Setting the Cost of Equity for Capacity Expansion at Heathrow Airport: A Review of Evidence on the Total Market Return for Infrastructure in Other Countries

Final Report for Heathrow Airport Limited

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Contents

1. Executive Summary

In December 2017, the Civil Aviation Authority (CAA) published a Consultation Paper on the economic regulation of capacity expansion at Heathrow Airport (HAL).[1] The paper by the CAA introduced an "early and preliminary range" of 2.8% to 4.6% for HAL's Weighted Average Cost of Capital (WACC)[2] for the capacity expansion. This range is based on an estimated cost of equity range of 4.9% to 7.1% and the assumption that the total market return (TMR) is in the range of 5.1% to 5.6% (in real terms). The CAA recognises that these assumptions have the potential to have a significant impact on their estimates of HAL's WACC and therefore it is important to consider a wide range of evidence before reaching final views on these matters.

As a contribution to the evidence base available to CAA about whether the preliminary estimate of the underlying cost of equity for HAL's capacity expansion is sufficient to attract the necessary equity investment in the international capital markets, HAL has engaged EY to undertake a review of the total market returns in selected international markets over the last four years, inferred by the allowed cost of equity on regulated infrastructure assets, as well as observed cost of equity on unregulated infrastructure assets.

Specifically, we have been asked to gather and assess the following evidence based on publicly available information:

- the allowed cost of equity and implied total market returns by sectoral economic regulators and their approaches to determining the appropriate total market returns, based on:
  - current decisions made for selected regulated European airports;
  - current decisions made for the electricity and gas networks in selected international jurisdictions; and
- empirical evidence and expert opinions on the market returns adopted by independent experts when valuing infrastructure assets.

The following table provides a summary of the evidence.

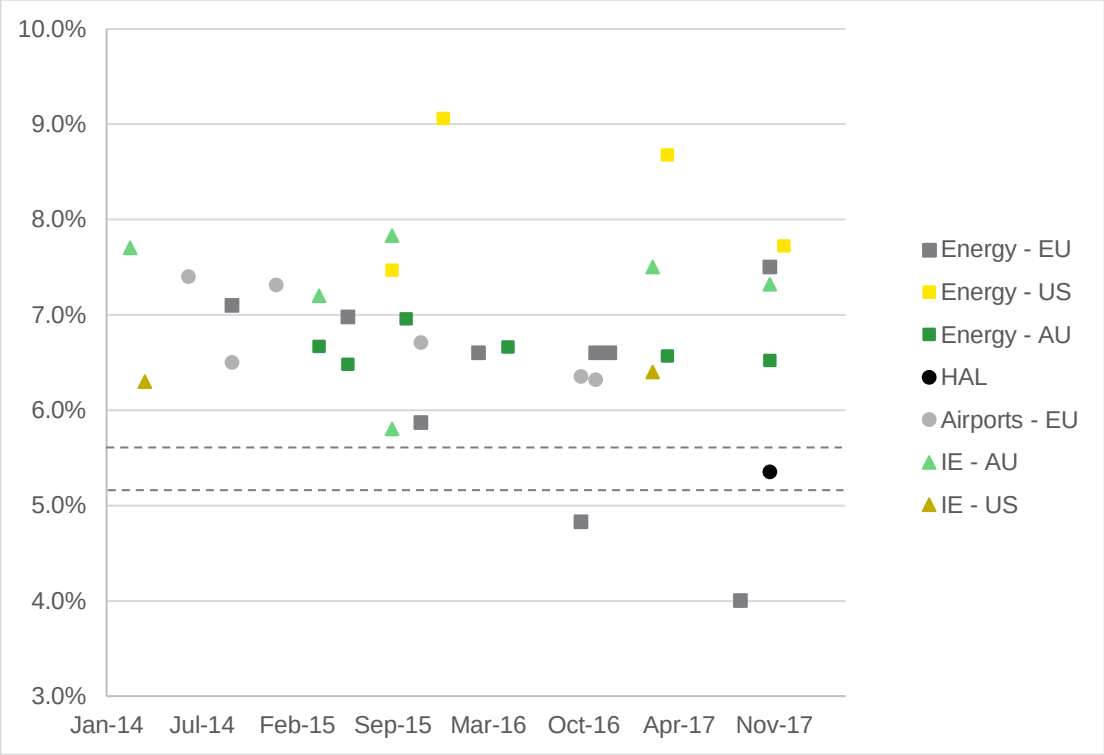
Table 1: Allowed and estimated total market returns for selected infrastructure assets in selected regions over the past four years by source of evidence (real)

Source of evidence	Region[3]	Real TMR range
Regulatory precedents – energy	Australia	6.48% - 6.96%
Regulatory precedents – energy	Norway & Sweden	6.98% - 7.50%
Regulatory precedents – energy	Other EU (Denmark, Finland, France, Germany)	4.00% - 6.60%
Regulatory precedents – energy	United States	7.47% - 9.06%
Regulatory precedents – airports	EU (Belgium, Denmark, France, Germany, Ireland, Italy)	6.32% - 7.40%
Independent expert reports	Australia	5.80% - 7.70%
Independent expert reports	United States	6.30% - 6.40%

[1] http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8132
[2] Vanilla WACC, which is based on the pre-tax cost of debt and the post-tax cost of equity weighted by gearing.
[3] The regions are grouped in accordance with HAL's request.

The following chart presents the evidence we observed on total market returns by source of evidence and how they compare to the range of 5.1% to 5.6% quoted in the CAA's Consultation Paper that underpins an "early and preliminary range" of WACC for HAL's capacity expansion scenario.

Figure 1: Allowed and estimated total market returns for selected infrastructure assets in selected regions over the past four years by source of evidence (real)



Our review of the approaches by the sectoral economic regulators and independent experts in our report concludes that a variety of approaches are taken to estimating the risk free rate, the equity risk premium and the total market return. This is consistent with these issues being extensively debated by practitioners, academics and economic regulators.

Notwithstanding the variety of approach adopted in arriving at these decisions, evidence has shown that the total market returns observed in the international market are mostly higher than the range quoted in the Consultation Paper: all but two of the data points we have considered supported a total market return above the 5.1 – 5.6% range in the Consultation Paper. In addition, the two data points below the Consultation Paper range appear to reflect particular characteristics of the approaches adopted in those cases and appear to have been balanced by relatively high equity betas determined by the regulators, bringing the cost of equity to a comparable range with the other jurisdictions.

2. Introduction

In December 2017, the Civil Aviation Authority (CAA) published a Consultation Paper on the economic regulation of capacity expansion at Heathrow Airport (HAL).[4] The paper by the CAA introduced an "early and preliminary range" of 2.8% to 4.6% for HAL's Weighted Average Cost of Capital (WACC)[5] for the capacity expansion. This range is based on an estimated cost of equity range of 4.9% to 7.1% and the assumption that the total market return is in the range of 5.1% to 5.6% (in real terms). The CAA recognises that these assumptions have the potential to have a significant impact on their estimates of HAL's WACC and therefore it is important to consider a wide range of evidence before reaching final views on these matters.

