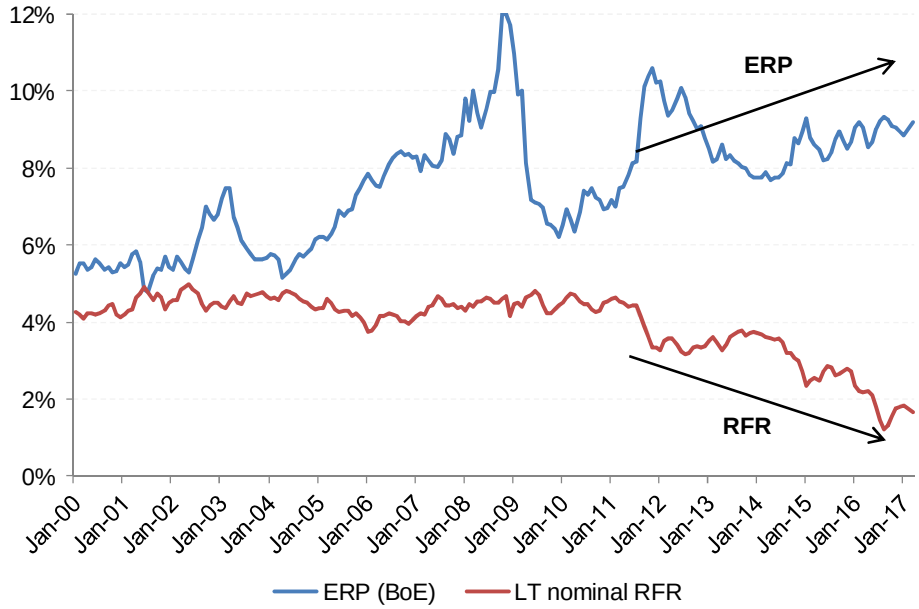
[18] See for example: (1) Campbell and Cochrane (1999), By force of habit: A consumption-based explanation of aggregate of stock market behaviour, Journal of Political Economy, 107, 205-51; (2) Wright, S. et al. (September 2006), Report on the Cost of Capital – provided to Ofgem, Smithers & Co Ltd; (3) Harris, Robert, and Marston, Felicia (1999) , The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts, Darden Business School Working Paper No 99-08; (4) Maddox, F., D. Pippert and R. Sullivan (1995), An Empirical Study of ex ante Risk Premiums for the electric Utility Industry," Financial Management, 89-95.

[19] See for example: (1) Graham and Harvey (2010), The equity risk premium in 2010. (2) Cochrane and Piazzesi (2008), Decomposing the yield curve, Graduate School of Business, University of Chicago. Working Paper; (3) Wright, Mason, Miles (2003), A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK, Smithers & Company Limited.; (4) Scruggs (1998), Resolving the puzzling intertemporal relation between the market risk premium and conditional market variance: A two‐factor approach. The Journal of Finance, 53(2), 575-603.; (5) Siegel W(1998), Stocks for the Long Run McGraw Hill, Second Edition.

[20] Siegel (1998), Stocks for the Long Run. McGraw-Hill, second edition, p.11, 13.

increased ERPs.[21] Indeed, the Bank of England's estimates of the ERP derived from its DGM have increased markedly with the recent fall in interest rates (see Figure 2.2) while the TMR remained relatively stable over time (as shown in Figure 2.1).[22]

Figure 2.2
Bank of England DGM shows reduction in RfR offset by increases in ERP over recent period



Source: NERA analysis of Bank of England data

Similarly, the German Bundesbank also noted that there is a strong negative correlation between ERP and risk free rates:

"*[…] the correlation between returns from stocks and long-term government bonds is a suitable measure of risk aversion... In times of heightened risk aversion, it is therefore often possible to observe that investors demand higher equity risk premiums or undertake shifts from stocks into secure government bonds (safe haven flows). The resulting contrasting price developments of stocks and government securities are accompanied by a negative correlation.*" [23]

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[21] See for example, Bank of England, (August 2017), Inflation Report, p.1; Bank of England, (August 2016), Inflation Report. The report states: ""*There remains, however, substantial uncertainty about the nature of the UK's future trading arrangement and the implications for competitiveness. This may have increased the risk premium required by investors to hold sterling-denominated assets.*""

[22] The TMR estimate from the Bank of England's DGM has been relatively stable over time, with the exception of the global financial crisis period as well as the Greek euro crisis period where it showed elevated values.

[23] Deutsche Bundesbank, (Nov 2007), Monthly Report.

Overall, financial literature and empirical evidence support the theory of an inverse relationship between the RfR and the ERP with the TMR being relatively stable over time, which in turn supports the use of long-run historical averages to estimate the TMR.

Given the constancy of the TMR over time, the TMR for the construction period should draw principally on the more objective historical time-series estimates. There is no rationale to rely on subjective DGM methods, as CEPA propose.

2.2.1.3. Historical evidence supports a TMR of 6.5 to 7.1 per cent (real, RPI)

We present long-run historical estimates of the TMR based on data from Dimson, Marsh and Staunton (DMS) database, which provides long-term time series data on returns on stocks, bonds, bills as well as inflation over the period since 1900, i.e. including 117 years of data in the latest publication. The DMS database is the standard reference point for UK regulators including the CMA as well as financial practitioners.[24]

In estimating the TMR based on historical data, the key question relates to whether historical estimates should be based on arithmetic or geometric averages.[25] In theoretical literature, papers by Blume (1974), Cooper (1996) and Jacquier, Kane and Marcus (2003) have been widely quoted on the subject of the appropriate averaging method.[26]

- Blume (1974) was among the first to propose an "almost" undistorted estimator of the expected return, in which the arithmetic mean gets more weight, the longer the historical averaging period compared to the investment horizon. This is known as the Blume estimator:

$$TMR = [\frac{T-n}{T-1}T * (1+AM)^n + \frac{n-1}{T-1} * (1+GM)^n]^{\frac{1}{n}} - 1$$

  Where T is the historical estimation period, and n is the investment horizon. Based on the above formula, the shorter the investment horizon relative to the historical estimation period, the greater the weight on the arithmetic mean (AM) relative to the geometric mean (GM).

- Cooper (1996) considers the use of arithmetic vs. geometric averages in the context of the CAPM applied in capital budgeting. Cooper concludes that: "*The use of arithmetic mean ignores estimation error and serial correlation in returns. Unbiased discount factors*

[24] See e.g. CMA (March 2014), NIE Limited price determination, para 13.139

[25] The arithmetic average is calculated as the sum of the annual returns divided by the number of years in the historical period, while the geometric average correspond to a constant rate of return that an investor would receive each year to achieve the same asset value as generated by the variable annual returns by the end of the period.

[26] Blume (1974), Unbiased Estimators of Long-Run Expected Rates of Returns, Journal of the American Statistical Association 69, p.634‑663.; Cooper (1996), Arithmetic versus geometric mean estimators: Setting discount rates for capital budgeting, European Financial Management, 2:2, p.157-167; Jacquier, Kane, and Marcus (2003), Geometric or Arithmetic Mean: A Reconsideration, Financial Analysts Journal 59(6), p.46‑53.

have been derived to correct for both these effects. In all cases, the corrected discount rates are closer to the arithmetic than the geometric mean".[27]

- Jacquier, Kane and Marcus (2003) provide a set of conditions under which both the arithmetic mean and geometric mean are biased or unbiased, demonstrating that the geometric mean is downward biased when the investment horizon is shorter than the historical estimation period. They also derive an unbiased estimator (JKM) of the expected return, calculated as the weighted average of the geometric and arithmetic means, with greater weight placed on the arithmetic mean the longer the historical period compared to the investment horizon (similarly to Blume).

Given the historical period from DMS data (117 years) is likely to be substantially longer than the investment horizon for the marginal investor, academic literature supports the TMR should be set close to the historical arithmetic mean.

The use of arithmetic mean is also supported by Brealey & Myers, authors of the pre-eminent "Corporate Finance" textbook, who state: *"If the cost of capital is estimated from historical returns or risk premiums, use arithmetic averages, not compound annual rates of return.*[28, 29]

Using updated data from the DMS 2017 database, the simple arithmetic mean provides an estimate of the TMR for the UK market of 7.1 per cent (real RPI).[30]

In its 2014 NIE decision, the CMA presented alternative historical TMR estimates using a number of different averaging techniques, including those by Blume and JKM discussed above, for different investment horizons (referred to by the CMA as holding periods).[31] Table 2.3 below shows an update of the CMA calculations using data over the period 1900-2016 from the latest DMS 2017 publication.

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27 Cooper (1996), Arithmetic versus geometric mean estimators: Setting discount rates for capital budgeting, European Financial Management, 2:2, p.165.

28 Brealey. & Myers (2007), Principles of Corporate Finance, 8th ed., p. 151.

29 In contrast, CEPA notes that its upper bound DGM-derived TMR is consistent with historical realised returns calculated using a geometric mean. As we explain above, the geometric mean is a downward biased estimator of the expected TMR, which invalidates CEPA's cross-check.

30 Dimson, Marsh and Staunton (February 2017), Credit Suisse Global Investment Returns Yearbook 2017, p.217-220. We note that the 2017 DMS publication includes real returns for the UK market since 1988 which have been calculated using CPI as opposed to RPI inflation. (See DMS (February 2017), Credit Suisse Global Investment Returns Yearbook 2017, p.212.) As a result, the DMS reported historical real return for the UK market of 7.3 per cent over the period 1900-2016 should not be interpreted as a real RPI-deflated measure. To ensure consistent treatment of inflation, we have re-calculated the real UK historical returns to be based on a RPI-deflated basis. This provides an estimate of historical real returns of 7.1 per cent for the UK market over the period 1900-2016.

31 CMA (March 2014), NIE Limited price determination, p. 13-27, Table 13.7.

Table 2.3
The latest long-run DMS TMR estimates lie in range of 6.2 to 7.7 per cent, a slight increase relative to evidence presented by CMA at NIE 2014

	Simple	Overlapping	Blume	JKM
1Y holding	7.1 (+0.0↑)	7.1 (+0.0↑)	7.1 (+0.0↑)	7.1 (+0.1↑)
2Y holding	7.5 (+0.0↑)	7.0 (+0.0↑)	7.1 (+0.0↑)	7.1 (+0.1↑)
5Y holding	7.2 (+0.5↑)	6.8 (+0.0↑)	7.0 (+0.0↑)	6.9 (+0.1↑)
10Y holding	6.7 (+0.3↑)	6.7 (-0.1↓)	6.9 (+0.0↑)	6.7 (+0.1↑)
20Y holding	7.7 (+1.0↑)	6.8 (-0.1↓)	6.8 (+0.0↑)	6.2 (+0.1↑)

Source: NERA calculations using DMS (February 2017),Credit Suisse Global Investment Returns Yearbook 2017 (DMS data since 1988 converted to real, RPI-deflated figures as explained in footnote 30), CMA (2014), Northern Ireland Electricity price determination, Final Determination, p. 13-27, Table 13.7.
Note: The figures in black in the table represent different historical estimates considered by the CMA for NIE (2014), calculated using updated DMS data up to 2016. [32] *The figures circled in green represent the difference between the updated estimates and the estimates presented by the CMA in NIE (2014).*

As shown in Table 2.3, the historical TMR estimates lie in a range between 6.2 and 7.7 per cent, depending on the averaging technique and holding period. The figures circled in green represent the difference between the updated estimates and the estimates presented by the CMA in the NIE 2014 determination. On average, the updated estimates show a marginal increase relative to the estimates presented by the CMA in 2014. In the NIE 2014 decision, the CMA concluded that the long run historical data supported a TMR range of 6 to 7 per cent.[33]

Table 2.3 shows that the assumed holding period is an important factor in estimating the TMR. We consider evidence supports the use of relatively short holding periods for the following reasons:

- GB regulators such as Ofgem and Ofwat have typically considered the TMR for a holding period of 1 year.
- The use of short-term holding periods is consistent with evidence from a survey of equity market participants by the CFA Institute UK that suggests that the average holding period is between 1-2 years.[34]

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[32] The simple approach calculates the arithmetic mean for successive time periods (and therefore there are few observations for long holding periods) and the overlapping approach is identical other than it allows for overlapping time periods. For holding periods greater than 1 year, the simple approach first calculates the compounded nth period return (e.g. for a 5-year holding period, it calculates the 5-year compound return earned in the consecutive periods 1-5, 6-10, 10-15 etc.), and then takes an average of these 5-period compound returns. The overlapping approach is identical other than it allows that the compound 5-year return is calculated for periods 1-5, 2-6 etc. The Blume adjustment takes a weighted average of the arithmetic and geometric returns, and the JKM is a statistical approach that provides efficient estimates for small samples, but this adjustment also effectively produces unbiased estimates of the nth period return as a weighted average of the geometric and arithmetic averages over the observation period.

