NERA
ECONOMIC CONSULTING

Cost of Debt for HAL in H7

Prepared for Heathrow Airport

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Executive Summary

Heathrow Airport Ltd (HAL) has commissioned NERA Economic Consulting (NERA) to review PwC's analysis on HAL's cost of debt for the H7 price control. Our analysis focuses on: 1) evidence for a HAL specific adjustment to the cost of new debt; and 2) the appropriate trailing average period for setting embedded debt costs for HAL in H7.

Latest market evidence supports 10 to 20 bps premium for HAL debt costs relative to iBoxx benchmark indices

We undertake a comprehensive analysis of HAL's debt costs relative to the iBoxx indices as well as GB energy and water bonds to assess whether the evidence supports a company specific adjustment to the cost of debt for HAL.

We find that a range of estimation methods support the conclusion that HAL issues debt at a cost above that of water and energy network comparators and the iBoxx benchmark indices as follows:

- *Traded yield spreads HAL vs. water and energy*: Comparing traded yield spreads on a portfolio of HAL A-rated nominal bonds to comparable energy and water bonds supports a HAL premium of 5 to 20 bps.
- *Yield at issue HAL vs. iBoxx*: Comparing yield at issue of HAL's nominal bonds to yield on iBoxx indices supports a HAL premium of 40 bps, even after adjusting for outliers and excluding bonds issued during the 2008-2009 financial crisis.
- *Yield at issue HAL vs. water and energy:* We find water and energy companies issue debt in line with iBoxx yields, whereas there is evidence that HAL's issues debt at around 30 bps above yields at issue for energy and water comparator bonds.

Overall, we conclude that latest market evidence supports a premium of 10 to 20 bps for HAL's debt costs relative to the iBoxx benchmark indices, drawing primarily on evidence from our analysis of HAL's traded yield spreads.

PwC's proposed 15-year average of iBoxx index understates HAL embedded debt costs; a 20-year average provides a better proxy for HAL's actual debt portfolio

Overall, we find that a 15-year averaging period of the benchmark iBoxx index as proposed by PwC fails to reflect HAL's debt issuance and maturity profile, by ignoring debt issued prior to the Financial Crisis and, which remains a sizable proportion of HAL's expected embedded debt outstanding in H7, and would therefore not allow HAL to recover its efficiently incurred historical debt costs. Indeed, PwC's proposed 15-year average is lower than HAL's estimated actual cost of embedded debt by around 1.3 to 2.2 per cent.

We consider a longer 20-year averaging period should be used, consistent with the average tenor at issue of HAL's debt and indeed the average remaining tenor of the benchmark iBoxx index. We do not consider PwC's proposed simplistic approach of rolling forward the 20-year trailing average during H7 is appropriate and instead a more precise modelling of HAL's full notional debt portfolio would be required to appropriately assess and model the expected embedded debt retiring during H7. Alternatively, the CAA may take the simple 20-year average calculated at the start of H7 as a reasonable approximation of HAL's embedded debt costs during H7.

1. Introduction

Heathrow Airport Ltd (HAL) commissioned NERA Economic Consulting (NERA) to review PwC's analysis of HAL's cost of debt for the H7 price control.[1] In particular, we have been asked to focus on two issues: i) evidence for a HAL specific adjustment to the cost of new debt; and ii) the appropriate trailing average period for setting embedded debt costs for HAL in H7.

This short report is structured as follows:

- Section 2 analyses the evidence for a company specific adjustment to the cost of new debt for HAL; and
- Section 3 considers the appropriate trailing average period for setting embedded debt costs for HAL for H7 based on benchmark corporate debt indices.

[1] PwC (February 2019), Estimating the Cost of Capital for H7 - Response to Stakeholder Views.

2. HAL Specific Adjustment to The Cost of New Debt

In this section, we set out our analysis of a HAL company specific adjustment to the cost of new debt. We start by summarising PwC's analysis of company specific adjustments for HAL's cost of debt in H7, and then present our own analysis.

Overall, we conclude that latest market evidence from HAL's publicly traded bonds supports a premium of 10 to 20 bps for HAL's debt costs relative to the iBoxx benchmark indices.

2.1. Summary of PwC's Analysis

In its November 2017 report[2], PwC estimated a range for HAL's real cost of new debt for H7 of 0.15 per cent to 0.65 per cent real RPI-deflated, based on i) current real A/BBB-rated iBoxx GBP Corporate Non-Financial 10Y+ index yields[3], which is around zero; and ii) a forward-looking uplift implied from real gilt yields, ranging between 0.15 and 0.65 per cent.

In response to PwC's report[4], HAL argued that the cost of new debt for HAL should be set at 15 bps above the benchmark iBoxx index to reflect that HAL issues debt at a premium to the index. HAL estimated a spread based on a comparison of HAL and Anglian Water's debt costs of 30 bps, but noted that Ofwat assumed that water companies can issue debt at 15 bps below the index (so-called "halo effect"). Based on this, HAL estimated a company specific premium of 15 bps relative to iBoxx index.

In its February 2019 report[5], PwC disagrees with HAL's proposed company specific adjustment, and sets out three reasons:

- PwC compares the nominal yield at issue of four HAL bonds relative to the average A/BBB-rated iBoxx Corporate Non-Financial 10Y+ index yield at the time of issuance. PwC argues that the yield at issue of the four selected HAL bonds is not much higher than the yield on the A/BBB iBoxx indices. [6]
- PwC argues that HAL's analysis based on a single bond is unlikely to be a robust basis for an adjustment, and points out that the 15bps "halo effect" assumed by Ofwat is based on the wider water sector sample rather than any individual issuance. PwC further argues that the spread between the HAL and Anglian Water bonds is not consistent over time, while a spread between HAL and a Southern Water bond is materially lower on average than the spread relative to the Anglian Water bond.[7]

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2 PwC, November 2017, Estimating the cost of capital for H7, A Report Prepared for the Civil Aviation Authority (CAA), p.25-30.

3 PwC deflates the nominal iBoxx yield using 10-year breakeven inflation from Bank of England yield curves

4 CAA, May 2018, Economic regulation of capacity expansion at Heathrow: working paper on the cost of capital and incentives, CAP 1674, p.23.

5 PwC, February 2019, Estimating the cost of capital for H7 - Response to stakeholder views, A report prepared for the Civil Aviation Authority (CAA), p 24

6 PwC, November 2017, Estimating the cost of capital for H7, A Report Prepared for the Civil Aviation Authority (CAA), p.29.