As a contribution to the evidence base available to CAA about whether the preliminary estimate of the underlying cost of equity for HAL's capacity expansion is sufficient to attract the necessary equity investment in the international capital markets, HAL has engaged EY to undertake a review of the total market returns in selected international markets over the last four years, inferred by the allowed cost of equity on regulated infrastructure assets, as well as observed cost of equity on unregulated infrastructure assets.

Specifically, we have been asked to firstly gather available evidence on the cost of equity and the underlying total market returns determined by economic regulators for the following regulated European airports, selected on the basis of their regulatory framework and the availability of information in the public domain:

- Belgium – Brussels Airport
- Demark – Copenhagen Airport
- France – Charles de Gaulle Airport (Paris)
- Germany – Frankfurt Airport
- Ireland – Dublin Airport
- Italy – Leonardo da Vinci airport (Rome)

Secondly, we were asked to undertake a similar review of regulatory precedents from the energy sector in selected international jurisdictions as a comparison, based on publicly available information, for their respective current regulatory periods. These jurisdictions include:

- European countries:
  - Denmark – recent decisions by Danish Energy Regulatory Authority (DERA)[6];
  - Finland – recent decisions by Finnish Energy Authority (FEA)[7];
  - France – recent decisions by Commission de régulation de l'énergie (CRE)[8];
  - Germany – recent decisions by the Federal Network Agency (BNetzA)[9];
  - Norway – recent decisions by Norwegian Water Resources and Energy Directorate (NVE)[10]; and
  - Sweden – recent decisions by Energimarknadsinspektionen (Ei) or Energy Markets Inspectorate[11].
- US – selected recent determinations by the Public Utilities Commission (PUC) of Texas (TX)[12] and Public Service Commission (PSC) of the New York State (NY)[13]; and
- Australia – recent determinations by the Australian Energy Regulator (AER)[14].

[4] http://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8132
[5] Vanilla WACC, which is based on the pre-tax cost of debt and the post-tax cost of equity weighted by gearing.
[6] Danish Energy Regulatory Authority; http://energitilsynet.dk/tool-menu/english/
[7] Finnish Energy Authority; https://www.energiavirasto.fi/web/energy-authority/energy-authority
[8] Commission de régulation de l'énergie; http://www.cre.fr/en
[9] Federal Grid Agency; https://www.bundesnetzagentur.de/EN/Home/home_node.html
[10] Norwegian Water Resources and Energy Directorate; https://www.nve.no/english/
[11] Energimarknadsinspektionen (Ei) or Energy Markets Inspectorate; www.ei.se
[12] Public Utilities Commission of Texas, http://www.puc.texas.gov/
[13] Public Utilities Commission of New York; http://www.dps.ny.gov/
[14] Australian Energy Regulator; https://www.aer.gov.au/

For the decisions above, we have provided a summary on the approach that the respective regulators have taken to determining the total market returns, including the amount of weight placed on short-term market evidence compared to longer-term market evidence.

In addition to regulated infrastructure assets, we were also asked to review recent Independent Export Reports[15] for empirical evidence and expert opinions on various components of the prevailing cost of equity, including the market returns underpinning their estimation and the approach to determining the appropriate values for these components for unregulated assets. Whilst this evidence is concentrated in the Australian market due to the legislative requirements in Australia, some of the independent expert reports involve analysis of overseas markets when the proposed transaction involves operations or assets in those markets. This evidence is of particular interest as the independent experts estimate the cost of equity for the purpose of valuing certain businesses and investment opportunities (transactions) using financial theory, market data, market knowledge and other available information and the reports are published in accordance with the legislative requirements.

The expert reports provide a credible source of market evidence because they are prepared by qualified and accredited independent experts, working within an explicit regime of regulation, comprising both formal statutory rules and less formal guidelines, which require that the expert be accountable for the results of their work.

The rest of this report is structured as followed:

- Section 3 discusses the allowed cost of equity and implied total market returns determined by international economic regulators and their approaches to determining the appropriate total market returns;
- Section 4 gathers market evidence of prevailing cost of equity and total market returns from recent independent expert reports; and
- Section 5 summarises our findings from Section 3 and Section 4.

[15] The Corporations Act in Australia and the Australian Stock Exchange (ASX) Listing Rules specify the circumstances where an independent expert report must be issued to those shareholders who are affected by certain types of transactions (e.g. takeover bids, mergers/schemes, related party transactions, buy-backs, acquisitions / divestments, and others).

3. Allowed cost of equity and implied total market returns by selected international economic regulators

This section discusses the allowed cost of equity and implied total market returns by sectoral economic regulators and their approaches to determining the appropriate total market returns. We focus on current decisions made for selected regulated airports in Belgium, Denmark, France, Germany, Ireland and Italy, as well as current decisions made for the electricity and gas networks in Australia, Denmark, Finland, France, Germany, Norway, Sweden and the US.

For the purpose of comparing the total market returns that underlie the regulators' decisions on the allowed cost of equity in different jurisdictions, we have converted all the nominal values into real terms using the regulators' stated expected rate of inflation where this information is available. For decisions that do not specify an expected inflation, we have relied on forecast inflations for the respective jurisdictions, published by Oxford Economics around the time when the decisions were made, for the periods where the decisions were applied to.

3.1 Evidence of other regulated European airports

In this subsection we present available evidence on the risk-free rate (RFR) and equity risk premium (ERP) determined, and in turn the total market returns (TMR) inferred, by the relevant regulatory authorities for a selected number of European airports subject to economic regulation.

Table 2: Total market returns by selected airport regulators in Europe

Airport	Regulator	Date of decision	Regulatory period	Real RFR	ERP	Real TMR	Equity beta
Brussels Airport	Regulatory Service for Railway Transport and for Brussels Airport Operations[16]	Nov-15	2016-21	0.00%	6.71%	6.71%	0.99
Copenhagen Airport	TBST[17]	2014	2015-16	0.90%	6.50%	7.40%	0.92
Charles de Gaulle Airport (Paris)	French Government	Jan-15	2016-20	1.31%	6.00%	7.31%	0.82[18]
Frankfurt Airport	LBA[19]	Oct-16	2017	0.15%	6.20%	6.35%	0.93
Dublin Airport	CAR[20]	Oct-14	2015-19	1.50%	5.00%	6.50%	1.20
Aeroporti di Roma (ADR)	ENAC[21]	Nov-16	2017-21	1.32%	5.00%	6.32%	1.41

[16] http://www.regul.be/en
[17] Danish Transport, Construction and Housing Authority; https://www.trafikstyrelsen.dk/EN.aspx
[18] Calculated based on unlevered asset beta of 0.58 and gearing of 28.9%.
[19] Federal Office of Civil Aviation Luftfahrt Bundesamt; http://www.lba.de/EN/Home/home_node.html
[20] Commission for Aviation Regulation; https://www.aviationreg.ie/
[21] the Italian Civil Aviation Authority; https://www.enac.gov.it/Home/

As shown in the table above, the underlying total market returns the other airport regulators have determined for other regulated airports in Europe are in the range of 6.3% to 7.4% in real terms. In addition, for decisions with relatively lower total market returns, e.g. for Frankfurt Airport, Dublin Airport, and ADR, the equity betas tend to be on the upper end of the observed range, compensating for the relatively lower total market returns in the cost of equity calculation.