[33] CMA (March 2014), NIE Limited price determination, p. 13-27, para. 13.141.

[34] Kay Review of UK Equity Markets and Long-Term Decision Making, Interim Report, Feb 2012I; CFA UK response to the Kay Review of UK Equity Markets and Long-Term Decision Making – Call for Evidence

- Helm and Tindall (2009)[35] find that most utilities are held by private equity or infrastructure funds, where the former have an average holding period of 4-5 years while the latter tend to be more long-term.

Overall, we consider the historical evidence supports a TMR range of 6.8 to 7.1 per cent. The top end of our range is based on the simple arithmetic average of historical realised returns, as used by regulators in the past and supported by financial literature. For the bottom end of our range, we draw on the range of alternative averaging techniques and holding periods considered by the CMA in its NIE 2014 decision but with the exception of: i) simple average estimates based on long holding periods, as these estimates are based on a small number of observations; ii) very long holding periods of 10 and more years which are not supported by empirical evidence on investor behaviour. This supports a bottom end of the TMR range of 6.8 per cent.

At recent reviews regulators have discussed changes to how RPI inflation is measured and the implications for setting real RPI allowed rates of return going forward. In 2010 the ONS modified the way certain clothing and footwear price indices were collected. The change in data collected raised the variation of the relevant samples and had an impact on the relative difference between RPI and CPI, because they are calculated using different formulae at the lowest level of aggregation: arithmetic and geometric means respectively. The ONS concluded that, going forward, the wedge between RPI and CPI attributed to differences in the formulae ("the formula effect") increased by about 32bps as a result of this change.[36]

We have considered whether there is a clear rationale for an adjustment to the real historical realised return data to reflect the relative increase in RPI post 2010. Primarily, we note that the 2010 change in the way RPI is measured represents only one of potentially many changes to RPI over the historical period since 1900. Indeed, the DMS returns data relies on RPI as a measure of inflation only from 1962 onwards with an "index of retail prices" used for earlier years.[37] If we make a change for the 2010 adjustment, for consistency, we would also need to analyse and correct for all other historical methodological changes to RPI and its predecessor indices, some of which may have had large quantitative effects. [38]

In the absence of a detailed review of all historical changes to the RPI (and its predecessors), we consider 30bps to be the maximum value for any adjustment.[39] Given that the RPI has

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35 Helm and Tindall (November 2009), The evolution of infrastructure and utility ownership and implications, *Oxford Review of Economic Policy*, Vol 25, pp 411 – 434

36 ONS (December 2010), CPI and RPI: Increased impact of the formula effect in 2010, p. 1.

37 Dimson, Marsh and Staunton (February 2017), Credit Suisse Global Investment Returns Yearbook 2017, p.212.

38 To take a recent example, a 2015 OBR report shows that the OBR has revised downwards its estimate of the RPI-CPI wedge because of a downward revision to the "weights effect" from 0 to -0.4 per cent As OBR notes, part of this difference *"represents interactions between categories, in particular between the formula and weights effect"*. This shows the change in the weights effect may have potentially offset an increase in the "formula effect" arising from the 2010 changes to the method for collecting clothing, as identified by ONS as 32 bps. In practice it is simply not possible to review every change in RPI over the past 100 years and adjust the historical real returns data accordingly, not least due to data limitations. OBR (March 2015), Economic and fiscal outlook, p.62. Link: http://obr.uk/docs/dlm_uploads/March2015EFO_18-03-webv1.pdf

39 Our estimate is based on the difference between RPI and RPIJ at the time of the change to the structure of RPI. As we explain in a previous NERA report, a comparison of RPI and RPIJ is a more appropriate method for estimating the

undergone other structural changes in the past, and will continue to do so in the future, it would be selective to adjust for this effect without considering the possible effect of other changes to the way RPI is (or will be) calculated. To reflect the uncertainty over other adjustments and the impracticality of identifying all changes, we consider that it is reasonable to make no adjustment at all.

In conclusion, assuming the maximum value for the adjustment for the RPI formula effect of 30 bps, we conclude historical data supports a lower bound TMR of 6.5 per cent, equal to the 6.8 per cent lower bound historical TMR minus 30 bps for the RPI effect. We make no adjustment to our upper-bound value of 7.1 per cent to reflect the uncertainty over other off-setting adjustments.

2.2.1.4. TMR – conclusion

CEPA proposes a TMR of 4.4 to 5.3 per cent real (RPI-deflated), based on its own and PwC's DGM evidence. As we explain above, CEPA's DGM TMR is downward biased compared to independent estimates by the Bank of England, which the CMA relied on in its 2014 NIE determination, and which support a TMR of around 7 to 8 per cent (real, RPI-deflated). CEPA's (and PwC's) understatement of the TMR is principally driven by their reliance on forecast UK GDP growth as a basis of forecasting dividends, which ignores that FTSE companies derive more than 70 per cent of their earnings from outside of the UK, where expected GDP growth is higher.[40]

In deriving the TMR for the construction phase, we recommend to rely on long-run historical averages as the primary source of evidence. We recommend forward looking estimates based on DGM should be used only as a cross-check, given the subjectivity of DGM evidence (as evidenced by the differences between CEPA's and the Bank of England's DGM TMR estimates). The use of historical evidence as a measure of the expected TMR is supported by the stability of the TMR over time as documented in financial literature.

Drawing on historical evidence, we estimate a TMR in the range between 6.5 and 7.1 per cent (real, RPI-deflated). We note that our TMR derived from historical data is lower than forward looking evidence from the Bank of England, which supports a TMR between 7.2 and

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increase in RPI due to the methodological change that ONS implemented in 2010. By contrast, the "formula effect", as defined and calculated by ONS, can be summarised as "the difference between the CPI and RPI" arising from different formulae used to aggregate price changes. However, the formula effect measures the difference between the actual CPI and a recalculated CPI using the RPI formula. Put simply, it is the effect of the RPI formula on the CPI, not the effect of the RPI formula on the RPI. Since the two indices differ in other ways (e.g. they include different items and place different weights on the items they both include) these two effects may not be identical. See: NERA (2014) Review of Ofgem's Estimate of the RPI Formula Effect, Section 2. Link: https://www.spenergynetworks.co.uk/userfiles/file/App14_201408_NERA_ReviewOfOfgemEstimateRPIFormulaEffect.pdf

[40] In contrast, the Bank of England estimates its DGM by using weighted average growth for the different regions from which FTSE companies derive their earnings as a basis of long-terms dividend forecasts and analyst estimates to forecast dividends in the short-run.

8.1 per cent. We also note that the bottom end of our TMR range is consistent with the latest TMR precedent by the CMA from its 2014 NIE and 2015 Bristol water determinations.[41]

2.2.2. CEPA's beta estimates are understated due to reliance on illiquid comparators and unknown methodological issues

CEPA estimates an asset beta for the construction phase of 0.45 to 0.55, based on evidence from allowed asset beta for RIIO-T1 for Scottish TOs (lower bound) and for comparator companies from the UK construction sector (upper-bound). In selecting the comparators, CEPA draws on "engineering and construction" companies, using Bloomberg's BICS classification. This set comprises around thirty companies operating in the UK construction and engineering markets.

We consider that Bloomberg's set of thirty UK construction and engineering companies represents a reasonable starting point for estimating the beta for the construction phase. As CEPA notes, UK construction and engineering firms undertake activities that appear most closely linked to the nature of the activities undertaken by the TO during the construction phase under the Competition Proxy model. The Competition Proxy model may provide some risk mitigation relative to construction projects undertaken in unregulated sectors, e.g. recognising efficient cost overruns, which suggests the comparators may face higher risk in this aspect. On the other hand, the potential set of comparators are not, unlike the Competition Proxy model, delivering a single project but instead will have a portfolio of projects, and many also provide lower risk engineering services and operations.

First, we have sought to replicate CEPA's beta calculations using the full set of around 30 UK construction comparators as classified by Bloomberg. The only difference between our and CEPA's calculations relates to our use of a more up-to-date cut-off date[42], and limiting the minimum level of net debt to zero when converting the equity beta into an asset beta.[43]

Based on the full set of UK construction comparators, we calculate a five-year average of the two-year asset beta of 0.71, substantively higher than CEPA's estimate of 0.55 (see Figure 2.3).

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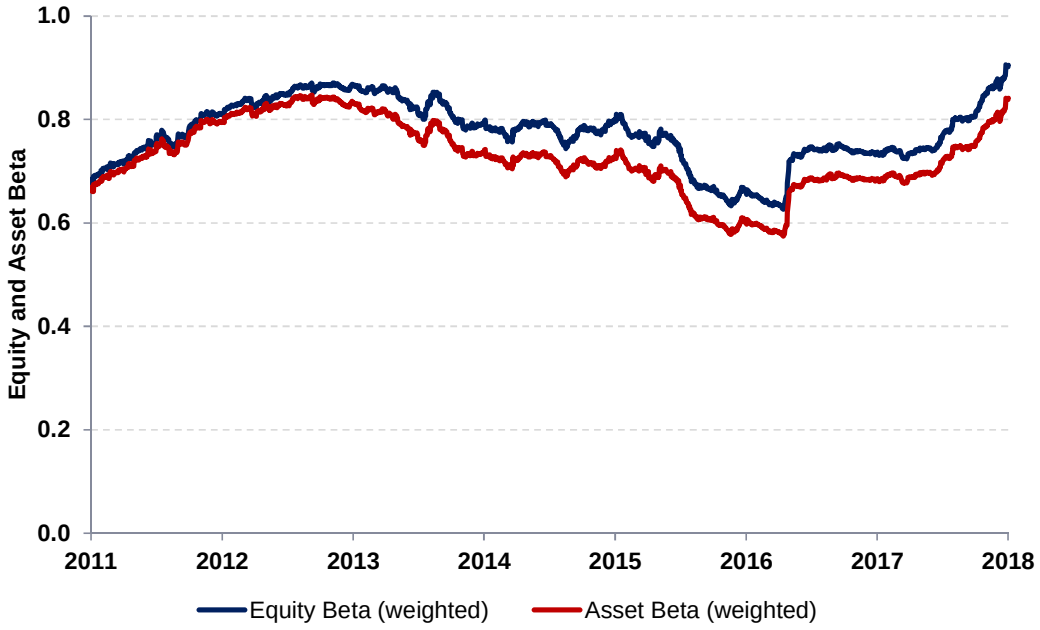
41 CMA (March 2014), NIE Limited price determination, p. 13-39, Table 13.11 and CMA (October 2015), Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991, Report, p332, para 10.186.