7 PwC, February 2019, Estimating the cost of capital for H7 - Response to stakeholder views, A report prepared for the Civil Aviation Authority (CAA), p 25, footnote 13.

- PwC argues that HAL has a credit rating of A- for its senior debt, so HAL's cost of debt should be expected to be lower than the average A/BBB index by a small margin.

In the following sections, we undertake a comprehensive analysis of HAL's debt costs relative to the iBoxx indices as well as GB energy and water bond to assess the basis for a company specific adjustment to the cost of debt for HAL.

2.2. Empirical Evidence on Traded Yields

In this section, we assess whether there is evidence of a debt premium for HAL debt by comparing traded yield spreads for HAL's bonds and comparable bonds issued by GB water and energy network companies, controlling for various risk factors. Our analysis shows that HAL's traded yield spreads are higher than traded yield spreads for comparable bonds issued by GB water and energy networks.

We start by constructing a portfolio of HAL's nominal GBP bonds, and select comparator energy and water bonds comparable to the HAL bond portfolio. To ensure a like-for-like comparison, we adopt the following selection criteria:[8]

- Credit rating (to control for differences in credit risk);
- Maturity (to control for differences in spreads over time);
- Fixed-rate bond (to control for interest rate risk);
- GBP-denominated bond (to control for currency risk);
- No embedded options (to control for the optionality); and
- Bullet bonds (to control for repayment prior to redemption).

To control for rating differences and maturity, we form an A-rated and a BBB-rated HAL bond portfolio separately, and identify comparator bonds with similar maturity for each bond portfolio. In addition, instead of comparing traded yields, we calculate the spread for each HAL bond and the comparable bonds relative to UK government bonds with similar maturities.[9] The purpose of this approach is to remove the term premia embedded in the bond yields, so that bonds with different maturities can be analysed on a comparable basis. We then calculate the debt-weighted average spread to gilt yield for the A-rated and BBB-rated HAL bond portfolio and the comparator bond portfolio.

We note that it is not always feasible to exactly match the maturities of the HAL and comparator bond portfolios since the maturities vary over time. Figure 2.1 shows the weighted average maturities of the A-rated and BBB-rated HAL bond portfolios relative to those of the comparator bond portfolios.

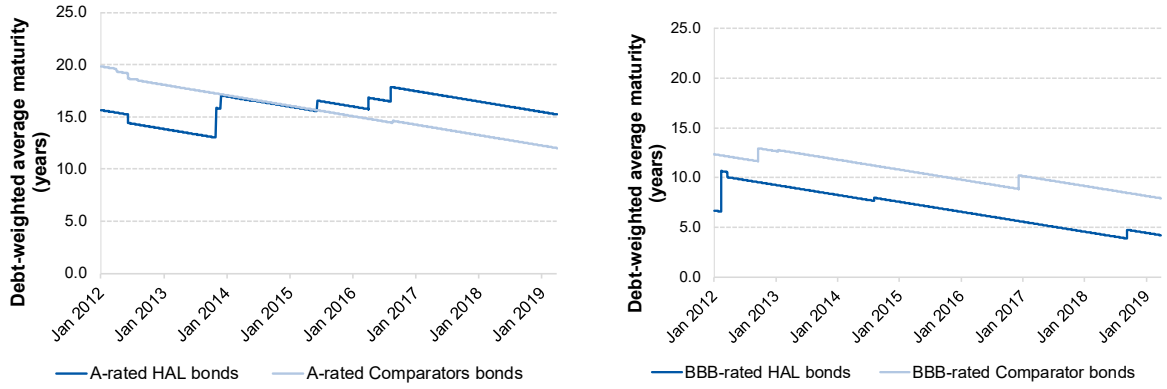
- For A-rated bonds, the remaining maturity of the HAL bond portfolio is around 15 years and is on average tracked by the comparator bond portfolios.
- For the BBB-rated portfolio, the BBB-rated HAL bonds are relatively close to maturity, which could distort the estimated debt spread. This is because as a bond approaches

[8] See Appendix A for the list of energy and water bond comparators.

[9] For example, if on a given date a bond's years to maturity is 15 years, we calculate its credit spread relative to the 15-year UK gilt yields on the date from the Bank of England yield curve.

maturity, the credit spread will tend to zero since at maturity the spread will be zero by definition. As a result, any difference in the spread for HAL and comparable bonds will be low when close to maturity, and comparing bond yields close to maturity could potentially understate a potential debt premium for a longer maturity HAL bond (at issuance). There are also relatively few observations for HAL's BBB-rated bonds. We therefore consider that caution should be taken when interpreting the evidence on traded yield spreads for BBB-rated bonds, which should only be used as a cross-check, while placing greater weight on the comparison using the A-rated debt.

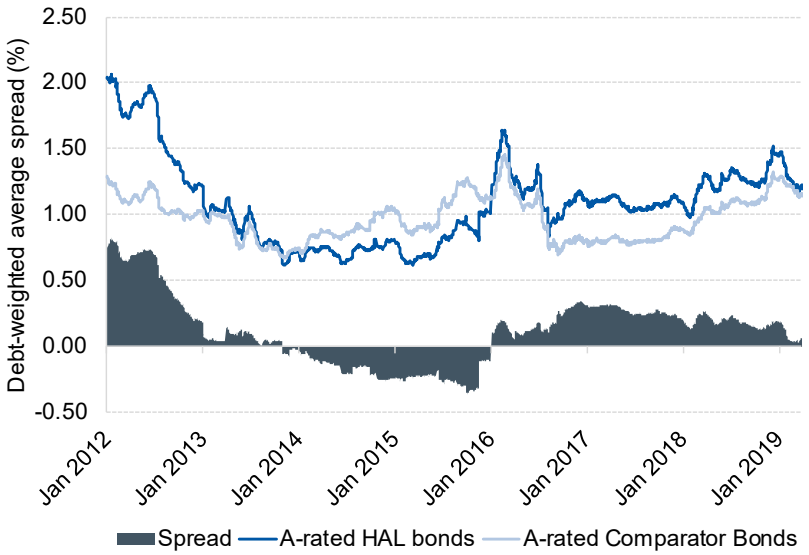
Figure 2.1: Debt-Weighted Average Maturity of A And BBB-Rated HAL Bonds And Comparator Bonds