The table below summarises the basis on which the airport regulators determined the risk-free rates and the equity risk premium, where such information is available.

Table 3: Basis for determining the risk free rates and equity risk premium by selected airport regulators in Europe

Airport	Regulator	Risk-free rate	Equity risk premium
Brussels Airport	Regulatory Service for Railway Transport and for Brussels Airport Operations	Risk free rate is based on the historical average yield of a ten-year Belgian government bond over the preceding ten years	Damodaran (July 2015)[22]
Charles de Gaulle Airport (Paris)	French government	Based on the five-year historical average yield on ten-year French sovereign bonds	Based on a five-year average using the Damodaran and FactSet consensus
Dublin Airport	CAR	Based on evidence on current spot yields (approximately 0% real) on 10 year government bonds (for Germany, Ireland and Finland) and recent regulatory precedent by other regulators (up to 2% real). CAR chose a point estimate (of 1.5%), which allowed for headroom over prevailing market rates.	Based on long-term historical data from Dimson, Marsh and Staunton

Whilst publicly available information is limited on how the relevant authorities determine the risk free rate, the equity risk premium or the total market returns, based on the approaches by the above three regulators we can see that the risk free rate is generally determined with considerations to the historical government bond yields, while the equity risk premium is estimated with regard to long term historical evidence.

When determining the risk free rate, both the Regulatory Service for Railway Transport and for Brussels Airport Operations and the French Government used historical average of long term government bond yields. In the case of Dublin Airport, the CAR considered the real yields on Irish, German and Finnish Government bonds, then however, determined a real risk free rate of 1.5% when the real yields on German government bonds[23] were close to 0% at the time. The CAR stated that, while the market evidence continued to suggest a lower value might be appropriate, it took into considerations other regulatory precedents including determinations by the Irish Commission for Energy Regulation and other regulators in the utilities sector when determining a range that it considered appropriate.[24] In addition, when determining the point estimate of a real risk free rate, the CAR considered that 1.5%, combined with their proposed equity risk premium of 5%, would give an implied total market return of 6.5% that was consistent with their 2011 Determination.[25] This implies that the CAR could be of the view that the total market risk premium is relatively stable over time, notwithstanding the significant downward movement of the real risk free rate since their 2011 Determination.

[22] See https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2630871
[23] The CAR cited current yields on German government bonds as an indicator of the risk free rate. See https://www.aviationreg.ie/_fileupload/2014final/2014%20Final%20Determination.pdf
[24] See https://www.aviationreg.ie/_fileupload/2014-05-29%20Draft%20Determination%20Airport%20Charges.pdf
[25] See https://www.aviationreg.ie/_fileupload/2014final/2014%20Final%20Determination.pdf, p87

In relation to the equity risk premium, the Regulatory Service for Railway Transport and for Brussels Airport Operations and the French Government used Damodaran as a source of evidence to inform their decisions, whilst the CAR used long term historical data from Dimson, Marsh and Staunton. According to Damodaran (2017)[26], the decision to use either long-term historical data or current implied values when determining the appropriate risk premium depends on the purpose of the analysis, as well as assumptions about market efficiency. Damodaran is of the view that, for the purpose of determining a cost of capital and the long-term investments of the company, "*it may be more prudent to build in a long-term average (historical or implied) premium*".

[26] Damodaran, Aswath, Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2017 Edition (March 27, 2017). Available at SSRN: https://ssrn.com/abstract=2947861

3.2 Decisions by selected international energy regulators

To provide a comparative view of the total market returns by other sectoral economic regulators internationally, this subsection provides a review of the decisions made by selected international energy regulators.

The follow table summarises the regulatory decisions on the risk-free rate, the equity risk premium, the implied total market returns and the equity beta by country.

Table 4: Summary of selected regulatory decisions by selected international energy regulators

Country	Sector	Regulator	Date of decision	Regulatory period	Real RFR	ERP	Real TMR	Equity Beta
Australia	Gas	AER	Nov-17	2017-22	0.02%	6.50%	6.52%	0.7
Australia	Electricity	AER	Apr-17	2017-22	0.07%	6.50%	6.57%	0.7
Australia	Electricity	AER	May-16	2016-20	0.16%	6.50%	6.66%	0.7
Australia	Electricity	AER	Oct-15	2015-20	0.46%	6.50%	6.96%	0.7
Australia	Gas	AER	Jun-15	2015-20	-0.02%	6.50%	6.48%	0.7
Australia	Electricity	AER	Apr-15	2014-19	0.17%	6.50%	6.67%	0.7
Denmark	Gas	DERA	Sep-17	2018-21	-1.50%	5.50%	4.00%	1.33
Finland	Electricity	FEA	Nov-15	2016-23	0.87%	5.00%	5.87%	0.72 / 0.83[27]
Finland	Gas	FEA	Nov-15	2016-23	0.87%	5.00%	5.87%	0.69
France	Gas	CRE	Dec-16	2017-21	1.60%	5.00%	6.60%	0.75
France	Electricity	CRE	Nov-16	2017-21	1.60%	5.00%	6.60%	0.34 / 0.73[28]
France	Gas	CRE	Mar-16	2016-20	1.60%	5.00%	6.60%	0.66
Germany	Electricity & gas	BNetzA	Oct-16	2019-23 & 2018-22	1.03%	3.80%	4.83%	0.83
Norway	Electricity	NVE	Nov-17	2018	2.50%	5.00%	7.50%	0.88
Sweden	Electricity	Ei	Jun-15	2016-19	1.98%	5.00%	6.98%	0.72
Sweden	Gas	Ei	Oct-14	2015-18	2.10%	5.00%	7.10%	0.76
US	Electricity	PUC-TX	Dec-17	2017-19	0.71%	7.01%	7.72%	0.69
US	Gas	PSC-NY	Apr-17	NA[29]	-0.12%	8.79%	8.67%	0.75
US	Electricity	PUC-TX	Dec-15	NA	1.27%	6.20%	7.47%	0.76
US	Electricity & gas	PSC-NY	Sep-15	2017	0.34%	8.72%	9.06%	0.75

[27] 0.83 for electricity distribution and 0.72 for electricity transmission.
[28] 0.34 for electricity distribution (assuming gearing of 0%) and 0.73 for electricity transmission.
[29] The specific time period to which the decision applies is sometimes not specified in the decisions or Staff Testimonies.