42 We use a cut-off date of 2nd March 2018. Given that our cut-off date is five months later than that of CEPA's report, the constituents of the BICS group might not be the same: in fact, although we have obtained the same number of comparators, two of the companies (Van Elle Holdings and Lakehouse) were listed less than 2 years ago and hence it is not possible to calculate the 2-year beta.

43 A small number of companies in the sample have *negative* net debt, i.e. debt less cash and cash equivalents is less than zero. We use a lower bound value of zero for the net debt values in calculating asset betas in such cases. The effect of this assumption is to supress asset betas for such companies (relative to not imposing this constraint).

Figure 2.3
We calculate a five-year average of two-year asset betas of 0.71 (as of 2 March 2018), substantively higher than CEPA's estimate for the same set of 0.55



Source: NERA analysis of Bloomberg data; Asset beta estimated using FTSE All Shares index assuming zero debt beta. The floor for the net debt used to de-lever the equity betas is 0. Cut-off date 2nd March 2018.

Using the same comparator set and methodology for estimating betas as described by CEPA (with the exception of a later cut-off date and a limit on minimum net debt), we calculate a five-year average of the two-year asset beta of 0.71we calculate a five year average of two-year asset betas of 0.71, far higher than CEPAs reported value of 0.55. Thus, we conclude it is not clear to us how CEPA has derived its result which does not appear to accord with the evidence that it states it has used.

Second, we have also considered the robustness of individual asset beta estimates within CEPA's comparator group. In particular, we observe that a number of companies within CEPA's comparator group have very low market capitalisation and are very thinly traded, as demonstrated by bid-ask spreads substantially higher than 1 per cent.[44] CEPA's inclusion of small illiquid companies in the comparator group is likely to result in downwardly biased beta estimates.[45] We therefore exclude the illiquid companies, with bid-ask spreads exceeding 1 per cent, which provides a narrower set of 9 UK construction comparators.[46]

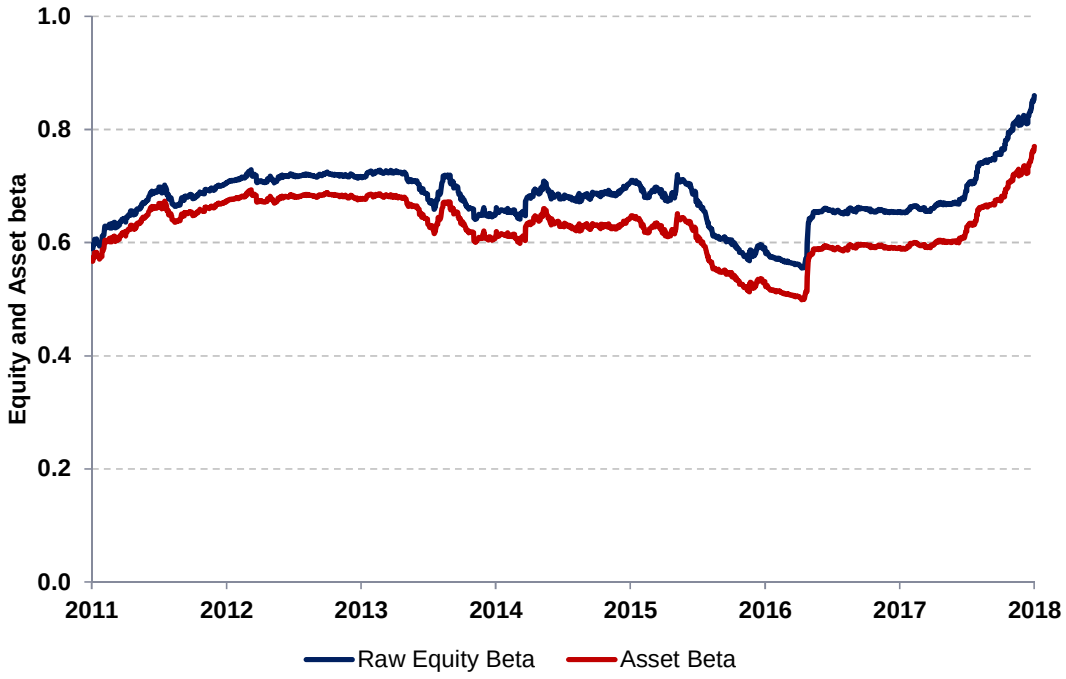
[44] For example, the full set employed by CEPA includes companies with a market capitalisation ranging from £2 million (Trafalgar New Homes) to £4.1 billion (Spirax-Sarco Engineering).

[45] Damodaran, A (1996), Investment Valuation: tools and techniques for determining the value of any asset, p.187

[46] Spirax-Sarco Engineering Plc, Homeserve Plc, Balfour Beatty Plc, Kier Group Plc, Keller Group Plc, Morgan Sindall Group Plc, Ricardo Plc, Headlam Group Plc, Costain Group Plc.

Using this narrower set of comparators, we estimate the five-year average of two-year asset betas, as per CEPA's methodology, yielding an asset beta in the range of 0.61 (simple average of comparator betas) and 0.79 (weighted average of comparator betas).[47] Our average beta estimates are set out in Figure 2.4 (unweighted basis) and Figure 2.5 (weighted basis). Betas for each of the individual liquid comparators are shown in Appendix A.

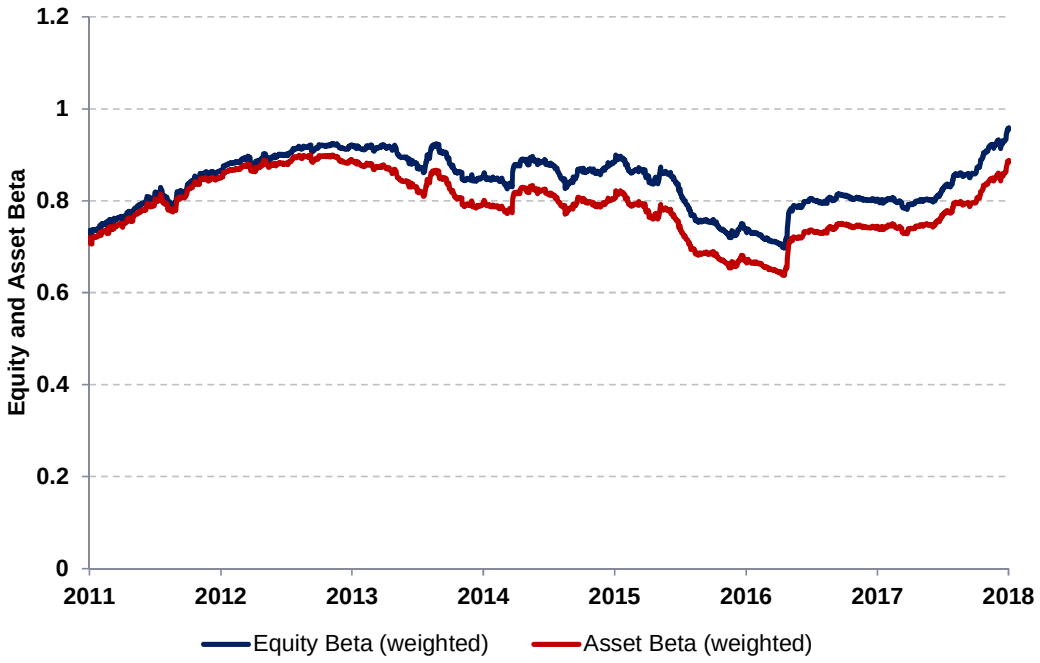
Figure 2.4
Considering actively traded companies only, 2-year asset beta over the last 5 years is 0.61 (unweighted average)



Source: NERA analysis of Bloomberg data; Asset beta estimated using FTSE All Shares index assuming zero debt beta. The floor for the net debt used to de-lever the equity betas is 0. Cut-off date 2nd March 2018.

[47] As we have excluded the thinly traded and generally smaller companies from the set, we consider that it is reasonable to rely on the unweighted as well as the weighted average beta.

Figure 2.5
Weighted average asset beta of the actively traded sample is 0.79



Source: NERA analysis of Bloomberg data; Asset beta estimated using FTSE All Shares index assuming zero debt beta. The floor for the net debt used to de-lever the equity betas is 0. Cut-off date 2nd March 2018.

The lower bound of 0.45 used by CEPA is based on asset beta estimates for Scottish Transmission Operators (TOs) at the RIIO-T1 price decision. CEPA selects Scottish TOs as comparators, as it notes that they financed relatively high capex programmes at RIIO-T1. However, we do not consider that the construction risk faced by the TOs at T1, nor the regulatory framework governing the construction phase, support the use of the T1 beta decisions for the Competition Proxy model for the following reasons.

First, in terms of construction risk, Ofgem determined higher allowed asset betas at RIIO-1 for companies with greater exposure to construction risk (proxied by the projected capex/RAB ratio). Among the regulated companies, Scottish Hydro Electric Transmission plc (SHET) faced the highest ratio (around 27 per cent average capex/opening RAB)[48] and received an allowed asset beta of 0.43.[49] Although the level of capex for SHET was higher as a percentage of RAB compared to other energy networks, it is still not comparable to the

[48] Ofgem (December 2012), RIIO-T1: Final proposals for National Grid Electricity Transmission and National Grid Gas, Finance Supporting document, Figure 3.1, p.16.

[49] Ofgem set an allowed cost of equity of 7 per cent and a notional gearing of 55 per cent for SHET. Assuming an RfR of 2 per cent and ERP of 5.25 per cent (in line with T1 slow track) implies an equity beta of 0.95 and an asset beta of 0.43 for SHET at RIIO-T1. Source: Ofgem (April 2012), RIIO-T1: Final proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd, p.23; Ofgem (December 2012), RIIO-T1: Final proposals for National Grid Electricity Transmission and National Grid Gas, Finance Supporting document, p.24.

delivery of a single greenfield asset with no existing RAB, and no lower risk operational activities.

Second, we also do not consider that the regulatory regime governing the construction phase of the Competition Proxy model provides a comparable level of risk mitigation as the on-shore RIIO network regime. For example, the on-shore RIIO network regime benefits from an up-front ex-ante sharing factor, which applies equally to under and to over-spends. By contrast, Ofgem is not proposing a comprehensive ex-ante sharing factor for the Competition Proxy model, and instead overall costs will be subject to an ex-post review (itself subject to materiality thresholds) which imposes asymmetric and regulatory risk. Ofgem itself acknowledges that the approach is unlike RIIO.[50] In addition, the Competition Proxy model represents a new form of regulatory regime introduced by Ofgem, which may increase risk perception by investors e.g. in relation to Ofgem's approach under its ex-post review (at least in the initial phase).

For these reasons, we consider that the beta estimates for the construction phase should principally draw on construction and engineering comparators which undertake similar activities as the TOs during the construction phase under the Competition Proxy model. We estimate an asset beta of 0.6 based on an (unweighted) asset beta for the set of 9 UK construction comparators which meet the standard liquidity requirements.

2.2.3. CEPA's gearing drawing on project financed infrastructure projects is overstated

CEPA estimates a gearing for the construction phase of 37.5 per cent, based on the average of actual gearing observed for its UK construction company comparators (around 10 per cent) and gearing for other onshore and offshore construction projects e.g. interconnectors (in the region of 65 per cent).