Source: NERA analysis of Bloomberg data. Cut-off date: 29 March 2019

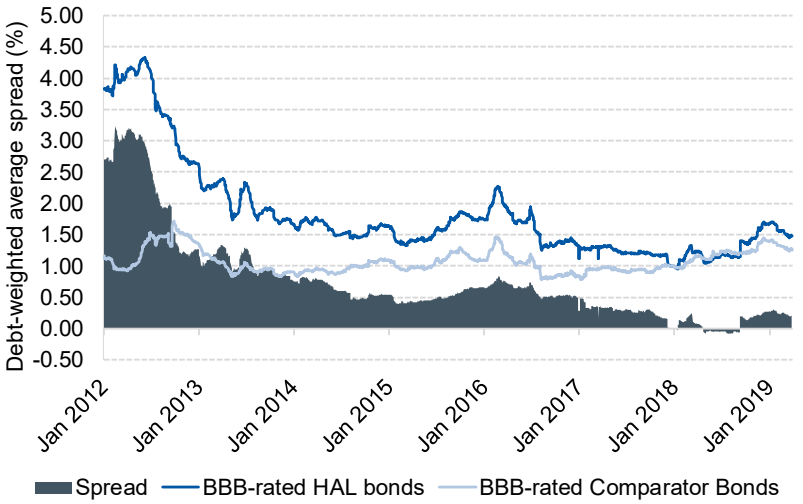
Figure 2.2 and Figure 2.3 show the difference in weighted average yield spreads for HAL's A-rated and BBB-rated bonds portfolio relative to their respective comparator bonds portfolio.

Figure 2.2: Weighted Average Spreads Relative to Gilt Yield For A-Rated HAL Bonds And Comparator Bonds



Note: The shaded area shows the difference between the weighted average yield spread of A-rated HAL bonds and the weighted average of the yield spread of A-rated comparator bonds.
Source: NERA analysis of Bloomberg data. Cut-off date: 29 March 2019.

Figure 2.3: Weighted Average Spreads Relative to Gilt Yield For BBB-Rated HAL Bonds And Comparator Bonds



Note: The shaded area shows the difference between the weighted average yield spread of BBB-rated HAL bonds and the weighted average of the yield spread of BBB-rated comparator bonds.
Source: NERA analysis of Bloomberg data. Cut-off date: 29 March 2019.

As shown in Figure 2.2 and Figure 2.3, the difference between HAL's yield spread and comparator bonds' yield spread varies over time and also depends on the credit rating. Over the sample period, HAL's traded yield spreads have been on average above those of the comparator bond issued by energy and water companies, which suggests that there may be an

additional debt premium for HAL's bonds relative to energy and water bonds, after controlling for credit rating and maturity.

In Table 2.1 we summarise the difference between HAL's bond yield spreads and energy and water comparator bonds' yield spreads over different averaging periods.

Overall, we find that the evidence supports an average HAL spread relative to the comparable energy and water bonds of around 5 to 20 bps, drawing primarily on market evidence of A-rated bonds.

Table 2.1: Difference Between HAL's Yield Spread and Comparator Yield Spread

Averaging period	A-rated	BBB-rated	Average A/BBB rated
6-month average	0.12 %	0.13 %	0.12 %
1-year average	0.15 %	0.03 %	0.06 %
2-year average	0.20 %	0.02 %	0.11 %
5-year average	0.06 %	0.28 %	0.17 %

Source: NERA analysis of Bloomberg data. Cut-off date: 29 March 2019.

2.3. Evidence on Yields at Issue

In this section, we assess whether there is evidence of a HAL debt premium by comparing the yield at issue of HAL's bonds and GB water and energy network companies' bonds to the respective iBoxx benchmark indices. Our analysis shows that HAL's yield at issue is higher than the iBoxx benchmark indices controlling for credit rating and tenor, whereas energy and water companies' bonds have zero spread at issue relative to the benchmark iBoxx benchmark indices.

2.3.1. Yield at issue analysis suggests a HAL debt premium of 40 bps relative to the iBoxx benchmark index adjusted for rating and tenor

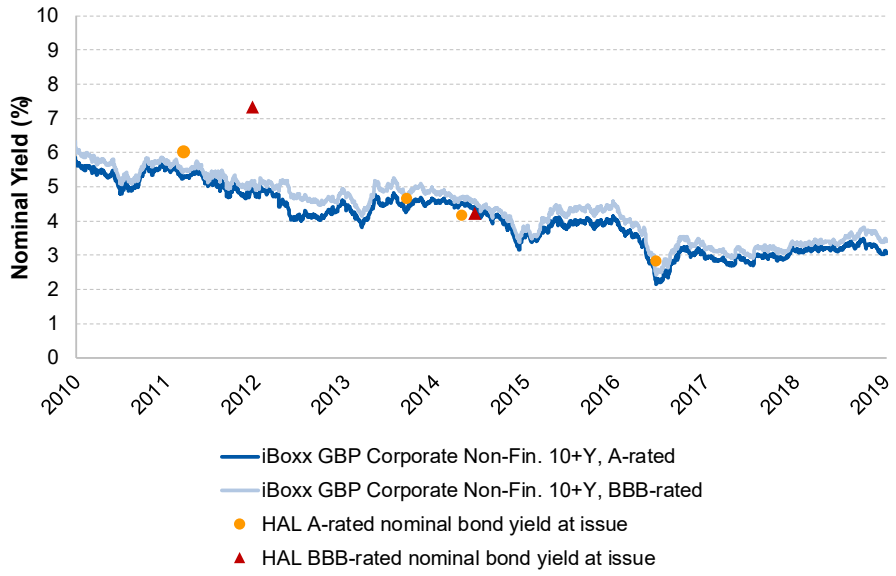
First, we calculate the yield at issue for HAL's GBP denominated bonds and compare them to yields of benchmark iBoxx indices, controlling for differences in tenor and rating.[10]

Figure 2.4 compares yield at issue for HAL's individual nominal debt issuances with the relevant iBoxx benchmark indices with maturities of 10+ years over the period after the 2008/2009 Global Financial Crisis.[11]

[10] Our use of the yield at issue to measure the debt cost is consistent with established GB regulatory methodology. The yield at issue measure was used by Ofgem at RIIO-ED1 Strategy Decision, and the CMA at the appeal of Ofgem's RIIO-ED1 decision by British Gas Trading (BGT).