The table shows that the real total market returns implied in recent decisions made by energy regulators were mostly above the range of 5.1% to 5.6% quoted in the Consultation Paper that underpins an "early and preliminary range" of WACC for HAL's capacity expansion scenario, with the exception of Denmark and Germany. The table also shows that the regulators are relatively consistent in their decisions over time.

In the case of Denmark, the relatively low real total market return implied by the regulator was mainly driven by the significantly low real risk free rate of -1.5% determined by the regulator. However, the low total market return was compensated by a relatively high beta value of 1.33, bringing the cost of equity back to a comparable level to other decisions.

On the other hand, the relatively low total market return implied by BNetzA in Germany was driven by the lower equity risk premium compared to other jurisdictions. The equity risk premium was determined based on the arithmetic and geometric averages of historical excess stock market returns over government bonds for a worldwide portfolio of 23 countries over the period 1900 to 2015, using data published by Dimson, Marsh and Staunton.

Below we summarise how the selected energy regulators determine the risk free rate and the equity risk premium in their recent decisions.

3.2.1 Australia

In determining the most appropriate models and evidence for estimating the cost of equity for energy network businesses, the AER considers the Sharpe-Lintner CAPM to be the most appropriate because, amongst other reasons, this approach is widely and consistently used for estimating the expected return on equity by financial market practitioners, academics, and other regulators and has well-accepted and unbiased methods for estimating its parameters.[30]

The risk free rate determined by the AER is estimated as the yield, averaged over a 20 business day period as close to the start of the price control period as possible, on Australian government securities with a ten-year term-to-maturity. According to the AER's Rate of Return Guideline (2013)[31], the AER adopted this approach because it wanted to "adopt a forward looking risk free rate that is commensurate with prevailing conditions in the market for funds at the commencement of the regulatory control period".

In the AER's Rate of Return Guideline (2013), the AER stated that the estimate of the market risk premium should be informed by a range of theoretical and empirical evidence – including historical excess returns, DGM estimates (from its preferred construction of the DGM), survey evidence of the expectations of investors and market practitioners, conditioning variables (dividend yields, credit spreads and implied volatility) and recent decisions by Australian regulators. The AER then determines the point estimate for the market risk premium based on the AER's regulatory judgement, taking into account estimates from each of those sources of evidence and considering their strengths and limitations.

The AER has consistently applied a market risk premium of 6.5% in all its recent determinations for the energy network businesses for their respective current regulatory periods.

[30] See for example https://www.aer.gov.au/system/files/AER%20-%20Final%20decision%20ActewAGL%20Distribution%20Access%20Arrangement%20-%20Attachment%203%20-%20Rate%20of%20return%20-%20May%202016.DOCX, pp44-45.
[31] https://www.aer.gov.au/system/files/AER%20Rate%20of%20return%20guideline%20-%20December%202013.pdf

3.2.2 Denmark

DERA uses a CAPM framework to estimate the allowed cost of equity for gas distribution networks and has indicated it will adopt the same approach for electricity distribution in future.[32]

The risk-free rate is estimated using a 3-month average (June-August) of a 4-year zero-coupon Danish government bond in the year before the start of the regulatory period. The use of a 4 year period was intended to match the duration of the price control period. The estimate period is set at 3 months to reduce the effect of very short-term fluctuations in the effective interest rate on government bonds.

The equity risk premium is calculated by reference to expected excess returns of the Danish stock market over Danish government bond yields with 5 years to maturity (the nearest available to the four year maturity used for estimating the risk-free rate). DERA had regard to a number of different types of evidence (historical returns, surveys and implied estimates derived from a DGM), but rather than adopting any one particular approach, DERA chose to exercise a degree of judgement taking into account each of these kinds of estimates. DERA noted that its intention was to estimate the current market risk premium as it was matched with an estimate of the current risk-free rate, implicitly recognising an inverse relationship between these two parameters.

3.2.3 Finland

FEA uses a CAPM framework for estimating the cost of equity. FEA's approach to estimating each of the CAPM parameters is largely based on an independent EY report they commissioned.[33]

The risk-free rate is set equal to the higher of an average of yields on Finnish government bonds with 10 years to maturity over:

- the April to September period in the previous year e.g. when setting the risk free rate for 2014, the six months from April to September 2013 would be relevant;
- the previous 10 years.

In this way, any significant increase in bond yields will flow through to the risk-free rate, but reductions in bond yields will only be passed through gradually.

The market risk premium is formed through judgement based on a review of evidence from historical market data, surveys and estimates implied from other methods e.g. DGM. The relationship between risk-free rate and ERP is acknowledged by FEA, but the ERP is assumed to remain constant regardless of changes in the risk free rate.

3.2.4 France

CRE uses a CAPM framework for estimating the cost of equity for all of the gas and electricity networks.

The risk free rate is estimated based on the average over the period since 2008 of the yields on French treasury bonds with maturity of 10 years.

[32] See http://energitilsynet.dk/fileadmin/Filer/0_-_Nyt_site/GAS/Afgoerelser/2017/17/Afgoerelse_om_indtaegtsrammer_for_2018-2021.pdf, p29 and following.
[33] See http://www.energiavirasto.fi/documents/10179/0/EY_kohtuullinen_tuotto_WACC_loppuraportti.pdf/65533364-df15-4c0c-96ae-ad3d8a4268eb

The market risk premium is estimated from the long term historical average for France and Europe and consideration[34] has been given to using the arithmetic average for France for the upper bound and the arithmetic average for Europe for the lower bound (both based on Dimson Marsh and Staunton data over the period 1900-2014).

3.2.5 Germany

BNetzA uses a CAPM framework for estimating the cost of equity since the introduction of incentive regulation in 2009.[35]

The risk free rate is determined as a 10 year average return of domestic fixed interest securities reported monthly by the German Bundesbank.

The market risk premium is based on historical data published by Dimson, Marsh and Staunton. Specifically, an average of the arithmetic and geometric averages of historical excess stock market returns over government bonds for a worldwide portfolio of 23 countries over the period 1900 to 2015 is used.

BNetzA's current approach would see a marked reduction in the allowed cost of equity compared to the previous period. This reduction is due to significant decreases in both the risk-free rate and the equity risk premium, suggesting that BNetzA does not consider there to be an inverse relationship between the two parameters. The BNetzA's approach also does not appear to be consistent with placing significant weight on historical data and trying to preserve a stable and predictable long-term cost of equity over the course of a macroeconomic cycle – rather the BNetzA appears to be responding to changing market conditions.

BNetzA's decision on the cost of equity for the third regulatory period (both gas and electricity) is currently being challenged by around 1,100 network businesses (most of the network businesses in Germany). The case is ongoing, with hearings commencing early in 2018.