We do not consider that the gearing associated with interconnectors or other project financed onshore construction projects presents relevant benchmarks for determining the gearing for the construction phase. Project financed assets can maintain (higher) levels of gearing based on a structured financing arrangement. By contrast, the Competition Proxy model as proposed by Ofgem will be delivered by existing onshore TOs with corporate financed structures in place (as discussed in more detail in section 3.2.2).

We have considered historical evidence on actual gearing for the set of 9 liquid UK construction comparators considered in our beta analysis in section 2.2.2. Our analysis shows gearing levels of up to around 30 per cent for the comparators, which we consider provides a reasonable basis for the notional gearing for the construction phase of the Competition Proxy model.

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[50] Ofgem states that: "*We intend to carry out an expenditure review at the end of the construction period on the less certain costs and all cost areas deemed to be outside of NGET's control to determine which of these costs should be included in an updated revenue allowance for HSB.(...) We expect that this post-construction review will focus on cost areas such as risk contingency for severe weather and uncertain ground conditions. Unlike under RIIO, these costs would no longer be subject to a sharing factor or a re-opener mechanism during the construction period." Source:* Ofgem Draft Decision, p.33-34)

2.2.4. CEPA cost of debt does not take into account impact of capex risk on credit rating

CEPA estimates the cost of debt for the construction phase in the range of 1.6 to 2.3 per cent (nominal) based on current (spot and 1-year average) yields on A/BBB rated iBoxx GBP corporate non-financial indices with 3-5 and 5-7 years maturity.

We believe that the assumption used by CEPA for the credit rating is flawed.

CEPA's assumed credit rating of A/BBB fails to reflect the credit risk during the construction phase of the Competition Proxy model. As noted by Moody's, capex risk is an important determinant of the credit rating for regulated networks.[51] Recent regulatory precedent also supports the use of lower notional gearing for large construction projects. For example, the Thames Tideway Tunnel (TTT) cost of debt allowance is based on iBoxx BBB UK non-financials reflecting the higher risk associated with the construction project, and the lower rating relative to GB water and other networks. Similarly, Phoenix Natural Gas (PNG) and firmus notional cost of debt allowance is based on BBB reflecting the higher risk associated with these networks, namely, the networks operate under a deferred revenue formula.[52] Regulatory precedent supports that the notional rating for the construction phase of the Competition Proxy model should be BBB as opposed to CEPA's assumed A/BBB.

We estimate the cost of debt for the construction phase of the Competition Proxy model as follows:

- We calculate the current cost of debt of 2.1 per cent (nominal), based on the 3-months average BBB iBoxx corporate non-financial indices with 3-5 and 5-7 years maturity. We use the 3-months average for the current cost of debt estimate, as it strikes a balance between current evidence while smoothing short-run volatility (although we accept that shorter 1 month or 2 month averages would achieve a similar result).
- We calculate an uplift of 0.2 per cent, drawing on 5-year forward rate evidence to reflect the expected increase in yields between now and our assumed financing point in mid-2018 ahead of the start of construction in 2019.

Overall, this provides a cost of debt estimate of 2.3 per cent for the construction phase of the Competition Proxy model starting in 2019.

Finally, we note that to estimate the cost of debt for the construction phase, CEPA assumes all debt required to fund capex will be raised upfront. Such an assumption has important implications for the associated pre-financing costs of around 3 years on average before the capex funded with that debt is recognised in the RAB, as we discuss in the next section. An alternative approach to assuming full pre-financing of capex would be to assume capex will

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[51] One of the categories of risk Moody's considers when setting rating is "scale and complexity of the capex programme", which receives a 10 per cent weighting in the overall Moody's credit score. Large capex programme will also affect companies' financial metrics, which have a total 40 per cent weight in the overall Moody's credit score. (Source: Moody's (March 2017), Rating methodology, Regulated Electric and Gas Networks, p.4.)

[52] UREGNI (15 September 2016), Price Control for Northern Ireland's Gas Distribution Networks GD17 – Final Determination

be financed over the duration of the construction phase. In this case, an allowance could be determined upfront (including an appropriate adjustment to reflect the expected change in debt costs during the construction phase) or updated ex-post based on changes in the market benchmark cost of debt between the decision and the time when financing is raised. For example, the TTT licence allows for an update to the cost of debt determined at licence award based on change in the iBoxx BBB 10Y+ index at the time debt is issued.[53]

2.2.5. CEPA estimate of transaction costs is too low

CEPA proposes an allowance of 25 to 50 bps for transaction costs. CEPA states that its estimate draws on 15-25 bps transaction costs across all asset classes as well an estimate of the cost of carry of 35 bps, assuming debt is raised upfront and used to finance capex over the construction period. CEPA does not provide any supporting evidence for its estimates.

We consider that CEPA fails to properly take into account the shorter time-frame for amortising debt issuance costs over the construction period as well as the greater cost of carry or liquidity costs associated with CEPA's assumption of full pre-financing of capex ahead of the construction phase.

Table 2.4 sets out recent regulatory precedent on transaction cost allowances. This shows that the allowance for transaction costs lies in the range of 10 to 60 bps, with transaction cost allowances for the smaller water companies (Bristol Water) and smaller NI gas distribution networks generally in the top end of this range.[54]

[53] Ofwat (2015), Project Licence: Bazalgette Tunnel Limited, p.72-73

[54] The higher transaction costs for smaller companies reflects the element of fixed costs associated with debt issuance which need to be amortised over smaller debt amounts.

Table 2.4
Regulatory precedent on transaction costs

Decision	Embedded debt	New debt
Large regulated networks		
Ofgem RIIO (2012-14)	0.20%*	0.20%*
CAA HAL/GAL (2014)	0.15%-0.20%	0.15%-0.20%
CMA NIE (2014)	-	0.20%
Ofwat PR14 (2014)	0.10%	0.10%
NERL (2014)	0.10%-0.20%	0.10%-0.20%
TTT (2015)	n/a	0.10% + liquidity allowance
Small water companies/ GDNs		
CMA Bristol (2010)	0.30%	0.30%
CMA Bristol (2015)	0.20%-0.30%	0.10%
UREGNI (2016)	0.30%-0.60%	0.4%-0.6%

*Sources: NERA analysis of regulatory determinations. Note: * At RIIO-1, Ofgem did not include a transaction cost allowance as it considered transaction costs were covered by companies ability to outperform the benchmark index due to the regulatory "halo effect" which it estimated at 20 bps.*

As set out above, UK evidence supports a range of between 10 to 60 bps and towards the upper-end of this range for smaller networks which are more comparable to the scale of the HSB project under the Competition Proxy model. This is before taking into account the shorter amortisation period for the construction phase debt (5 years) compared to regulated networks (typically around 20 years). Moreover, we note that regulators often also include allowances for cost of carry in their overall transaction costs allowances. As we calculate the cost of carry separately below, we deduct it from the transaction cost allowances provided by regulators to calculate the relevant debt issuance costs for the shorter construction phase. Drawing on precedent, we assume a starting point of 30bps transaction cost allowance, based on evidence for small regulated companies (e.g. Bristol). We then assume that this allowance equally reflects the issuance costs (15bps) and the cost of carry (15bps). Taking only the issuance cost element of 15bps and amortising it over the shorter 5-year construction period implies an annualised issuance cost of 60 bps (i.e. 30 bps * 0.5 * (20 years / 5 years).

In addition to amortising issuance costs over the shorter construction period, as explained above, we also need to take into account the substantively higher cost of carry or liquidity costs during the construction phase associated with CEPA's assumed full pre-financing of the capex. Assuming full pre-financing, we estimate cost of carry of around 100 bps, assuming cash held on deposit earns 0.5 per cent return.[55]

[55] We calculate the cost of carry by assuming all debt is raised upfront in the middle of 2018 to finance the notional debt portion of capex over the construction period 2019-2023. We calculate the cost of carry of 96 bps, as the required uplift to the cost of debt to ensure that the actual cost of debt (based on debt issued in mid-2018) is equal to the allowed cost of debt (based on debt-financed portion of capex entering the RAB over the construction period, assuming a uniform capex profile) and assuming that any cash held on deposit earns a 0.5 per cent return.

Our estimate of around 100 bps for the costs of carry is higher than CEPA's estimate of 35 bps, for which it provides no detailed explanation or assumptions, and seems implausibly low particularly as it assumes debt is raised up-front, implicitly assuming a pre-financing period of around 3 years on average.

In conclusion, we consider a total transaction cost allowance of 160 bps, calculated as the sum of issuance costs of 60bps and cost of carry of 100bps, is appropriate for the construction phase of the Competition Proxy model which starts in 2019 and assuming full upfront financing of the capex.

2.3. Corrected Construction Phase WACC

In this section, we present our alternative WACC estimate for the construction phase of the Competition Proxy model starting in 2019, correcting for the issues identified with CEPA's analysis in section 2.2.

Our WACC estimate is based on the following parameters:

- A TMR of 6.5 to 7.1 per cent (real, RPI-deflated), based on long-run evidence, as discussed in section 2.2.1.
- A RfR of -1.7 to -1.4 per cent (real, RPI-deflated). We use the CEPA's estimate based on current evidence on yield to maturity for 5-year gilts, but apply an uplift of 0.74 per cent to reflect the expected increase in 5-year gilt rates during the construction phase, based on evidence from forward markets.
- An asset beta of 0.6, based on the unweighted average asset beta for liquid UK construction comparators, as discussed in section 2.2.2.
- A gearing of 30 per cent, drawing on actual gearing for construction comparators included in our beta sample, as discussed in section 2.2.3.
- A cost of debt of -0.7 per cent (real, RPI), based on current yields on BBB iBoxx corporate non-financial indices with 3-5 and 5-7 years maturity, adjusted by the expected increase in 5-year gilt rates to mid-2018 (as discussed in section 2.2.4) and deflated using CEPA's RPI inflation of 3.0 per cent.[56]
- A transaction cost estimate of 160 bps, based 60 bps issuance costs and 100 bps cost of carry/liquidity allowance, as discussed in section 2.2.5.

Overall, we estimate a vanilla WACC (real, RPI-deflated) of 4.0 to 4.4, as shown in Table 2.5 below.

We note that the WACC estimate should be updated closer to the start of the construction period, in particular for the cost of debt, to reflect changes in market conditions and the expected financing date for the HSB project.

[56] We have cross-checked CEPA's inflation assumption using inflation forecasts from the HMT and OBR for the construction period starting in 2019 (as shown in Table 3.5) and conclude that CEPA's assumption is consistent with this evidence.

Table 2.5
We estimate a vanilla WACC of 4.0 to 4.4 per cent (real, RPI-deflated) for the construction phase of the Competition Proxy model starting in 2019, substantially higher than CEPA

	NERA Lower Bound	NERA Upper Bound	CEPA Lower Bound	CEPA Upper Bound
Gearing	30%	30%	37.5%	37.5%
Real TMR	6.5%	7.1%	4.4%	5.3%
Real risk-free rate	-1.7%	-1.4%	-2.4%	-2.2%
ERP	8.2%	8.5%	6.8%	7.5%
Asset Beta	0.60	0.60	0.45	0.55
Equity Beta	0.86	0.86	0.72	0.88
Real cost of equity	5.3%	5.9%	2.5%	4.4%
Real cost of debt	-0.7%	-0.7%	-1.4%	-0.7%
Transaction costs	1.6%	1.6%	0.25%	0.50%
Total real cost of debt	0.8%	0.8%	-1.1%	-0.2%
WACC (real vanilla)	**4.0%**	**4.4%**	**1.12%**	**2.70%**

Source: NERA calculations

In contrast, CEPA's vanilla WACC range is 1.12 to 2.70 per cent (real, RPI-deflated). This estimate is significantly lower compared to our estimated vanilla WACC range of 4.0 to 4.4 per cent.