[11] For index-linked bonds, we do not consider that it is feasible to compare the real coupon with the nominal iBoxx benchmark, due to the absence of a robust measure of inflation with which to deflate the nominal benchmark. Flaws in the measure of inflation will obscure any supposed out/underperformance of out/underperformance of cost of debt at issuance.

Figure 2.4: HAL Historical Nominal Debt Performance vs Benchmark Indices



Source: NERA analysis of data from Bloomberg and FactSet.

Table 2.2 shows the same data, which compares the yield at issue for HAL's nominal bonds with the benchmark iBoxx index yield values.

Table 2.2: HAL's GBP Nominal Yields at Issue Relative to Benchmark Indices

Issue Date	Amount Issued	Tenor & Rating	Yield at Issue	iBoxx Non-Fin Benchmark Yield	Spread
13/05/2011	£m 750	30Y A-	6.0%	5.3%	-0.7%
31/10/2013	£m 750	33Y A-	4.7%	4.3%	-0.4%
12/06/2014	£m 50	20Y A-	4.2%	4.5%	0.3%
09/08/2016	£m 400	33Y A-	2.8%	2.2%	-0.6%
A-rated Debt Spread					-0.5%
A-rated Debt Spread (adjusted for sub-rating and tenor difference)					-0.4%
14/02/2012	£m 600	12Y BBB	7.3%	5.1%	-2.3%
06/08/2014	£m 155	12Y BBB	4.2%	4.6%	0.3%
BBB-rated Debt Spread					-1.7%
Weighted average (adjusted for sub-rating)					**-0.7%**

Note: We use the iBoxx GBP Corporate Non-Financial 10+Y tenor indices to match HAL's average tenor at issue, and we match the rating of indices with individual issuance, i.e. we calculate the spread of A rated bond relative to the A-rated iBoxx index, and the BBB-rated bonds relative to BBB-rated iBoxx index. The spread is calculated as the benchmark indices minus HAL's yield at issue. We calculate the average yield spread weighted by the value of debt.
Source: NERA analysis of data from Bloomberg and FactSet. Cut-off date: 29 March 2019.

As shown in Table 2.2, HAL's yield at issue for nominal debt issued after the Financial Crisis has been higher than the iBoxx Corporate Non-Financial index by around 70 bps, reflecting a 40 bps underperformance for A-rated bonds and 1.7 per cent underperformance for BBB-rated bonds.

Our estimate takes into account the difference in the sub-rating of HAL's bond issuances, since all of HAL's single A rated bonds in our sample are rated A-, which we would expect to be issued at higher cost than the broader single A benchmark. To account for sub-rating differences, we make an adjustment of 10 bps for the difference in sub-rating for the A- rated bonds, which results in a spread of around 40 bps for HAL's A-rated nominal bonds reported in Table 2.2.

Nevertheless, we note that the evidence on the HAL debt premium from analysing yield at issue relies on relatively few observations and should therefore be interpreted with caution. The calculation of the average HAL debt premium is also influenced by the 2012 12Y BBB-rated bond whose spread to the benchmark is very high of around 2.3 per cent.[12] If we exclude this bond, the overall debt premium would fall to around 40 bps.

2.3.2. Evidence shows that GB energy and water companies have a zero debt premium relative to iBoxx benchmark indices

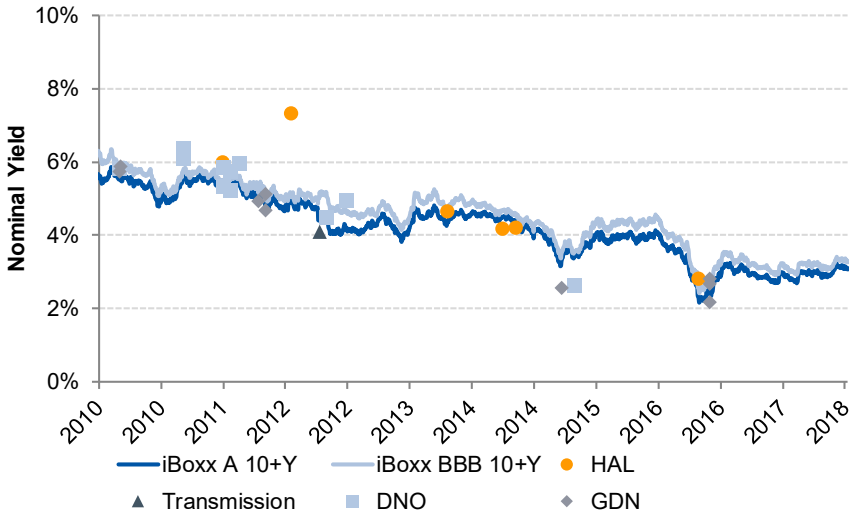
In this section, we undertake the same analysis of comparing yield at issue with benchmark iBoxx indices for bonds issued by GB energy networks and water companies.

For energy network bonds, we focus our analysis on nominal bond issuances, given nominal bonds comprise three-quarters of energy sectors' debt issuance and there is no robust measure of inflation with which to deflate the nominal iBoxx benchmark. We apply the selection criteria to include bonds that are denominated in GBP, rated A and BBB at issue, tenor of at least 10 years, and fixed coupon and bullet payment structure.

As shown in Figure 2.5, we find that on average energy network companies' yields at issue are in line with iBoxx indices controlling for tenor and rating at issuance, i.e. comparing A-rated bonds with the A-rated iBoxx index, and BBB-rated bonds with the BBB iBoxx index.

[12] The BBB-rated Bond with issue date of 14/02/2012, tenor at issue of 12Y, and yield at issue of 7.3%.

Figure 2.5: There Is No Evidence of Debt Premium of Energy Bonds Relative To iBoxx Benchmark Indices Once Controlled for Rating and Tenor

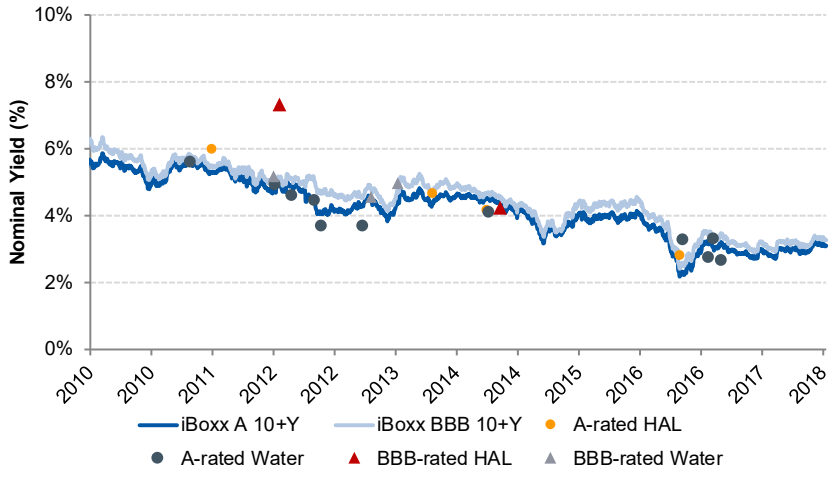


Source: NERA analysis of data from Bloomberg and FactSet

For water companies, we compare the yield at issue on nominal bonds to the iBoxx benchmarks, applying the selection criteria as for energy bonds: denominated in GBP, rated A and BBB at issue, tenor of at least 10 years, and fixed coupon and bullet payment structure to the benchmark iBoxx indices.