3.2.6 Norway

The NVE has adopted the CAPM framework for estimating the cost of equity and, in practice, appears to adopt the same parameter estimates for several years i.e. the CAPM parameters are only updated from time to time.

The WACC-model that the NVE uses to calculate the cost of capital, including the cost of equity, was changed in 2013 with the aim to continue with a stable and predictable regulated cost of capital, but at the same time to a larger extent take into account the changes and fluctuations in the financial markets. The adjustments in the WACC-model were due to the unstable markets, and no clear indications that the then-current observed levels of parameters would last. The current and future needs for expanding, upgrading and renewing the electricity networks were also a backcloth during the assessment. The changes concerned the risk free rate, the market premium and the debt premium.

The NVE sets the real risk free rate equal to an estimate of the real neutral interest rate in the Norwegian economy, which it estimates to be 2.5%.

The market risk premium was based on a combination of survey evidence and historical market returns data from international markets.

[34] CRE's advisers discussed this issue in their report, but CRE itself does not include a discussion of these issues in its own documents. We assume that CRE considered the advice it received from its advisers.
[35] See Bundesnetzagentur BK4-16-160 Beschlusskammer 4, p9 for further discussion.

3.2.7 Sweden

Ei uses a CAPM framework for estimating the cost of equity. Ei does not appear to have publically explained why it prefers a CAPM approach or if it has considered alternative models such as a DGM or market-to-asset ratios (MARs). However, Ei has recently published a draft proposal for future regulation where different cost of capital methods are assessed and it proposes to continue using a CAPM approach because it is most widely used by regulators and investors, accepted by the companies and no other method appears clearly better.[36]

Ei's approach to estimating the risk-free rate is slightly different for gas and electricity networks:

- for gas, the risk-free rate is calculated as an average of forecasts of yields on Swedish government bonds with 10 years to maturity for the following four years, where the first two years of forecasts are set equal to the corresponding forecasts by the Swedish National Institute of Economic Research and the third and fourth year forecasts are set equal to an estimate of the long term equilibrium interest rate (equal to 4.0%).
- for electricity, the risk free rate is set equal to an average of forecasts of yields on Swedish government bonds with 10 years to maturity for the following four years made by the Swedish National Institute of Economic Research. (The third and fourth years are set equal to the forecasts, not an estimate of the long term equilibrium interest rate).

The approach to the market risk premium differed between gas and electricity. For the gas networks, Ei estimated the ERP based on long term historical data[37], but for the electricity networks Ei placed more weight on short term evidence.

However, both of these determinations of the cost of capital by Ei were appealed to the courts by some of the network operators (96 out of 180 electricity networks and 3 out of 7 gas networks). The court then subsequently decided on a risk-free rate that is relatively higher than Ei had concluded, based on the court's view that the risk free rate should be estimated over a longer time horizon than Ei had used. Ei had considered yields on bonds with only ten years to maturity forecasted for only four years to try and match the duration of the price control period, but the courts rejected this approach in favour of a longer period: in both the gas and electricity appeals the Administrative Court estimated the risk-free rate by averaging forecasts by the National Institute of Economic Research of the yields on Swedish government bonds with 10 years to maturity over the next 9 years.[38]

In the case of the gas networks the courts did not make any adjustment to the ERP despite increasing the risk-free rate. For the electricity networks, however, the courts accompanied a larger increase in the risk-free rate with a reduction in the ERP, arriving at the same equity risk premium as for the gas networks based on the same approach i.e. to set the ERP based on long-run historical estimates.

Based on the above, the courts appear to have placed more weight on long-term data than current data: the ERP is based on long-run historical data and the risk-free rate is based on forecasts over the medium term or the very long term.

[36] See https://www.ei.se/Documents/Publikationer/rapporter_och_pm/Rapporter%202017/Ei_R2017_07.pdf, chapter 2.5 – 2.6.
[37] The estimate of 5.0% was based on Dimson, Marsh and Staunton analysis of historical excess returns (stock market returns less bond yields) in Sweden over the long term adjusting for historical events that were unlikely to be repeated in future. In reaching its conclusion, Ei also took into account the views of market participants.
[38] For the electricity networks appeal, the Administrative Court made an adjustment to the average forecast of 10 year government bond yields over the next 9 years. This adjustment was to uplift those forecasts for the expected difference between the yield on a 10 year bond and the yield on a 30 year bond, which was estimated to be 30 basis points.

3.2.8 US

In the US, economic regulation of gas and electricity transmission and distribution networks is carried out by a combination of state regulators (typically Pubic Utilities Commissions (PUCs) or Public Service Commissions (PSCs)) and the Federal Energy Regulatory Commission (FERC)). FERC regulates the interstate transmission of electricity and natural gas, while the state regulators oversee the electricity and gas distribution companies as well as any intra state electricity and transmission activities.

The precise details of the PUCs return on equity (RoE) decisions are typically not explained in detail in their rate case determinations (i.e. most PUCs do not explain exactly what calculation inputs were used to determine the final RoEs). However, PUC Staff Testimonies to the rate case hearings are often publicly available and provide some insight into the views of the staff advising the PUC Commissioners (who ultimately make the decision).

Below we provide a summary of the approaches by New York PUC and Texas PUC based on staff testimonies from their recent cases as examples.

Texas PUC

Texas PUC staff considered three different approaches to estimating the cost of equity: CAPM, a "bond yield plus risk premium" approach and a discounted cash flow (DCF) method.

The "bond yield plus risk premium" approach is described in PUC Staff Testimony as being "based on the idea that the equity of the company is riskier than its debt, but the cost of these sources move in tandem".[39] In this approach the PUC staff use utility bond yields as the return on debt and add a risk premium calculated as the average difference between authorized returns on equity and the bond yield over the period January 2000 to December 2016 (spanning two recessions and two periods of growth). Accordingly, the risk premium used in this method is lower than the equity risk premium used in a CAPM calculation.

The three different methodologies are not all afforded equal weight by PUC staff. For example staff's testimony indicates DCF and Bond Yield Plus Risk Premium as the models of choice in setting the RoE range.[40] CAPM was calculated, but was not used in setting the RoE in the El Paso Electric (EPE) case below. Staff stated:[41]

"The CAPM results in a low cost of equity for EPE because of the current low interest rate environment. The 30-year Treasury bond yields remain low, even after the Federal Reserve started raising interest rates, and as stated earlier electric utility stocks are less risky with betas less than 1.0. When these inputs are entered into the CAPM formula, they result in a relatively low return on equity. As a result, I have not directly incorporated the results of my CAPM analysis into my overall estimate of EPE's cost of equity; rather, I have used the results only as a qualitative check on the results of my other analyses."