The key difference reflects CEPA's substantial understatement of the cost of equity based on understated TMR which places too much weight on CEPA's flawed current DGM evidence, understated beta based on use of illiquid comparators as well as onshore TOs which are subject to less risk than the Competition Proxy model. CEPA also understates the cost of debt, principally due to understating transaction costs.

3. Operational Phase WACC

3.1. Summary of CEPA proposed WACC[57]

CEPA proposes a vanilla WACC of 0.6 to 1.75 per cent real (RPI-deflated) for the operational phase of the Competition Proxy model starting in 2024 and covering a period of 25 years.[58] The individual components of CEPA's proposed WACC are summarised in Table 3.1 below.

Table 3.1
CEPA estimates a vanilla WACC of 0.6 to 1.75 per cent real (RPI-deflated) for the operational phase of the Competition Proxy model starting in 2024

	CEPA Lower Bound	CEPA Upper Bound
Cost of debt (nominal, pre-tax)	3.50%	3.75%
Cost of equity (nominal, post-tax)	7%	9%
Gearing	85%	80%
WACC (nominal, vanilla)	**4.03%**	**4.80%**
Inflation (RPI)	3.4%	3.0%
Cost of debt (real, pre-tax)	0.10%	0.73%
Cost of equity (real, post-tax)	3.48%	5.83%
WACC (real RPI, vanilla)	**0.60%**	**1.75%**

Source: CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, section 7

CEPA's WACC is based on a cost of equity of 7 to 9 per cent (nominal post-tax), estimated from equity IRRs implied from bids for OFTO licenses during the second and third tender rounds (TR2 and TR3) of 8 to 9 per cent, adjusted downwards for market movements in equity returns since TR2 and TR3, as proxied by changes in the RfR and TMR. CEPA uses a gearing of 80 to 85 per cent, in line with the OFTO evidence.

CEPA estimates a cost of debt of 3.5 to 3.75 (nominal), based on current yields on A and BBB iBoxx GBP corporate non-financial indices with 10+ years maturity, adjusted upwards by 50bps to reflect the expected increase in yields up to the start of the operational phase in 2024 based on evidence from 20-year forward gilts and a 10bps transaction costs allowance.

[57] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, section 7.

[58] CEPA also presents a "current" estimate of the operational phase WACC of 0.19 to 1.26 per cent real (RPI-delated) vanilla, but in practice there are no projects which are expected to enter the operational phase under the Competition Proxy model at the present time.

To calculate the WACC in real (RPI-deflated) terms, CEPA deflates the nominal cost of equity and debt values using forecast RPI inflation of 3.0 to 3.4 per cent, derived from 10 to 20 year breakeven inflation evidence.

In relation to setting the operational phase WACC, CEPA notes that Ofgem can either determine this figure upfront (i.e. prior to the commencement of the construction phase) or update the allowance upon completion of the construction phase (i.e. in 2024). The above estimates relate to the first option of setting the WACC upfront.

We have identified a number of issues with CEPA's estimates, which lead to a substantial understatement of the operational phase WACC, as we discuss in section 3.2. We also present alternative estimates of the operational phase WACC in section 3.3, correcting for CEPA's errors.

3.2. Issues with CEPA calculations

3.2.1. CEPA's OFTO equity IRR numbers are not evidenced

CEPA considers that the implied equity IRRs for successful bidders for TR2 and TR3 OFTO projects provide an appropriate benchmark for the cost of equity during the operational phase of the Competition Proxy model. In its report, CEPA states that successful OFTO bidders in TR2 and TR3 bid an IRR of 8 to 9 per cent (nominal post tax).[59]

However, CEPA provides no supporting evidence or published source for its estimate of equity IRRs for TR2 and TR3. Unless CEPA provides supporting evidence, we do not consider that such figures provide a reliable basis for setting the allowed cost of equity for the operational phase of the Competition Proxy model. For example, we have no means of understanding which and how many projects the cited range relates to or how CEPA derived the equity IRRs and therefore how such numbers should be interpreted.

Indeed, the only evidence that CEPA quotes on equity IRRs for OFTOs is the 2012 report by the National Audit Office (NAO) on the outcomes of the TR1 OFTO regime. In this report, the NAO provides an estimate of the equity IRRs of 10 to 11 per cent.[60] In its report, CEPA incorrectly refers to the NAO report as supporting a 9 to 11 per cent equity return, further undermining confidence in CEPA's cost of equity analysis. [61]

To understand the appropriateness of the OFTO equity IRRs (e.g. as quoted by the NAO) as a benchmark for the cost of equity for the operational phase of the Competition Proxy model, it is important to understand how the bidding process for OFTO projects operates. Bidders for OFTO projects bid and are evaluated based on their proposed revenue stream over the OFTO licence period. [62] Equity IRRs targeted by investors for OFTO projects are therefore

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[59] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, p.54 – 55.

[60] NAO (June 2012), Offshore electricity transmission: a new model for delivering infrastructure, p.29.

[61] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, p.54.

[62] The bidding criteria place a 60 per cent weight on the bidders proposed revenue stream and a 40 per cent weight on quality of the underlying assumptions. See e.g. Ofgem (October 2014), Invitation to Tender Document for Tender Round 3 (TR3): Westermost Rough, p.60-62.

unknown and can only be backed out from the available evidence. To calculate an equity IRR implied by the winning bidder's revenue stream, the NAO (or indeed CEPA) have to make a number of assumptions on e.g. forecast opex and capex costs, tax, cost of debt financing including forecasts or gearing. Neither the NAO report nor CEPA provide the details on these crucial assumptions.

It is therefore impossible to use the NAO (or CEPA) quoted figures for the purpose of setting the cost of equity for the operational phase, until it is clear on what basis they were derived and therefore what adjustments may be required to calculate the cost of equity for the Competition Proxy model (e.g. adjustments for expected cost outperformance, financing outperformance, changes in capital structure, any tax differential e.g. from tax losses relief at group level, or additional sources of shareholder return via the availability incentive).

At best, the equity IRRs quoted in the 2012 NAO report of 10-11 per cent, which represents the only evidence available on OFTO equity IRRs, can be used as a high-level cross check on the cost of equity calculated using a standard bottom-up CAPM approach, as we discuss in section 3.3.

3.2.2. CEPA's conversion of OFTO equity IRRs to onshore COE is flawed

CEPA uses the OFTO equity IRR of 8 to 9 per cent for TR2 and TR3, and applies a 100 bps downward adjustment to the bottom end of the range to account for changes in investors' expected equity returns since TR2 and TR3 (projects concluded over the period 2013 to 2016) and the start of the operational phase in 2024, based on movements in the RfR and TMR evidence.[63] CEPA then uses this adjusted range of 7 to 9 per cent (nominal, post-tax) together with a gearing of 80 to 85 per cent based on OFTO evidence and uses this as the cost of equity for the operational phase of the Competition Proxy model.

Notwithstanding the issue of CEPA's lack of evidence supporting the OFTO equity IRRs of 8 to 9 per cent in TR2 and TR3 and the underlying assumptions (as discussed in the previous section), CEPA's conversion of the OFTO equity IRRs to a cost of equity for the operational phase of the Competition Proxy model is flawed for a number of reasons.

First, CEPA's proposed adjustment of 100bps to the lower end of the OFTO IRRs for decline in investors' expected equity returns between 2013-2016 and the start of the operational phase in 2024 is entirely unwarranted. As we discuss in section 2.2.1.2, financial theory supports an inverse relationship between the RfR and the ERP with the TMR being relatively stable over time, implying that no adjustment to the IRR evidence is required. Moreover, CEPA's 100bps downward adjustment is particularly implausible, given CEPA's own

[63] In its calculations, CEPA applies two adjustments to its original 8 to 9 per cent OFTOs equity IRR range. First, it applies a downward adjustment of 50-100bps to obtain a "current" estimate of the cost of equity for the operational phase. This adjustment is based on evidence on changes in discount rate since 2013-2016 reported by HICL Infrastructure (around 1 per cent), changes in nominal gilt yields since 2013-2016 (69bps) and changes in CEPA's DGM evidence since 2013-2016 (53bps). Second, CEPA applies an offsetting upward adjustment of 50bps to its upper bound estimate, to account for the expected increase in the risk-free rate up to 2024, the start of the operational phase. These adjustments overall result in a 100bps downward adjustment to the lower bound of CEPA's original equity IRRs for OFTOs in TR2 and TR3. Source: CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, sections 7.2.2 and 7.6.2.

assumptions on the evolution of the risk-free rate.[64] Specifically, CEPA first calculates that risk-free rates since TR2 and TR3 (2013-2016) have fallen by 69 bps.[65] Subsequently, CEPA assumes that risk-free rates will increase by 50 bps up to 2024, the start of the operational period.[66] This implies a mere 19bps reduction in the risk-free rate between 2013-2016 and start of 2024, under CEPA's own assumptions, before taking into account the negative relationship between the RfR and the ERP.[67] In this context, it is therefore not clear to us why CEPA considers a downward adjustment of 100bps can be justified. We conclude that no downward adjustment to OFTO equity IRRs for changes in investors' expected equity returns between TR2 and TR3 (2013-2016) and the start of the operational phase in 2024 is required.

Second, CEPA uses the equity IRRs for OFTOs based on a gearing of 80 to 85 per cent directly as the cost of equity for the operational phase of the Competition Proxy model. CEPA's proposed gearing is far higher than empirical evidence on gearing for onshore GB electricity transmission companies, which lies between 55 and 63 per cent (see Table 3.2). It is also far higher than regulatory determinations of notional gearing of between 45 and 65 per cent (see Table 3.3). Similarly, Moody's rating methodology for regulated utilities suggests a gearing of 45 to 60 per cent and of 60 to 75 per cent for A and Baa rating respectively. [68,]

Table 3.2
CEPA's assumed gearing of 80 to 85 per cent, based on OFTOs, is far higher than actual gearing for GB TOs

	Actual gearing (March 2017)
NGET	58%
SHET	63%
SPT	55%

Source: NGET Regulatory Account Statements 2016/2017 (p.81); computed as net debt/RAV for SHET based on Directors report and regulatory financial statements, year ended 31 March 2017 (p.2 and p.34); and computed as net debt/RAV using net debt in SP Transmission Corporate report and regulatory accounts for the year ended 31 March 2017 (p.3) and RAV in SP Transmission Annual Performance Report 2016/17 (p.25).

64 CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, p.55.

65 CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, Table 7.4, p. 56.

66 CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, Table 7.10, p. 61.

67 As we discuss in section 3.2.3, we consider CEPA's estimate of the expected increase in government bond yields up to 2024 is understated.

68 Moody's (March 2017), Regulated Electric and Gas Networks, Rating Methodology, p.19.

Table 3.3
CEPA's assumed gearing of 80 to 85 per cent, based on OFTOs, is far higher than UK regulators' notional gearing assumptions of 45-65 per cent

	Notional gearing
Ofgem GDPCR7 (2007)	62.5%
Ofgem DPCR5 (2009)	65%
Ofwat PR09 WaSCs (2009)	57.5%
Ofwat PR09 WoCs (2009)	52.5%
CC Bristol (2010)	60%
RIIO GD1 (2012)	65%
CAA Heathrow (2014)	60%
CAA Gatwick (2014)	55%
CMA NIE (2014)	45%
RIIO ED1 (2014)	65%
Ofwat PR14 (2014)	62.5%
CMA Bristol (2015)	62.5%

Source: NERA analysis of regulatory determinations.