As shown in Figure 2.6, we also find that on average there is no evidence of out/underperformance of water companies' bonds relative to the respective iBoxx benchmark, controlling for the rating differences.

Figure 2.6: There Is No Evidence of Debt Premium of Water Bonds Relative to iBoxx Benchmark Indices Once Controlled for Rating and Tenor



Source: NERA analysis of Bloomberg and FactSet Data

Overall, we find that the water and energy bonds' yield at issue spread to the iBoxx at the time of issuance is practically zero, as summarised in Table 2.3.

Table 2.3: There Is No Evidence of a Debt Premium of Energy or Water Bonds Relative to iBoxx Benchmark Indices When Controlling for Rating and Tenor

	Out/underperformance relative to iBoxx benchmark
Energy sector	-3 bps
Water sector	3 bps

Source: NERA calculations based on data from Bloomberg and FactSet over the period 2000 to 2018

The above analysis shows that on average there is no out/underperformance of yield at issue for bonds issued by either GB energy or water companies. In contrast, as discussed in Section 2.3.1, we find that HAL yields at issue have been around 40 bps higher compared to the benchmark iBoxx indices. This in turn implies that on average, we would expect HAL bonds to have a higher yield at issue relative to the energy and water bonds, which are issued in line with benchmark iBoxx yields. To corroborate this conclusion, we compare yields at issue for HAL's bonds relative to bonds issued by water and energy networks at similar points in time.

As shown in Table 2.4, yields at issue on HAL's bonds is generally greater than or equal to the yields of comparable water and energy bonds, and on average higher by around 30 bps. This is consistent with our conclusions of comparing the HAL bonds and the water and energy bonds to the iBoxx indices.

Table 2.4: HAL Debt Costs Compared to Water and Energy Networks at Similar Time

Bond	Issue Date	Amount Issued (£m)	Tenor at Issue	Rating	Yield at Issue	Yield spread
HAL bond 1	13/05/2011	750	30.0	A-	6.0%	
Thames	11/02/2011	500	30.0	A-	5.6%	-0.4%
SPD	18/07/2011	350	15.0	A-	6.0%	-0.0%
WWU	04/11/2011	150	16.4	A-	5.1%	-0.9%
HAL bond 1 average spread						***-0.4%***
HAL bond 2	31/10/2013	750	33.0	A-	4.7%	
Affinity	04/02/2013	250	23.2	A-	4.5%	-0.2%
NGET TO	30/01/2013	100	22.0	A-	3.2%	-1.5%
HAL bond 2 average spread						***-0.8%***
HAL bond 3	12/06/2014	50	20.0	A-	4.2%	
Thames	19/06/2014	500	11.0	A-	4.1%	-0.1%
HAL bond 3 average spread						**-0.1%**
HAL bond 4	09/08/2016	400	33.0	A-	2.8%	
Affinity	22/08/2016	85	26.0	A-	3.3%	0.5%
Thames	23/12/2016	400	41.3	A-	3.3%	0.5%
Cadent	22/09/2016	800	30.0	A-	2.8%	0.0%
Cadent	22/09/2016	700	22.0	A-	2.7%	-0.2%
HAL bond 4 average spread						**0.2%**
Overall HAL bond average spread						**-0.3%**

Source: NERA analysis of data from Bloomberg. Cut-off date: 29 March 2019.

2.4. Conclusion on HAL Debt Premium

In this section, we considered a range of evidence for assessing whether there is evidence of a debt premium for HAL debt by comparing:

- traded yield spreads between HAL's bonds and comparable bonds issued by water and energy network companies;
- yield at issue of HAL bonds relative to iBoxx benchmark index;
- yield at issue of energy and water company bonds relative to iBoxx benchmark index; and
- yield at issue for HAL bonds and comparable energy and water bonds.

All of the above evidence shows that HAL issues debt at a cost above that of water and energy network comparators and the iBoxx benchmark indices. The different estimation methods provide a range of estimates of the HAL specific premium:

- Evidence on traded yield spreads for HAL's A rated bonds indicates an average HAL spread of around 5 to 20 bps relative to the comparable energy and water bonds.
- HAL's yield at issue spread relative to iBoxx benchmark indices suggests a debt premium of 40 bps, after adjusting for potential outliers and excluding bonds issued during the 2008-2009 financial crisis.
- Comparative analysis shows no evidence of a debt premium for energy or water bonds relative to iBoxx benchmark indices, whereas there is evidence that HAL's yield at issue is around 30 bps higher compared to energy and water comparator bonds.

Overall, we conclude that latest market evidence supports a premium of 10 to 20 bps for HAL's debt costs relative to the iBoxx benchmark indices, drawing primarily on evidence from our analysis of HAL's traded yield spreads.

3. Appropriate Trailing Average Period for Estimating HAL's Cost of Embedded Debt

In this section, we consider the appropriate trailing average period of benchmark iBoxx indices for estimating cost of embedded debt for HAL at H7. We start by summarising PwC's analysis, and then present our own analysis.

Overall, we conclude that PwC's proposed 15-year trailing average period fails to reflect HAL's debt issuance and maturity profile, understating HAL's embedded debt costs. We consider a 20-year average should be used instead, consistent with the average tenor at issue of HAL's debt and indeed the average remaining tenor of the benchmark iBoxx index.