New York PSC

New York PSC Staff Testimony in the National Fuel Gas Distribution case indicated:[42]

- Two versions of the CAPM were applied because "prior research has revealed that the traditional CAPM model can possibly underestimate the required return when betas are less than 1.0".[43]

[39] Winker Testimony, June 23, 2017, pg. 25
[40] Winker Testimony, June 23, 2017, pg. 31 notes "I recommend a return on equity of 9.10% for EPE. I have recommended a return on equity from the top end of my constant-growth DCF range and that is slightly above my calculated bond yield plus risk premium range."
[41] Winker Testimony, June 23, 2017, pg. 31.
[42] See Staff Finance Panel Testimony, Case 16-G-0257, August 2016, p51.
[43] See Staff Finance Panel Testimony, Case 16-G-0257, August 2016, p61.

- The risk-free rate is estimated using yields on US Treasury bonds with maturities of 10 and 30 years for the most recent three month period.[44] The most recent three months were used because it provides a "realistic representation of investors' current expectations" and "*smooths out any potential short-term volatility*".[45] Ten and 30 year bonds were used as this approximates the time horizon of most investors (in the NY PSC's view).
- The Market Risk Premium is derived from Merrill Lynch's two forward-looking market returns measures: a required return and an implied return (p64) averaged over the most recent 3 months. The use of historical returns data was rejected because "*ex-post MRPs are based on the faulty premise that past performance is a valid proxy for expectations regarding future results*".[46]

Staff goes on to explain:[47]

"The CAPM should be given less preference relative to the DCF because the CAPM components are less observable and are more dependent on estimations. The inputs in the DCF model are readily observable outside of the dividend growth rates. The DCF application of fewer subjective inputs relative to the CAPM provides a more stable foundation, thus a lesser chance of error in a ROE calculation. … Staff has advocated giving the CAPM less weight in the overall ROE calculation than the DCF. This has primarily been due to the subjectivity of the MRP and fluctuations in beta. In addition, there are wide ranging inputs (growth rates, DCF inputs, historical versus future estimates for market returns, time periods for market returns, source for market returns) used in estimating the MRP, which result in large differences."

3.3 Summary of evidence by selected international economic regulators

Our review of decisions made by regulatory authorities for other selected European airports, as well as for the energy sector in selected jurisdictions, suggests that a variety of approaches are taken to estimating the risk free rate, the equity risk premium and the total market return.

Specifically, we note:

- the risk-free rate is typically estimated using historical average of local government bond yields, usually of a long maturity.
- the equity risk premium is sometimes estimated by reference to long term historical excess returns data, but some regulators place more weight on forward-looking estimates from DGMs or survey-based estimates.
- some economic regulators place more weight on short term evidence than others. Some use very short term data on the basis this provides the best indication of investors' expectations about the future.
- some regulators appear to estimate the risk-free rate and the equity risk premium in isolation, rather than trying to estimate the total market return and then deduct the risk free rate to come up with an estimate of the equity risk premium.
- some regulators appear to attempt to take a consistent approach to estimating the risk-free rate and the equity risk premium i.e. estimate them using data over a similar time period and taking into account an estimate of the relationship between these two parameters.
- the selected energy regulators do not appear to have explicitly assumed that the total market return is constant in most cases. Some jurisdictions do not appear to assume an inverse relationship between equity risk premium and risk free rate, but others do appear to assume some inverse relationship between these two parameters.

[44] See Staff Finance Panel Testimony, Case 16-G-0257, August 2016, p61. See also Prepared Testimony of Staff Finance Panel in Cases 16-E-0060 & 16-G-0061, pgs. 88-89.
[45] See Staff Finance Panel Testimony, Case 16-G-0257, August 2016, p62.
[46] See Staff Finance Panel Testimony, Case 16-G-0257, August 2016, pp65-66.
[47] See Staff Finance Panel Testimony, Case 16-G-0257, August 2016, pp68-70.

Combining the above, there does not appear to be a consensus approach among the economic regulators considered to estimating the total market return, risk-free rate or the equity risk premium. This is consistent with these issues being extensively debated by practitioners, academics and economic regulators.

Notwithstanding the variety of approach adopted by these regulators, the implied total market returns by these regulators, as discussed in Section 3.1 and 3.2, were mostly above the range quoted in the CAA's Consultation Paper, with the exception of Denmark where the real risk free rate was significantly lower (-1.5%), and Germany where the relatively low equity risk premium was derived based on an average of the arithmetic and geometric averages of historical excess stock market returns over government bonds for a worldwide portfolio of 23 countries over the period 1900 to 2015. Further, in both cases the relatively low total market returns implied by these regulators appeared to have been balanced by relatively high equity betas determined by the regulators, bringing the cost of equity to a comparable range with the other jurisdictions.

4. Market evidence of prevailing cost of equity and total market returns by independent experts

This section provides a summary of the market evidence on the prevailing cost of equity and the total market returns based on analyses by independent experts. We have reviewed selected Independent Export Reports published over the period of 1 January 2014 to 31 January 2018, for empirical evidence and expert opinions on various components of the prevailing cost of equity, including the market returns underpinning their estimation and the approach to determining the appropriate values for these components.

4.1 The roles of independent experts

The Corporations Act in Australia and the Australian Stock Exchange (ASX) Listing Rules specify the circumstances where an expert report must be issued to those shareholders who are affected by certain types of transactions (e.g. takeover bids, mergers/schemes, related party transactions, buy-backs, acquisitions / divestments, and others).

The independent expert (IE), in their expert report, provides their opinion on whether a proposed transaction is 'fair and reasonable' and / or 'in the best interests of' affected shareholders. Whilst these terms are not defined in the Corporations Act or the ASX Listing Rules, guidance on their meaning and considerations required in arriving their expert opinion is provided by Australian Securities and Investments Commission (ASIC) in Regulatory Guide 111, Content of expert reports; and guidance on the Independence of experts is set out in Regulatory Guide 112.[48]

In arriving at their expert opinion on a transaction of an infrastructure asset, the independent expert often, but not always, undertakes an independent valuation of the asset. The valuation methodology may vary depending on the nature of the transaction or asset and the availability and reliability of information. In general, we have observed that when a discounted cash flow methodology is used to value the asset, either as the primary methodology or as a cross-check on the valuation, the independent expert often forms a view on the prevailing cost of equity as part of the discount rate or weighted average cost of capital (WACC) estimation.

The expert's opinion on, and approach to estimating, the prevailing cost of equity is of interest because the independent experts seek to rely on financial theory, market data, market knowledge and other information when forming their expert opinions on the required return on investment. Moreover, the expert reports provide a credible source of information and market evidence because they are prepared by qualified and accredited independent experts, working within an explicit regime of regulation, comprising both formal statutory rules and less formal guidelines, which require that the expert be accountable for the results of their work.

Whilst the independent expert reports are specifically required under the Australian legislation, the independent experts sometimes assess equity markets in other jurisdictions when the transaction involves assets overseas or businesses that have operations overseas. In those instances, we have included their expert opinions on total market returns or market cost of equity in those jurisdictions.