Regulatory precedent as well as rating agency guidance suggest that a gearing level of around 60 per cent, in line with actual gearings for onshore TO networks, including National Grid which will be delivering the HSB project, is more appropriate for setting the cost of equity for the operational phase of the Competition Proxy model, instead of assuming a highly leveraged securitised financial structure as CEPA does.

However, assuming a 60 per cent gearing requires an adjustment to CEPA's equity IRRs for OFTO calculated at 85 per cent gearing. Such an adjustment poses two key methodological issues. First, it requires assumptions about the beta risk, RfR and TMR associated with the OFTO IRRs, which are unknown. Second, at the OFTO gearing levels of 80 to 85 per cent, it is likely that debt will take on some equity risk, implying that OFTO IRRs should be de-levered using a positive debt beta. These adjustments are not trivial, and the OFTO bids do not provide the requisite evidence for calculating such adjustments.

CEPA simply ignores these difficulties by assuming a highly leveraged structure for the operational phase; but that structure is patently not supported by empirical evidence for National Grid who will be delivering the HSB project or regulatory decisions.

Third, CEPA also uses an incorrect measure of inflation to derive a real cost of equity from the nominal equity IRRs for OFTO. CEPA calculates the real cost of equity for the Competition Proxy model by deflating the nominal equity IRRs from TR2 and TR3 (concluded in 2013-2016) with expected RPI inflation of 3.0 to 3.4 per cent calculated as of 2017.[69] This is incorrect, as the nominal IRRs calculated over the period 2013-2016 include

[69] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, p.59 Table 7.8

inflation expectations over the duration of the OFTO licence as of 2013-2016 as opposed to expected inflation in 2017. Drawing on 10-year breakeven inflation evidence, we calculate the average expected RPI inflation over the period 2013-2016 of 2.9 per cent, which is far lower than CEPA's assumed inflation of 3.0 to 3.4 calculated as of 2017. This suggests that CEPA's real cost of equity is understated by 10-50 bps for this factor alone.

In conclusion, we do not consider that OFTO equity IRRs provide a reasonable basis for estimating the cost of equity for the operational phase of the Competition Proxy model, given the absence of public evidence on the bid IRRs, and even if there were, there are too many unobserved and/or subjective assumptions required to adjust these IRRs, e.g. for differences in gearing, inflation expectations, bidder assumptions on incentives and cost, tax or financing outperformance. Instead, the allowed cost of equity should be based on the established CAPM method, as we set out in section .3.3.1.

3.2.3. CEPA's cost of debt is understated for a number of factors

CEPA calculates the cost of debt based on a spot and 1 year average yields of iBoxx corporate non-financial indices with 10+ years maturity, with low end based on A rated iBoxx index and the top and based on A/BBB rated iBoxx indices. CEPA also adjusts the current yields upwards by 50bps to account for the expected increase in yield based on 20 year forward gilt evidence and adds an allowance of 10bps for transaction costs, resulting in a nominal cost of debt of 3.5 to 3.75 per cent for 2024.[70]

There are a number of issues with CEPA's estimates which lead to a substantial understatement of the cost of debt in 2024 for the operational phase of the Competition Proxy model.

First, CEPA's assumed A rating for the bottom end of the range is wholly inconsistent with its assumed gearing of 85 per cent for the bottom end. According to Moody's rating methodology, Baa rated utilities should have a gearing of 60 to 75 percent and A rated utilities of 45 to 60 per cent, far below CEPA's assumed 85 per cent. [71] The ability to achieve A/BBB rating at 80 or indeed 85 per cent gearing is also highly questionable, given rating methodology guidance discussed above.

Highly leverage financial structures, as proposed by CEPA, typically employ structured debt portfolios with several tranches of debt with different seniorities (and therefore ratings). This further complicates the estimation of cost of capital under CEPA's assumed highly leveraged financial structure for the operational phase of the Competition Proxy model. In contrast, a notional gearing assumption of around 60 per cent, in line with the corporate financed onshore TOs, can be combined with an A/BBB rating assumption as is the standard approach in GB utility regulation.

Second, in choosing the benchmark index for the cost of debt, the average remaining tenor of the constituent bonds should match the length of the operational phase period, as this is also

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[70] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, p.53 and p.61.

[71] Moody's (March 2017), Regulated Electric and Gas Networks, Rating Methodology, p.19.

the expected tenor at issuance for the Competition Proxy model. CEPA chooses a 10+years benchmark iBoxx index, which has a remaining maturity of around 21 years, which is shorter than the length of the operational phase of 25 years. We consider that a more appropriate benchmark for the operational phase would be the A/BBB 15+ years iBoxx index, with a remaining maturity of around 26 years which more closely matches the length of the operational period of 25 years (see Table 3.4 below).

Table 3.4
CEPA's proposed use of 10Y+ index is too short relative to operational period of 25 years

	A/BBB iBoxx 10yr+	A/BBB iBoxx 15yr+
Years to maturity (3 months average)	21.1	26.2
Yield to maturity (3 months average)	3.09%	3.19%

Source: NERA analysis of Factset data. Cut-off date 2nd March 2018.

Third, CEPA calculates an uplift to account for expected increases in interest rates up to 2024 of 50 bps based on 20-year forward rate gilt evidence. While the 20-year maturity assumption is consistent with CEPA's proposed benchmark index, we prefer to rely on 10 year maturity gilts for estimating the expected increase in interest rates from forward rate evidence, as the long end of the yield curve which is required for estimating forward rates for longer maturities is illiquid. Using 10 year forward rate evidence (as opposed to CEPA's 20 years) supports a higher uplift of 86 bps.[72]

Finally, we note that if Ofgem were to determine the WACC for the operational phase after the completion of the construction phase, it should take into account the time lag between the decision and the point at which the debt for the operational phase is expected to be issued. Such an adjustment does not appear to be reflected in CEPA's "current" estimates of the cost of debt.

3.2.4. CEPA's RPI inflation forecast is overstated at top end

In deriving the real cost of debt from the nominal iBoxx benchmark, CEPA uses an RPI inflation of 3 to 3.4 per cent, on spot and 1 year average of 10 (bottom end) and 20 years (top end) RPI breakeven evidence.[73]

CEPA's reliance on the 20-year breakeven evidence for the top end of its inflation estimate is not appropriate, given the well documented distortions in the index-linked gilt market for long maturities.[74] CEPA's overstatement of RPI inflation is apparent when considering alternative evidence from the OBR and HMT, commonly used by UK regulators including

[72] Calculated as the 3-months average of weekly 10 year forward rates for January 2024 based on Bloomberg data.

[73] CEPA (January 2018), Review of cost of capital ranges for new assets for Ofgem's networks division, p.59 Table 7.8.

[74] A large portion of the long-dated ILD gilt is held by UK pension funds for asset-liability management, but the pension funds do not actively trade their bonds, because the liability matching portfolios are in generally rebalanced passively. Therefore, the majority of the long-dated ILD gilt market is infrequently traded and lacks liquidity. See discussion e.g. in Competition Commission (March 2014), Northern Ireland Electricity Limited price determination, p.13-21.

the CMA as a basis of forecasting inflation[75], which support long-term forecast of 3 to 3.1 per cent, in line with CEPA's bottom end inflation forecast from 10-year breakeven evidence (see Table 3.5 below).

Table 3.5
Forecasts from HMT and OBR support RPI inflation of 3 to 3.1 per cent

	2018	2019	2020	2021	2022
HMT (Feb 2018)	3.5	3.0	3.0	3.1	3.1
OBR (Mar 2018)	3.7	3.0	2.9	2.9	3.0

Source: HM Treasury (February 2018), Forecasts for the UK economy: a comparison of independent forecasts, p.16; and Office for Budget Responsibility (March 2018), Economic and fiscal outlook, p.83.

3.3. Corrected Operational Phase WACC

In this section, we present our alternative WACC estimate for the operational phase of the Competition Proxy model, correcting for the issues identified with CEPA's analysis in section 3.2.

3.3.1. We employ CAPM to estimate operational phase cost of equity

We do not consider that the OFTO IRRs provide a reasonable basis for estimating the cost of equity for the operational phase of the Competition Proxy model. There is no verifiable public evidence on the bid IRRs, and even if there were, the assumptions required to adjust these IRRs (e.g. for differences in gearing, inflation expectations, bidder assumptions on incentives and cost, financing and tax outperformance) are too many and unobservable to objectively derive a comparable cost of equity for the onshore model.

By contrast, the application of a bottom-up CAPM based cost of equity provides an established and objective approach to estimating the cost of equity, which we set out below. The OFTO IRR can at best apply as a cross-check on the CAPM.

We discuss each of the CAPM COE parameters in the following sections.

We estimate a TMR of 6.5 to 7.1 (real, RPI-deflated) based on long-run historical evidence

For the TMR, we use a long-run historical estimate of 6.5 to 7.1 per cent (real, RPI-deflated) as we explain in section 2.2.1, the same approach as for the construction phase. Notwithstanding its use of OFTO IRRs, CEPA also appears to support the long-run historical approach to the TMRs for the interconnector cap and floor model which covers a period of 25 years, in line with the length of the operational phase of the competition proxy model.[76]

For our RfR, we propose to adopt a range of 1.25 to 2.0 per cent, implying an ERP of 5.25 to 5.1 per cent calculated as the residual under a TMR approach. Our 1.25 lower bound RfR is

[75] CMA (October 2015), Bristol Water plc, p.313

[76] CEPA (2018), Review of cost of capital ranges for new assets for Ofgem's network division, p.3 and 65.

based on recent regulators decisions which partially reflect the recent observed reduction in interest rates while the 2 per cent upper bound is based on regulatory decisions before the abnormal period of very low gilt yields (as summarised in Table 3.6 below).[77]

Table 3.6
Regulatory precedent on RfR determinations

	Date	Real RfR (%)
Ofwat PR09	Apr 2009	2.0
Ofgem DPCR5	Dec 2009	2.0
CC Bristol	Feb 2010	2.0
CAA NATS	Oct 2010	1.75
Ofgem RIIO-T1	Apr 2012	2.0
Ofgem RIIO-GD1	Dec 2012	2.0
CAA Heathrow/Gatwick Q6	Feb 2014	0.5
CAA NATS	Feb 2014	0.75
CMA NIE	Mar 2014	1.5
Ofwat PR14	Dec 2014	1.25
UR PC15	Dec 2014	1.5
CMA Bristol	Oct 2015	1.25
UR GD17	Sep 2016	1.25

Source: NERA analysis of regulatory decisions

We estimate an asset beta of 0.36 to 0.42 based on UK and European energy network empirical evidence

We estimate an asset beta for the operational phase of the Competition proxy model based on UK and European listed energy network betas, as summarised in Table 3.7 and Table 3.8 below.

[77] We note that forward rate evidence supports lower risk-free rates compared to historical regulatory precedent. However, given our equity beta is close to 1, the split between the RfR and ERP components of the TMR has a minimal impact on the cost of equity.

Table 3.7
UK energy network comparator asset betas

	1 Year	2 Years	5 Years
National Grid	0.53	0.36	0.39
SSE	0.44	0.60	0.57

Source: NERA analysis of Bloomberg data; Asset beta estimated using FTSE All Shares index assuming zero debt beta, and using net debt for un-levering the equity beta. Cut-off date 2nd March 2018.