3.1. Summary of PwC's Analysis

In its November 2017 report[13], PwC estimated HAL's cost of embedded debt range to be 1.1 to 1.8 per cent by the end of 2019, which was assumed to be the starting point of H7 control period. PwC's range was based on the 10- and 15-year trailing averages of the notional investment grade corporate bond yields, proxied by the real average A/BBB rated iBoxx GBP Corporate Non-Financial 10Y+ index yields.[14] PwC first calculated the spot 10- and 15-year trailing averages to be 1.9% and 2.2%, and adjusted the range to reflect the expected movement of yields implied by gilt forward rates, which resulted in a final estimate of 1.1% and 1.8% by the end of 2019.

PwC concluded the real cost of embedded debt should be based on the 15-year value of 1.8%, which it considered to be more consistent with a long-term notional financing assumption, and better reflected HAL's past debt issuance trend. PwC also stated that it does not consider using trailing average periods longer than 15 years would be appropriate, because the proportion of HAL's outstanding funding associated with their August 2008 re-structuring will be a small percentage of embedded debt at the start of H7. [15]

In response to PwC's report[16], HAL argued PwC's approach underestimates HAL's debt costs. HAL considered that PwC's notional approach failed to reflect HAL's actual debt issuance profile, specific credit rating, HAL's longer-than-15-years average debt tenor, and HAL's higher costs of issuing index-linked debt. HAL estimated its average real cost of embedded debt to be 3.4 per cent for H7.[17]

In its February 2018 report[18], CEPA suggested that the cost of embedded debt should be estimated based on the average cost of embedded debt over H7, rather than at the start point

[13] PwC (November 2017), Estimating the cost of capital for H7, A Report Prepared for the Civil Aviation Authority (CAA), p.28-30.

[14] PwC states that it deflates the nominal iBoxx yield using long-term breakeven inflation, but does not specify the tenor of breakeven inflation it has used.

[15] PwC (November 2017), Estimating the cost of capital for H7, A Report Prepared for the Civil Aviation Authority (CAA), p.30.

[16] CAA (May 2018), Economic regulation of capacity expansion at Heathrow: working paper on the cost of capital and incentives, CAP 1674, p.23.

[17] This estimate includes the ILD bonds and swaps.

[18] CEPA (February 2018), CEPA review of CAA Economic regulation of capacity expansion at Heathrow: policy update and consultation, (CAP1610) – cost of capital issues, for the Heathrow Airline Operators Committee (AOC), p.9 -10.

of H7. CEPA estimated HAL's cost of embedded debt to be 0.84%, based on the mid-point of their estimated 10- and 15-year trailing averages over 2020-2024. For 2022-2026, CEPA's estimated embedded debt is between 0.17 per cent and 0.80 per cent, based on 10- and 15-year trailing averages.

In its February 2019 report[19], PwC provides additional analysis to show the effect of the falling amount of embedded debt over the course of H7, assuming that the debt cost in the oldest year of the trailing average is removed as each year passes. Based on this approach, PwC estimates the average cost of embedded debt for the revised H7 period (2022-2026) to be between 0.4 per cent based on 10-year trailing average, and 1.2 per cent based on 15-year trailing average. PwC concludes that the 15-year trailing average is more appropriate for HAL's embedded debt, as it is consistent with a long-term financing assumption and broadly aligned to the period over which HAL existing debt was issued.[20] Table 3.1 summarises the approaches and estimates from PwC and CEPA.

Table 3.1: Estimates of HAL's Embedded Cost by PwC and CEPA

	Averaging period	Real embedded debt cost estimate
PwC (November 2017)	15-year	1.8% (2019)
CEPA (February 2018)	Average of 10- and 15 years	0.49% (2022-2026)
PwC (February 2019)	15 years	1.2% (2022-2026)

Source: PwC and CEPA reports

3.2. The Averaging Period for Embedded Debt Costs

In determining the averaging period for the cost of embedded debt, it is important that the resulting estimate allows HAL to recover its efficiently incurred historical debt costs. This means that the CAA should choose the averaging period for the embedded debt taking into account HAL's actual cost of embedded debt, which HAL estimates to be between 2.5 per cent and 3.4 per cent (real, RPI).[21]

PwC's latest estimate of real embedded debt cost based on 15-year average is 1.2 per cent, which understates HAL's estimated actual cost of embedded debt by around 1.3 to 2.2 per cent. One of the factors that could lead to this difference is that the 15-year averaging period does not reflect HAL's actual debt financing profile.

We calculate that around 18 per cent[22] of HAL's embedded debt outstanding in 2022 would have been issued more than 15 years before 2022 i.e. prior to 2007, and thus the cost of this

[19] PwC, February 2019, Estimating the cost of capital for H7 - Response to stakeholder views, A report prepared for the Civil Aviation Authority (CAA), p 24

[20] PwC, February 2019, Estimating the cost of capital for H7 - Response to stakeholder views, A report prepared for the Civil Aviation Authority (CAA), p 30

[21] PwC, February 2019, Estimating the cost of capital for H7 - Response to stakeholder views, A report prepared for the Civil Aviation Authority (CAA), p 27

[22] Based on HAL public nominal bond issuances sourced from Bloomberg. We use the nominal amount in sterling as per Heathrow website: https://www.heathrow.com/company/investor-centre/debt-information/financial-terms/heathrow-bonds

debt would be excluded from PwC's proposed 15-year average calculated at the start of the H7 period. A 15-year averaging period is therefore inappropriate as it fails to reflect HAL's efficiently incurred historical debt costs.

Moreover, PwC proposes that the embedded debt cost for HAL in H7 should be calculated by taking a 15 year average to calculate the cost of embedded debt in the first year of H7 only, while for the subsequent years, the averaging period should be shortened in line with assuming that HAL's embedded debt would mature during H7 (i.e. for the second year of H7, the embedded debt cost should be calculated as a 14-year average up to the start of H7, for the third year as a 13-year average and so on). The H7 embedded debt allowance should then be calculated as the average of the embedded debt cost estimates for the individual years of H7 (based on the 15-year, 14-year, 13-year, 12-year and 11-year averages calculated as of 2022), as shown in Table 3.2.