[48] ASIC, Regulatory Guide 111: Content of expert reports, March 2011 and ASIC, Regulatory Guide 112: Independence of experts, March 2011. These guidelines superseded versions dated October 2007 and included some revisions to provide additional guidance on various matters.

4.2 Selection of independent expert reports

We have focused on independent expert reports that:

- were published during the period from 1 January 2014 to 31 January 2018;
- were conducted for transactions that involved infrastructure assets; and
- involved a valuation using the DCF methodology either as the primary methodology or as a cross-check on the valuation.

It should be noted that the total market return is not directly estimated by the independent experts. However, given the expert's view on the risk free rate and the market risk premium (or the equity risk premium), the expert's view on the total market returns can be inferred.

4.3 Evidence from selected independent expert reports

The following table provides a summary of the risk-free rate, the equity risk premium, and the implied total market returns determined by the independent experts for the respective countries where the company assets or operations are located.

Details of these decisions are presented in Appendix B.

Table 5 Summary of Independent Expert Reports (2014 – 2017)

Company name	Asset	Location	Report date	Real RFR	ERP	Real TMR	Equity Beta
Envestra	Gas pipeline	AUS	Mar-14	1.70%	6.00%	7.70%	0.6-0.7
Aurora	Oil & gas production	US	Apr-14	0.30%	6.00%	6.30%	1.4-1.6
Toll Group	Transport & logistics services	AUS	Apr-15	1.20%	6.00%	7.20%	1.0-1.1
Energy Developments	Energy utility & generation	AUS	Sep-15	0.33%	7.50%	7.83%	0.8-0.9
Asciano	Container terminals &ports	AUS	Sep-15	-0.20%	6.00%	5.80%	0.9-1.1
Duet Group	Energy utility & generation	AUS	Mar-17	1.50%	6.00%	7.50%	0.40-0.45
Duet Group	Energy utility & generation	US	Mar-17	0.90%	5.50%	6.40%	0.40-0.45
Berkeley Energia	Uranium production	AUS	Oct-17	0.32%	6.00-8.00%	6.32-8.32%	1.25-1.35

Below we summarise how the selected independent experts determine the risk free rate, the equity risk premium and total market returns in their reports.

4.3.1 Risk free rate

In applying the CAPM to estimate the cost of equity in the Australian market, independent experts in our selected sample, as a starting point, commonly estimate the risk free rate based on the yield on a long term (typically 10 years for Australian assets) Commonwealth Government bond observed as at the valuation date (or in the immediate period preceding it).

Some experts then make adjustments to the current yields. For example, in the assessment of the proposed acquisition of the DUET Group in 2017[49], the independent expert stated:

"…However, since the global financial crisis in 2008, Government bond yields have remained low compared to long-term averages. Combined with market evidence which indicates that bond yields and the market risk premium are strongly inversely correlated, it is important that any assessment of the risk free rate should be made with respect to the position adopted in deriving the market risk premium. As we adopt a long term view on the market risk premium (rather than spot), it is also important to do the same with the risk free rate to ensure the combination of the risk free rate and market risk premium represents an appropriate return in the current investment environment."

Another example is the assessment of the proposed acquisition of Asciano in 2015[50], for which the independent expert stated that:

"…global interest rates, including long term bond rates, are at low levels by comparison with historical norms reflecting the very substantial amounts of liquidity being pumped into many advanced economies (particularly Western Europe and the United States) to stimulate economic activity. Effective real interest rates are now low and, in some cases are negative. There is an argument that these conditions have now been present for some years and are therefore the "new normal". While there is some merit in this argument, we do not believe the current position is sustainable over the long term and, in our view, the risk is clearly towards a rise in bond yields. Indeed, the Federal Reserve in the United States has signalled that official interest rate rises are likely to occur within the reasonably near future.

Conceptually, the interest rates used to calculate the discount rate should recognise this expectation (i.e. they should be forecast for each future period) but for practical ease market practice is that a single average rate based on the current long term bond rate is generally adopted for valuation purposes. Some academics/valuation practitioners consider it to be inappropriate to add a "normal" market risk premium (e.g. 6%) to a temporarily depressed bond yield and argue that a "normalised" risk free rate should be used. This practice has become increasingly common among broker analysts…"

4.3.2 Equity risk premium / market risk premium

In our selected sample, the independent experts typically apply a value for the equity risk premium that is consistent over time, with 6% being the minimum and most commonly applied point estimate.

Most experts in our sample estimate the risk free rate and the equity risk premium separately, with the exception of the assessment of the proposed funding transaction of an asset (2017)[51], where the independent expert derived the equity risk premium on the basis of capital weighted average return of all members of the S&P 200 Index deducting the risk free rate, which is dependent on the 10-year government bond rates.

The experts appear to attempt to take a consistent approach to estimating the risk free rate and the equity risk premium, applying a long term view in setting these parameters.

[49] See https://www.asx.com.au/asxpdf/20170308/pdf/43gn81yhwywqg1.pdf
[50] See http://member.afraccess.com/media?id=CMN://3A430737&filename=20150930/AIO_01667106.pdf
[51] See https://www.berkeleyenergia.com/wp-content/uploads/2017/10/171026-Notice-of-AGM-2017-Final_ASX.pdf

In the assessment of the proposed acquisition of Asciano in 2015, the independent expert stated that:

"There is no generally accepted approach to estimating a forward looking market risk premium and therefore the historical premium is used as the best available proxy measure. The premium earned historically by equity investments is usually calculated over a time period of many years, typically at least 30 years. This long time frame is used on the basis that short term numbers are highly volatile and that a long term average return would be a fair indication of what most investors would expect to earn in the future from an investment in equities with a 5-10 year time frame."

4.3.3 Other adjustments

Most independent experts in our sample do not subscribe to a mechanistic approach in their application of the CAPM to estimate the cost of equity and have made adjustments to the calculated weighted average cost of capital or cost of equity to arrive at the discount rate they apply. For example, in the assessment of the proposed acquisition of Asciano in 2015, the independent exper made adjustments to the calculated WACC range after reflecting on a broader range of matters, including the Gordon Growth Model[52], anecdotal information of equity investors repricing risk, the relatively low global interest rates, and brokers' reports. Specifically, it stated that:

"…anecdotal information suggests that equity investors have repriced risk since the global financial crisis and that acquirers are pricing offers on the basis of hurdle rates above those implied by theoretical models. However, this has yet to be translated into the measures of market risk premium (at least based on longer term historical data)…"

It also stated that,

"…global interest rates, including long term bond rates, are at low levels by comparison with historical norms reflecting the very substantial amounts of liquidity being pumped into many advanced economies (particularly Western Europe and the United States) to stimulate economic activity. Effective real interest rates are now low and, in some cases are negative.

There is an argument that these conditions have now been present for some years and are therefore the "new normal". While there is some merit in this argument, we do not believe the current position is sustainable over the long term and, in our view, the risk is clearly towards a rise in bond yields. Indeed, the Federal Reserve in the United States has signalled that official interest rate rises are likely to occur within the reasonably near future.