Table 3.8
European energy network comparators asset betas

	1 Year	2 Years	5 Years
Terna (ET Italy)	0.55	0.45	0.41
Red Electrica (ET Spain)	0.53	0.38	0.40
Snam (GT Italy)	0.58	0.46	0.42
Enagas (GT Spain)	0.46	0.34	0.38
Acea (ED Italy)	0.59	0.39	0.32
Gas Natural (GD Spain)	0.46	0.47	0.47
Average	**0.53**	**0.42**	**0.40**

Source: NERA analysis of Bloomberg data; Asset beta estimated using FTSE All Shares index assuming zero debt beta, and using net debt for un-levering the equity beta. Cut-off date 2nd March 2018.

In order to interpret the empirical evidence, we have also considered the relative risks of the operational phase of the Competition Proxy model compared to regimes for the listed UK and European comparators.

Table 3.9 summarises the risks borne by investors during the operational phase under the proposed Competition Proxy model, as compared to the RIIO regime.

Table 3.9
Relative risk of competition proxy model vs. RIIO

	RIIO (T1)	Competition Proxy Model for HSB – Operational Phase
Form / length of revenue period	• Revenue-cap • 8-years	• Revenue-cap • 25 years (start in 2024)
Setting cost allowances	• Expert review of totex • DB pension deficit recovery over 15yrs with 3Y re-valuation • Re-openers for some costs	• Cost allowances set for a duration of 25 years (indicative allowance set at pre-construction stage, finalised post construction) • Opex reopener for low probability, high impact events (subject to materiality threshold), and for unanticipated changes in law, in line with OFTO • Intra-period allowances for capex upgrade necessary to build additional connections (under competition regime if it meets the criteria; otherwise based on RIIO arrangements) • Tax: undecided if up front allowance subject to trigger events, or pass through
Outturn cost risk & incentives	• Sharing through Totex Incentive Mechanism (TIM) • Uncertainty/pass-through of non-controllables • Disapplication of price control	• NGET bears full cost risk during operational phase, but an adjusted sharing factor applies during construction
Financing cost risk	• COD update = 10Y trailing average iBoxx	• No sharing mechanism, TO bears full risk
Quality of Service/Output incentives	• Performance incentives : • NGET: +0.6/-1.4% of RORE	• RIIO incentives remain applicable, esp. Energy Not Supplied incentive
Stranding/ competition / regulatory risk	• No stranding risk for ET in short-term, but uncertainty over future role and operation of system from distributed generation	• No additional risk compared to RIIO (potential benefit of shorter asset life)

Source: NERA analysis of Ofgem documents

The proposed Competition Proxy model retains many aspects of the RIIO framework, including revenue cap regulation and application of incentive mechanisms.

Under the Competition Proxy model, Ofgem intends to set cost allowances for the entire duration of the operational phase, i.e. 25 years. It proposes to set indicative allowances for opex and capex under both project phases at the Project Assessment stage, i.e. before construction, taking into account the TO's Project Assessment submission (in line with RIIO). The allowances for the operational phase will be finalised at the post-construction review. At that time, Ofgem will review less certain or controllable capex categories and decide which ones to include in its updated allowance. It will also have the option to update the initial opex allowance following this review.[78]

Reopeners are limited to specific circumstances outside of the TO's control. For opex, this includes low probability, high impact events and unanticipated changes in the law. For capex,

[78] Ofgem (23 January 2018), Hinkley-Seabank project: minded-to consultation on delivery model, para 4.20 – 4.24, 4.28.

Ofgem can make an additional allowance for upgrades necessary to build additional connections.[79,80]

Based on our review of Ofgem's minded-to consultation, we have identified the following key differences between the Competition Proxy model and the RIIO regime:[81]

- Revenue allowance set for a period of 25 years without re-sets, as opposed to 8 years under RIIO;
- During the operational phase, no risk sharing mechanism for outturn operating and financing costs, implying that investors bear the full cost risk during that period; and
- Project-specific protections for the effects of events outside of the TO's control.

The long revenue period of 25 years and the absence of risk sharing for outturn costs during the operational phase, suggests that the Competition Proxy model is higher risk. Offsetting this, we also expect that the operational costs associated with these assets are lower (as a proportion of revenues) than for networks, implying lower operational leverage and lower risk.

We have also compared the proposed competition proxy model to other regulatory regimes in Europe, reaching similar conclusions as in our comparison to RIIO as we explain in Appendix B.

In summary, we find factors which imply higher risk for the operational phase of the Competition Proxy model relative to the comparators (e.g. long revenue period and absence of cost risk sharing), offset by factors which imply lower risk (e.g. lower operational leverage due to lower share of opex as a proportion of revenues during the operational phase). In the absence of detailed analysis of how these factors may offset each other (e.g. detailed assessment of comparative operational risks) and indeed in the absence of alternative listed comparators, we recommend relying on the observed betas for listed comparators as a basis for estimating the asset beta for the Competition Proxy model.

Based on our comparator evidence, we estimate beta in the range of 0.36 to 0.42. Our lower bound is based on the 2-year asset beta for National Grid (we do not draw on betas for SSE given this reflects risks associated with SSE's generation assets). Our upper bound is based on the average of the 2-year betas for European listed energy networks.

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79 Ofgem (23 January 2018), Hinkley-Seabank project: minded-to consultation on delivery model, para 4.30 – 4.33.

80 Ofgem (23 January 2018), Hinkley-Seabank project: minded-to consultation on delivery model, Appendix 4. With regard to capex, Ofgem's own assessment is that the probability for additional capacity requirements is higher for HSB than for OFTO (and OFTO does not have to spend additional capex >20% of initial investment), implying that investors in HSB face higher risk in this regard.

81 Ofgem (23 January 2018), Hinkley-Seabank project: minded-to consultation on delivery model, para 4.5, 4.11, 4.12, Appendix 4.

We use a gearing of 60 per cent assuming a corporate financed structure in line with onshore networks

To estimate the cost of equity, we use a gearing of 60 per cent, in line with the empirical evidence for onshore GB transmission networks (as shown in Table 3.2), given Ofgem's proposals under the Competition Proxy model envisage that National Grid, a corporate financed TO, will be delivering the HSB project.

Table 3.10 sets out our estimate of the cost of equity based on the above parameters. Overall, we estimate a post-tax cost of equity of 6.0 to 7.4 real (RPI-deflated) for the operational phase of Competition Proxy model.

Table 3.10
We estimate a post-tax cost of equity for the operational phase of Competition Proxy model of 6.0 to 7.4 (real, RPI-deflated)

	NERA Lower Bound	NERA Upper Bound	Approach
Gearing	60%	60%	Actual gearing of GB onshore TOs
Real TMR	6.5%	7.1%	LR historical evidence
Real RfR	1.25%	2.00%	Regulatory precedent
ERP	5.25%	5.1%	TMR - RfR
Asset beta	0.36	0.42	UK and European comparators
Equity beta	0.90	1.05	Calc.
CoE (real, post-tax)	**6.0%**	**7.4%**	Calc.

Source: NERA calculations

As a cross check on our CAPM cost of equity, we convert our cost of equity estimates to nominal values and adjust for gearing of 80-85 per cent for comparability with the NAO reported equity IRRs for OFTOs of 10 to 11 per cent. This provides an estimate of a nominal post-tax cost of equity of 11.9 to 13.9 per cent (as explained in Appendix C). We note that this is somewhat higher than the NAO range of 10 to 11 per cent. However, as discussed in section 3.2.1, it is not clear under what assumptions the NAO derived its reported equity IRRs and to what extent it includes all sources of investor returns (e.g. including cost, tax, financing and incentives outperformance), which may have been omitted by the NAO but would increase the expected IRR earned by investors.[82] Given the NAO numbers are unlikely to reflect the these additional sources of investor return (e.g. tax losses relief at group level, incentive revenues), we conclude that our cost of equity estimates for the operational phase of the Competition Proxy model are broadly consistent with the NAO reported figures on equity IRRs for OFTOs.

[82] OFTOs receive additional payments where availability of the network exceeds 98 per cent. Ofgem (2015) reports that 10 out of 13 OFTOs exceed the availability target, and according to Ofgem (2016) there were 10 outperformers out of 12. Source: Ofgem (2015), Offshore Transmission Owner Revenue Report, p.3 and Ofgem (2016), Offshore Transmission Owner Revenue Report, p.3 and p.5.

3.3.2. We estimate cost of debt based on benchmark indices and forecast increase in yields up to 2024

We estimate cost of debt for the operational phase of the Competition Proxy model, based on 3 months average of the iBoxx 15+ year corporate non-financial indices with A/BBB rating, correcting CEPA's use of a 10+ year maturity index which is too short compared to the 25-year operational period (as discussed in section 3.2.3).[83] Our choice of the A/BBB rating is appropriate, in contrast to CEPA, as we estimate the cost of equity based on a corporate financed model assuming a 60 per cent gearing.

We adjust the current cost of debt estimate upwards by 86 bps to reflect the expected increase in yields up to 2024, the start of the operational phase, based on evidence from 10-year forward gilt markets. As discussed in section 3.2.3, we prefer to rely on 10-year forward gilt rate evidence as the long end of the yield curve, which is required for estimating forward rates for longer maturities, is illiquid.

We deflate the nominal cost of debt based using inflation of 3.0 to 3.1 per cent, based on HMT and OBR evidence (as discussed in section 3.2.4).

We also apply a transaction cost allowance of 20 to 30 bps, in line with regulatory precedent (as set out in Table 2.4). Our lower bound is based on the implicit assumption made by Ofgem at RIIO-1 controls while our upper bound takes into account precedent for small companies, e.g. CMA for Bristol in 2015 and 2010 or UREGNI for PNG and firmus, reflecting the smaller size of the HSB project relative to onshore TO networks.

Our cost of debt parameters are summarised in Table 3.11 below, supporting an overall cost of debt of 1.2 (real, RPI-deflated).

[83] We use the 3-months average for the current cost of debt estimate, as it strikes a balance between current evidence while smoothing short-run volatility (although we accept that shorter 1 month or 2 month averages would achieve a similar result).

Table 3.11
We estimate cost of debt of 1.3 to 1.2 per cent (real, RPI-deflated) for the operational phase of the Competition Proxy model starting in 2024

	NERA Lower Bound	NERA Upper Bound	Approach
Current CoD	3.2%	3.2%	3-monthsaverage yield on A/BBB 15+ £ corporate non-financials index
Uplift	0.86%	0.86%	10Y gilt forward rate evidence (3 months average)
RPI inflation	3.0%	3.1%	HMT and OBR LT forecasts
CoD (real, RPI)	1.1%	0.9%	Calc.
Transaction costs	0.2%	0.3%	Precedent
Total CoD (real, RPI)	**1.2%**	**1.2%**	**Calc.**

Source: NERA calculations

However, we note that determining the cost of debt upfront may expose TOs to substantial re-financing risk. Such a risk could be addressed by having a re-opener mechanism for re-setting the cost of debt allowance at the start of the operational phase.

3.3.3. We estimate a vanilla WACC of 3.1 to 3.7 (real, RPI-deflated) for the operational phase of the Competition Proxy model starting in 2024

We estimate a vanilla WACC of 3.1 to 3.7 (real, RPI-deflated) for the operational phase of the Competition Proxy model starting in 2024, as shown in Table 3.12 below.

We note the below estimates would need to be updated closer to the start of the construction period, in particular for the cost of debt, to take into account changes in credit market conditions.