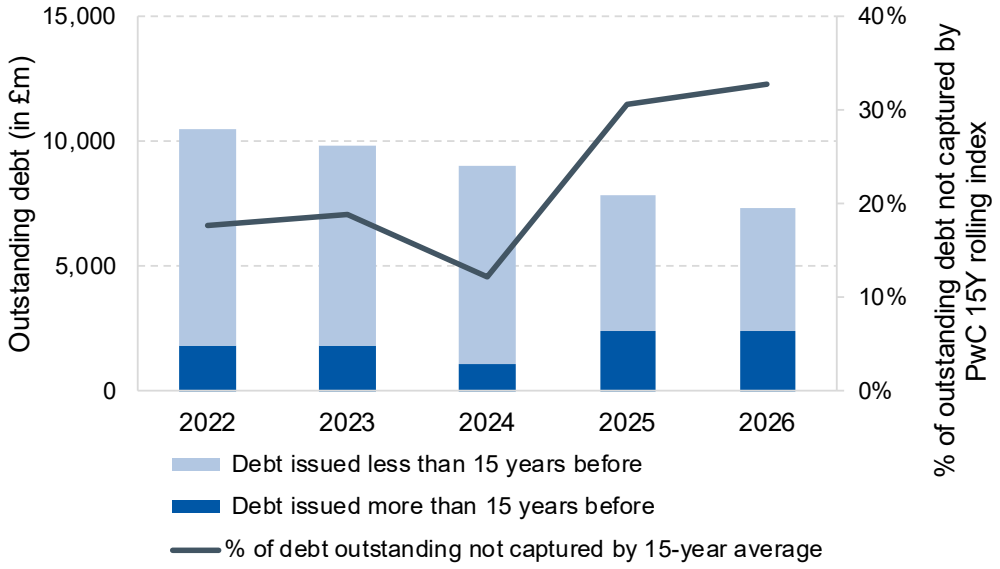
Table 3.2: PwC's Proposed Embedded Debt Cost Using the Rolling Average Approach

	2022	2023	2024	2025	2026	Average
10yr trailing average	0.7%	0.6%	0.4%	0.3%	0.2%	0.4%
Years remaining on embedded debt	10	9	8	7	6	
15yr trailing average	1.5%	1.4%	1.2%	1.0%	0.8%	1.2%
Years remaining on embedded debt	15	14	13	12	11	

Source: PwC 2019 Report, Table 10.

In Figure 3.1, we show for each year of H7 the proportion of HAL's existing debt issued 15 years prior, i.e. debt which is excluded from the calculation of embedded debt costs in each year of H7 under PwC's rolling average approach.

Figure 3.1: Sizable Portion of HAL's Existing Debt Is Issued Prior to The PwC's Proposed Averaging Period Used for Calculating HAL's Cost of Embedded Debt in Each Year of H7



Note: "Debt issued more than 15 years before" data series includes the bonds that are outstanding in a given year of H7 (e.g. 2022) and issued 15 years prior to the year.
Source: NERA analysis based on Bloomberg data on HAL's public bonds

As Figure 3.1 shows, PwC's proposed approach excludes 18 per cent of HAL's existing debt from the calculation of embedded debt costs for the first year of H7, while the percentage of debt excluded increases to around 33 per cent by the end of H7, due to PwC also proposing to roll forward the calculation of the historical average over H7.

The results in Figure 3.1 further demonstrates that PwC's proposed 15-year averaging period, which PwC also proposes to roll forward during H7 based on the assumption that part of HAL's embedded debt will mature during H7, fails to reflect HAL's debt issuance and maturity profile and would not allow HAL to recover its efficiently incurred historical debt costs during H7.

We calculate HAL's tenor at issue to be 22 years for sterling denominated bonds and 18 years for all bonds, i.e. around 20 years.[23] A 20-year historical averaging period would better match the average tenor at maturity of HAL's debt, allowing HAL to recover its efficiently incurred historical debt costs. A 20-year averaging period would also be consistent with the average tenor to maturity of the underlying benchmark iBoxx index which is also around 20 years.

[23] We calculate the tenor at issuance based on public bond information on HAL's website https://www.heathrow.com/company/investor-centre/debt-information/financial-terms/heathrow-bonds. We download the date of issuance from Bloomberg for each bond issuance (not reported on HAL website). For bonds originally issued by LHR Airports Limited (previous BAA plc) and migrated to Heathrow Funding Limited as part of the Group's refinancing completed in 2008, we use the original date of issuance, based on information provided by HAL. We calculate the weighted average tenor at issuance using the nominal amount in sterling as per information on HAL's website.

As we show in Table 3.3, the 20-year average of the A/BBB iBoxx Corporate Non-Financial 10Y+ index calculated as of the start of 2019 provides an estimate of 2.4 per cent (real, RPI deflated), which is closer to HAL's estimated embedded debt cost of 2.5 to 3.4 per cent. This is consistent with the 20-year averaging period providing a better match for HAL's historical debt issuance profile and hence its actual efficiently incurred historical debt costs.

Table 3.3: 20Y Trailing Average iBoxx Corporate Non-Financial 10Y+ A/BBB-Rated Yield at the Start of H7

	Start of 2019	Start of H7 (2022)
20-year trailing average (real, RPI)	2.4%	1.8 %

Note: We calculate the 20 year average as at the start of H7 in 2022, based on historical iBoxx yields up to the cut-off date, and forecasted iBoxx yields from the cut-off date to the start of H7 estimated using forward curve implied adjustments from Bloomberg. We deflate the nominal iBoxx index yields using breakeven inflations with 10-year maturity from Bank of England yield curve.
Source: NERA analysis of iBoxx data. Cut-off date: 5 March 2019.

We do not consider that PwC's approach of rolling forward the calculation of embedded debt costs during H7 is appropriate, even with a 20-year starting point. As Figure 3.1 shows, rolling forward the starting trailing average results in an increasing portion of HAL's existing debt being excluded from the calculation of embedded debt costs. This is because in reality, HAL issues a portfolio of debt which has a tenor which is around 20-years only *on average*, but in reality reflects a wider portfolio of debt with shorter and longer maturities. The 20-year averaging assumption therefore serves as an "approximation" of the fact that some of the older and more expensive debt is expected to remain outstanding during H7. It should therefore not be simply taken and "rolled forward" as proposed by PwC, assuming that all of HAL's debt is issued for exactly 20 years.

If the CAA wanted to model the effect of HAL's existing debt retiring over the H7 period, it would first have to construct a more precise "notional" debt index portfolio, using a range of benchmarks for different maturity debt that HAL typically issues (e.g. 30 years, 20 years, 10 years etc.) and appropriate weights. Based on this more precise "notional" portfolio, the CAA could then model the effect of the existing debt retiring during H7. This calculation would also have to take into account that the amount of existing debt will fall over time during H7, as shown in Figure 3.1, placing greater weight on the cost of debt calculated for the early years compared to the later years. (In contrast, PwC's approach gives equal weight to individual years which ignores the fact that the amount of existing debt still outstanding during H7 will fall over time and thus earlier years should have a greater weight in the calculation.)