Conceptually, the interest rates used to calculate the discount rate should recognise this expectation (i.e. they should be forecast for each future period) but for practical ease market practice is that a single average rate based on the current long term bond rate is generally adopted for valuation purposes. Some academics/valuation practitioners consider it to be inappropriate to add a "normal" market risk premium (e.g. 6%) to a temporarily depressed bond yield and argue that a "normalised" risk free rate should be used. This practice has become increasingly common among broker analysts…"

[52] Under the Gordon Growth Model, the implied cost of equity is calculated as the current forecast yield plus the expected long term growth rate (i.e. Re = (Dividend (t+1)/Price + g, where Re is the cost of equity capital and g is the perpetual growth rate).

5. Summary of evidence

This report has presented the risk free rate, equity risk premium and the total market returns determined, or inferred, by economic regulators in a variety of jurisdictions. To assess how these various international estimates might compare to the parameters quoted in the CAA's Consultation Paper, the following factors need to be considered (in no particular order):

- differences in the timing of when decisions were made, meaning they are not all based on the same market information;
- differences in the regulatory regimes and the objectives and duties of the economic regulators;
- differences in the ownership structures of the regulated entities e.g. some are publically owned and others are privately owned;
- differences in expected inflation and the way that inflation is measured; and
- differences in country specific risks or expected market returns e.g. historical total market return and equity risk premium data shows that different countries in our sample have historically had different rates of return, which may have impacted on the respective regulators' estimates of market parameters.

Making adjustments for some of the factors above would require making assumptions about perfect capital markets (e.g. that there is no home bias in investor preferences, no differences in country risk and that there are no cross-border transaction costs or other market frictions, such that the expected rate of return in each jurisdiction is the same) which have been the subject of debate in the academic literature.

Nevertheless, as a contribution to the evidence base available to CAA about whether the preliminary estimate of the underlying cost of equity for HAL's capacity expansion is sufficient to attract the necessary equity investment on international capital markets, we have undertaken a review of the total market returns observed in selected international markets over the last four years and how they compare to the total market returns quoted in CAA's report for the UK market.

The following table provides a summary of the evidence.

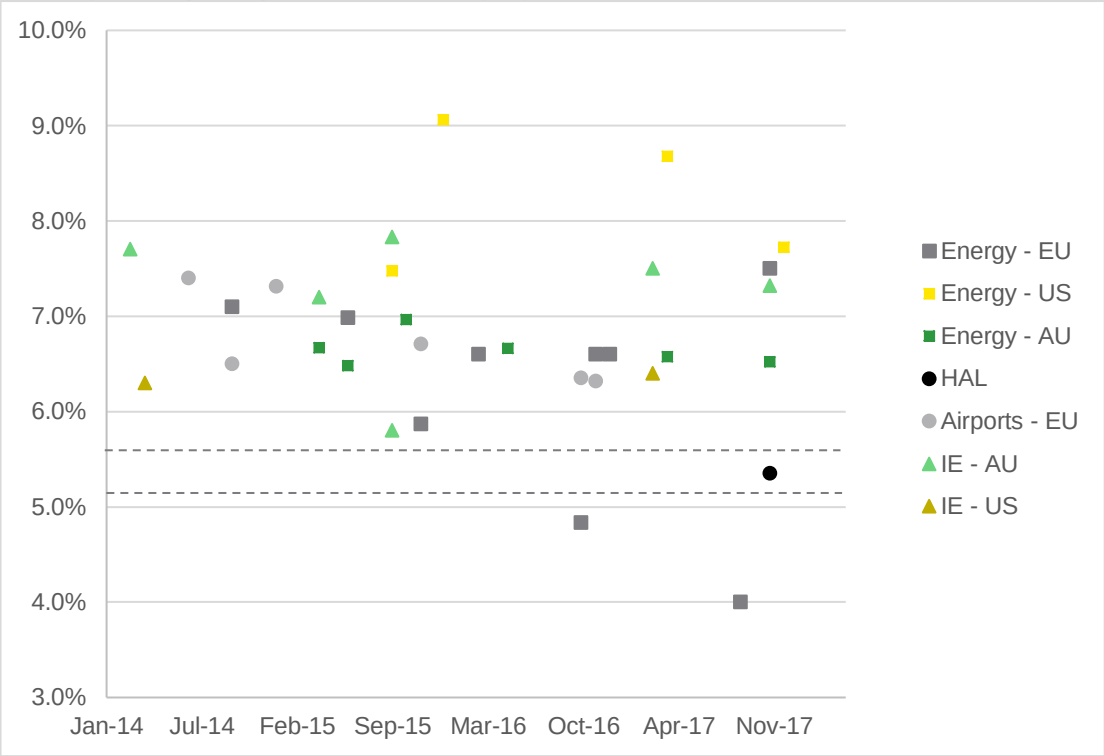
Table 6: Allowed and estimated total market returns for selected infrastructure assets in selected regions over the past four years by source of evidence (real)

Source of evidence	Region[53]	Real TMR range
Regulatory precedents – energy	Australia	6.48% - 6.96%
Regulatory precedents – energy	Norway & Sweden	6.98% - 7.50%
Regulatory precedents – energy	Other EU (Denmark, Finland, France, Germany)	4.00% - 6.60%
Regulatory precedents – energy	United States	7.47% - 9.06%
Regulatory precedents – airports	EU (Belgium, Denmark, France, Germany, Ireland, Italy)	6.32% - 7.40%
Independent expert reports	Australia	5.80% - 7.70%
Independent expert reports	United States	6.30% - 6.40%

[53] The regions are grouped in accordance with HAL's request.

The following chart combines the evidence we observed on total market returns implied in decisions made by the regulatory authorities for the airports as discussed in Section 3.1, by the energy regulators from different regions as discussed in Section 3.2, by the independent experts as discussion in Section 4, and how they compare to the range of 5.1% to 5.6% quoted in the CAA's Consultation Paper that underpins an "early and preliminary range" of WACC for HAL's capacity expansion scenario.

Figure 2: Allowed and estimated total market returns for selected infrastructure assets in selected regions over the past four years by source of evidence (real)



It shows that the total market returns quoted in the CAA's Consultation Paper are sitting towards the lower end of the evidence observed in the international markets, with the exception of two regulatory decisions – one by BNetzA in October 2016 and the other by the DERA in September 2017. The reasons why the implied total market returns are relatively low in these two decisions are explained in Section 3 of this report.

In summary, our review of the total market returns observed in selected international markets in recent years indicates that, while varying approaches and sources of evidence were considered by sectoral regulators and independent experts when determining the appropriate risk free rate, equity risk premium, and in turn the implied total market return, evidence has shown that the total market returns observed in the international market are mostly higher than the range quoted in the Consultation Paper.

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