Table 3.12
We estimate a vanilla WACC of 3.1 to 3.7 per cent (real, RPI-deflated) for the operational phase of the Competition Proxy model starting in 2024, substantially higher than CEPA

	NERA Lower Bound	NERA Upper Bound	CEPA Lower Bound	CEPA Upper Bound
Gearing	60%	60%	85%	85%
Real TMR	6.5%	7.1%	N/A	N/A
Real risk-free rate	1.3%	2.0%	N/A	N/A
ERP	5.3%	5.1%	N/A	N/A
Asset Beta	0.36	0.42	N/A	N/A
Equity Beta	0.90	1.05	N/A	N/A
Real cost of equity	6.0%	7.4%	3.48%	5.83%
Real cost of debt	1.0%	0.9%	0.00%	0.63%
Transaction costs	0.2%	0.3%	0.10%	0.10%
Total real cost of debt	1.2%	1.2%	0.10%	0.73%
WACC (real vanilla)	**3.1%**	**3.7%**	**0.60%**	**1.75%**

Source: NERA calculations

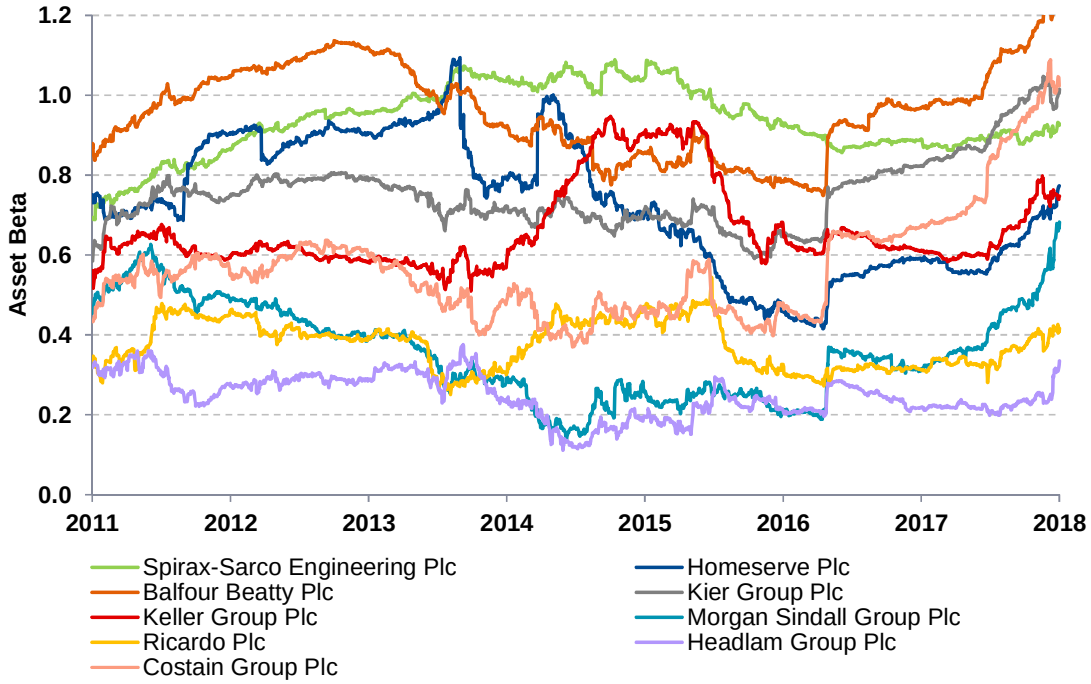
In contrast, CEPA's vanilla WACC range is 0.6 to 1.75 per cent (real, RPI-deflated). This estimate is significantly lower compared to our estimated WACC range of 3.1 to 3.7 per cent.

The key difference reflects CEPA's substantial understatement of the cost of equity based on its unsubstantiated OFTO equity IRR evidence and flawed methodology for converting the OFTO IRR's into a cost of equity for onshore networks under the Competition proxy model. CEPA also understates the cost of debt, due to overstating inflation, understating the uplift to 2024 and implausible assumptions on credit rating given CEPA's highly leveraged financial structure.

As we explain in this section, CEPA's estimate of the operational phase WACC for the Competition Proxy model is flawed and leads to a substantial understatement of the cost of capital. However, we highlight that CEPA's lower bound estimate of the WACC of 0.6 per cent (real, vanilla) is particularly implausible, as it combines CEPA's most extreme assumptions on the individual parameters, none of which are justified. Specifically, the lower bound is based on a low equity IRR of 7 per cent (nominal, post-tax) based on unsubstantiated OFTO evidence and a 100bps additional downward adjustment, deflated using 3.4 per cent RPI inflation which is substantially overstated, resulting in a real cost of equity of 3.5 per cent (real, RPI-deflated) at 85 per cent gearing, which is simply implausible. It also assumes a cost of debt based on A credit rating, contrary to rating agency methodology or indeed any empirical evidence of A rated companies with a gearing of 85 per cent. None of CEPA's assumptions can be justified standalone, let alone jointly in CEPA's lower bound operational WACC estimate.

Appendix A. Asset betas of actively traded companies in Bloomberg's "Engineering and construction" BICS group

Figure A.1
Asset betas for liquid construction comparators



Source: NERA analysis of Bloomberg data; Asset beta estimated using FTSE All Shares index assuming zero debt beta. The floor for the net debt used to de-lever the equity betas is 0. Cut-off date 2nd March 2018.

Appendix B. Relative risk assessment for European networks

Table B.1 below compares the risks investors bear during the operational phase under the Competition Proxy model to the risks under the regulatory regimes for Italian and Spanish energy networks.

Table B.1
Relative risk of Competition Proxy model vs. Italian and Spanish regimes

	Italy	Spain		GB
	Snam (GT),Terna (ET), Acea (ED)	Enagas (GT), Red Electrica (ET)	Gas Natural (GD)	Competition Proxy Model for HSB – Operational phase
Form / length of revenue period	• Hybrid of price cap (opex) and cost plus/pass through (capex), but virtually no volume risk on opex as a result of true up • 4 years (8 years under discussion)	• Revenue-cap • 6 years • Volume drivers for GT revenues based on outturn demand	• No set regulatory period • Revenue-cap (s.t. volume drivers)	• Revenue-cap • 25 years (start in 2024)
Setting cost allowances	• Based on actual opex in base year, updated annually according to CPI-X formula.	• Allowances set based on "standard" costs for capex and opex (review of historical data & technical input) • Standard costs revised at the start of every regulatory period and every 3 years for GT	• Revenues not linked to RAB but based on baseyear costs (2002) rolled forward with volume drivers (based on demand growth and customer numbers growth)	• Cost allowances set for a duration of 25 years (indicative allowance set at pre-construction stage, finalised post construction) • Opex reopener for low probability, high impact events (subject to materiality threshold), and for unanticipated changes in law, in line with OFTO • Intra-period allowances for capex upgrade necessary to build additional connections (under competition regime if it meets the criteria; otherwise based on RIIO arrangements)
Outturn cost risk & incentives	• Opex: 50% sharing factor, limited volume risk • Ex-post recognition of actual capex spent • Additional WACC allowed for some investments (e.g. security of supply)	• Opex: no sharing factor • Capex: 50% sharing factor; profit from underspend capped at 12.5% of costs (ET only)	• No explicit sharing of out/underperformance	• NGET bears full cost risk during operational phase, but an adjusted sharing factor applies during construction
Quality of Service/Output incentives	• Quality of service premiums/penalties (mainly technical, e.g. interruptions)	• ET: Availability incentive (of minor importance, capped)		• RIIO incentives remain applicable, esp. Energy Not Supplied incentive
Other	• Risks from prospective changes to regulatory regime (longer controls, outputs based regulation) • No significant stranding risk in ET	• No significant stranding risk in ET	• Higher unit remuneration for some assets	• No stranding risk over 25 years

Source: NERA analysis of regulatory determinations.

In Italy, networks are regulated under a hybrid of a price cap (on opex) and a rate of return regime (on capex). Due to a periodic true-up, only a very small share of opex is subject to volume risk (around 5%).[84] Moreover, their opex cost risk is partially mitigated through a 50 per cent sharing factor. Italian networks face very little capex risk given that capex is effectively passed through.

Whereas the Italian networks face relative low risk based on volume and cost risk considerations, there is uncertainty about the regulatory regime in Italy. In particular, there is a plan to extend the regulatory period from four to eight years, with a view to introducing

[84] See for example Aeegsi, Decision 514/2013/R/gas (Tariff regulation for gas transport for RP4), Article 13.

more stringent incentive regulation. This is likely going to increase the systematic risk of these networks, and is already reflected in the current beta estimates which are somewhat higher than for UK networks.

Given the relatively short regulatory period, opex sharing factor, and capex pass-through under the Italian regime, Italian networks appear to face less risk than investors during the operational phase under the Competition Proxy model. However, this is offset by the uncertainty about ongoing regulatory reforms in Italy.

In Spain, transmission networks are regulated under revenue caps, which shield them from volume risk. On the cost side, they are subject to a 50 per cent sharing factor on capex, but bear the full cost risk on opex. This makes them somewhat riskier than the UK networks regulated under RIIO.

Gas Natural (GD) is subject to a revenue cap, but this is based on volume drivers multiplied by a unit cost (opex and capex) assumption. Without a true-up, this implies a somewhat higher cost risk for Gas Natural, as the unit cost may deviate from the actual opex and capex. There is no sharing of opex and capex out or underperformance.

The operational phase of the competition proxy model is similar to the Spanish regimes with regard to opex risk (no opex sharing factor), albeit the Competition proxy model includes no re-sets over a longer 25-year period. Whereas Gas Natural faces potentially higher cost risk due to volume drivers, offsetting this, investors in HSB bear some additional risk related to the longer revenue period.

Appendix C. Comparison of NERA cost of equity to OFTO equity IRRs reported by the NAO

We convert use the individual parameters for the cost of equity presented in section 3.3.1 and convert them to a gearing of 80 – 85 per cent and nominal values, for comparability with the with the equity IRRs reported by the NAO of 10 to 11 per cent.[85]

In converting the cost of equity, we make the following assumptions:

- We use inflation of 3.1 per cent, calculated based on average 10-year breakeven inflation over 2011, the year in which we understand the OFTO projects evaluated by the NAO in its report were awarded.[86]
- When converting to 80 to 85 per cent gearing, we assume a debt beta of 0.1 to 0.2, in line with the assumption that at higher levels of gearing, debt will take on some of the equity risk. Our debt beta is based on debt beta estimates by the CMA.[87]

This provides an estimate of a nominal post-tax cost of equity of 11.9 to 13.9 per cent (as shown in Table C.1.

Table C.1
Our cost of equity converted to 80-85 per cent gearing is broadly consistent with NAO evidence on equity IRRs for OFTOs of 10-11 per cent

	NERA Lower Bound	NERA Upper Bound
Gearing	80%	85%
Inflation	3.1%	3.1%
Real TMR	6.5%	7.1%
Real RfR	1.25%	2.0%
ERP	5.25%	5.1%
Nominal RfR	4.3%	5.2%
Asset beta	0.36	0.42
Debt beta	0.10	0.20
Equity beta	1.40	1.67
CoE nominal, post-tax	**11.9%**	**13.9%**

Source: NERA calculations

[85] NAO (June 2012), Offshore electricity transmission: a new model for delivering infrastructure, p.29

[86] NAO (June 2012), Offshore electricity transmission: a new model for delivering infrastructure, p.24 Figure 4.

[87] The CMA undertook a comprehensive review of debt beta evidence in its 2007 report on cost of capital for designated airports, were it estimated a debt beta in a range of 0.09 to 0.19. Source: CMA (September 2007), BAA Ltd a report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd), p.47.

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