However, the correct approach of modelling a notional debt portfolio with a range of maturities and then modelling the effect of HAL's existing debt retiring over the H7 period would be substantially more complex. The alternative approach of using the 20-year simple average calculated at the start of H7 may be a reasonable approximation of HAL's embedded debt costs during H7, given the 20-year average matches the *average* tenor at issue of HAL's debt as well as the *average* remaining tenor of the iBoxx benchmark.

3.3. Conclusion on Trailing Average

Overall, we find that a 15-year averaging period as proposed by PwC fails to reflect HAL's debt issuance and maturity profile, by ignoring debt issued prior to the Financial Crisis,

which remains a sizable proportion of HAL's expected embedded debt outstanding in H7, and would therefore not allow HAL to recover its efficiently incurred historical debt costs. Indeed, PwC's proposed 15-year average is lower than HAL's estimated actual cost of embedded debt by around 1.3 to 2.2 per cent.

We consider a longer 20-year averaging period should be used, consistent with the average tenor at issue of HAL's debt and indeed the average remaining tenor of the benchmark iBoxx index. We do not consider PwC's proposed simplistic approach of rolling forward the 20-year trailing average during H7 is appropriate and instead a more precise modelling of HAL's full notional debt portfolio would be required to appropriately assess and model the expected embedded debt retiring during H7. Alternatively, the CAA may take the simple 20-year average calculated at the start of H7 as a reasonable approximation of HAL's embedded debt costs during H7.

Appendix A. Comparator Bond for Traded Yield Analysis

In this Appendix, we set out the HAL's bonds and the comparator bonds used in the traded yield analysis in Section 2.2.

Table A.1: HAL A-Rated Issues

No.	Bloomberg Ticker	Coupon (%)	Amount (£m)	Rating	Issue Date	Maturity Date
1	EH517938 Corp	5.2	750	A-	18/08/2008	15/02/2023
2	EH517874 Corp	5.9	396	A-	18/08/2008	27/11/2013
3	EH517762 Corp	6.5	900	A-	18/08/2008	10/12/2031
4	EH517934 Corp	12.5	300	A-	18/08/2008	31/03/2016
5	EH517766 Corp	7.1	200	A-	18/08/2008	04/08/2028
6	EH517958 Corp	9.2	250	A-	18/08/2008	29/03/2021
7	EI065055 Corp	6.8	700	A-	03/12/2009	03/12/2026
8	EI666145 Corp	5.9	750	A-	13/05/2011	13/05/2041
9	EJ218127 Corp	3.0	300	A-	08/06/2012	08/06/2015
10	EJ9027123 Corp	4.6	750	A-	31/10/2013	31/10/2046
11	EK2884451 Corp	4.2	50	A-	12/06/2014	12/06/2034
12	QZ0190590 Corp	2.8	400	A-	09/08/2016	09/08/2049

Source: NERA analysis based on Bloomberg data

Table A.2: HAL BBB-Rated Issues

No.	Bloomberg Ticker	Coupon (%)	Amount (£m)	Rating	Issue Date	Maturity Date
1	EI393606 Corp	6.3	400	BBB	10/09/2010	10/09/2018
2	EI873185 Corp	7.1	600	BBB	14/02/2012	14/02/2024
3	EJ074098 Corp	6.0	400	BBB	20/03/2012	20/03/2020
4	EK7576268 Corp	4.2	155	BBB	06/08/2014	06/08/2026

Source: NERA analysis based on Bloomberg data

Table A.3: Water and Energy A-Rated Comparator Bonds

No.	Bloomberg Ticker	Issuer	Coupon (%)	Amount (£)	Rating	Issue Date	Maturity Date
1	EC419205 Corp	National grid electricity transmission plc	6.5	360	A-	27/07/2001	27/07/2028
2	EC625157 Corp	Anglian water services financing plc	6.3	246	A-	30/07/2002	30/07/2030
3	EC787654 Corp	United utilities water ltd	5.6	300	A-	20/12/2002	20/12/2027
4	ED813861 Corp	United utilities water ltd	5.0	200	A-	28/02/2005	28/02/2035
5	EF147108 Corp	National grid electricity transmission plc	5.0	75	A-	01/03/2005	01/03/2035
6	EI191626 Corp	Western power distribution south west plc	5.8	200	A-	23/03/2010	23/03/2040
7	EI202146 Corp	Wales & west utilities finance plc	5.8	300	A-	31/03/2010	29/03/2030
8	EI495551 Corp	Western power distribution east midlands plc	6.3	250	A-	10/12/2010	10/12/2040
9	EI708675 Corp	South eastern power networks plc	5.6	300	A-	17/06/2011	30/09/2030
10	EI860467 Corp	Wales & west utilities finance plc	5.0	150	A-	04/11/2011	07/03/2028
11	EJ100716 Corp	Anglian water services financing plc	4.5	250	A-	02/04/2012	05/10/2027
12	EJ218237 Corp	National grid electricity transmission plc	4.0	575	A-	08/06/2012	08/06/2027
13	EJ261876 Corp	Northern powergrid yorkshire plc	4.4	150	A	05/07/2012	05/07/2032
14	EJ299009 Corp	Yorkshire water finance plc	3.6	250	A-	01/08/2012	01/08/2029
15	QZ287051 Corp	Affinity water finance plc	3.3	85	A-	22/08/2016	22/08/2042

Source: NERA analysis based on Bloomberg data

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Table A.4: Water and Energy BBB-Rated Comparator Bonds

	Bloomberg Ticker	Issuer	Coupon (%)	Amount (£)	Rating	Issue Date	Maturity Date
1	EF030249 Corp	Thames Water Utilities Finance PLC	5.1	200	BBB+	30/06/2005	30/06/2020
2	EI741101 Corp	SP Distribution PLC	5.9	350	BBB+	18/07/2011	17/07/2026
3	EJ352312 Corp	SP Manweb PLC	4.9	350	BBB+	20/09/2012	20/09/2027
4	EJ508751 Corp	Severn Trent Utilities Finance PLC	3.6	500	BBB+	16/01/2013	16/01/2026
5	AL457959 Corp	Severn Trent Utilities Finance PLC	2.8	400	BBB+	05/12/2016	05/12/2031

Source: NERA analysis based on Bloomberg data

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