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Implications of Observed Market-to-Asset Ratios for Cost of Equity at RIIO-T2

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Overview

National Grid (NG) commissioned NERA Economic Consulting (NERA) to consider the evidence on market-to-asset ratios (MARs) for National Grid and listed UK water companies and the implications for the cost of equity for RIIO-T2. In this short report, we also respond to recent publications on this topic, specifically a report by PwC, commissioned by Ofwat which considered the implications of water companies' MARs for the cost of equity at PR19 (2020-2025).[1]

Our analysis shows that it is necessary to make sizeable and uncertain adjustments, e.g. for substantive US non-regulated assets in the case of NG, to derive adjusted MARs relevant to UK regulated network businesses. For example, we show that the relevant MAR for NG's UK network business lies in the range of 0.35 to 1.46, which demonstrates the implausibility of drawing on MAR evidence for NG to inform investors' expected cost of equity. More generally, we find that MARs for both NG and listed UK water networks, once correctly adjusted for non-regulated activities, outperformance opportunities and other factors, are not clearly different from 1, providing no evidence that allowed returns are higher than investors' cost of equity.

In theory, market-to-asset ratios show the relationship between allowed rate of return and investors' expected cost of capital

Market-to asset ratios measure the ratio of the market value (MV) of the regulated business to the value of the regulated asset base (RAB)[2], as shown in Equation 1.

$$(1) \quad MAR = \frac{MV \ of \ regulated \ bussiness \, (debt + equity)}{RAB}$$

Under certain assumptions, Equation 1 can be re-written to express the MAR as showing a direct relationship between the regulatory allowed rate of return (AROR) and investors' expected cost of capital (WACC). Finance theory tells us that the market value of the regulated business is equal to the net present value of future cash-flows of the regulated business, discounted at the cost of capital. Assuming the company will perform in line with the regulatory assumptions (e.g. there is no outperformance) and assuming no growth in the RAB, the expected future cash flows for the regulated company will be constant and equal to the AROR multiplied by the RAB. Under these assumptions, the market value of the regulated business can be expressed as the present value of a perpetual stream of identical cash flows, as shown in Equation 2.

$$(2) \quad MV = \frac{AROR * RAB}{WACC}$$

Substituting the market value derived in Equation 2 back into the MAR formula in Equation 1 and rearranging terms shows that the MAR can be re-written as the ratio of AROR to WACC, as shown in Equation 3.

$$(3) \quad MAR = \frac{AROR}{WACC}$$

The MAR equation shows that assuming the allowed rate of return is equal to the investors' expected cost of capital, and assuming that investors expect the company to perform in line with regulatory assumptions underlying the price controls, then the market value of the regulated business should be equal to the RAB and the MAR should be equal to 1.

In practice, stock market valuations of UK networks are affected by a number of factors unrelated to the cost of capital

In practice, stock market valuations of listed UK networks are driven by a number of factors unrelated to the cost of capital, including for example:

- **Non-regulated/non-UK activities,** which can form a substantial portion of the overall market value of the company, as is the case for National Grid where non-regulated / non-UK activities amount to around half of the company's overall market value (as we discuss in more detail below).

- **Outperformance of regulatory assumptions** other than the cost of equity**,** e.g. outperformance on costs under the totex incentive mechanism.

- **Real RAB growth**, which accentuates the impact of outperformance on the observed MAR premium.

- **Market sentiment,** general market volatility as well as volatility in individual stock prices, e.g. related to take-over rumours which drive up prices.

The impact of outperformance and RAB growth on the observed MAR premium is illustrated in Figure 1 below. For example, Figure 1 shows that outperformance on costs leading to an additional 1 per cent of return on regulated equity (RORE), and 0 per cent RAB growth in perpetuity are consistent with a MAR premium of around

10 per cent, while the same 1 per cent RORE outperformance and a 2 per cent real RAB growth are consistent with a MAR premium of around 20 per cent.

Figure 1. **RORE outperformance and RAB growth are substantial drivers of MAR premia for UK networks**
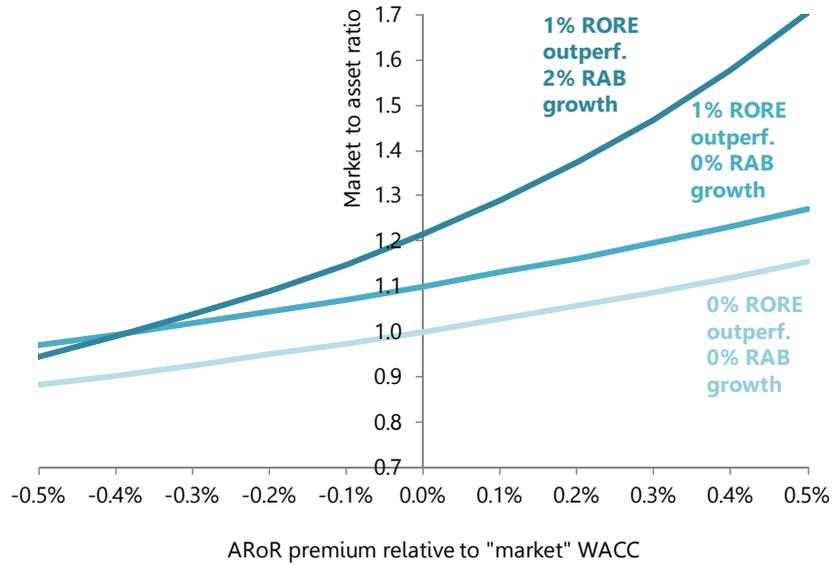
Source: NERA illustration assuming AROR=3.74% and 62.5% gearing[3]

The MARs calculated from raw stock market data therefore must be adjusted for all the relevant factors which drive market valuations but are unrelated to the cost of capital, before using the evidence from MARs to assess the relationship between the allowed rate of return and investors' cost of capital for UK utilities.

Unadjusted MARs have been around 2.2 for NG and around 1.3 for water companies since the start of their current price controls, but before relevant adjustments

We calculate raw MARs for National Grid and listed UK water companies (United Utilities and Severn Trent) since the start of RIIO-T1/GD1 and PR14 respectively, as shown in Figure 2 below.

Figure 2. **Raw MAR for NG has been around 2.2 since the start of RIIO-T1/GD1 and around 1.3 for water companies since the start of PR14**
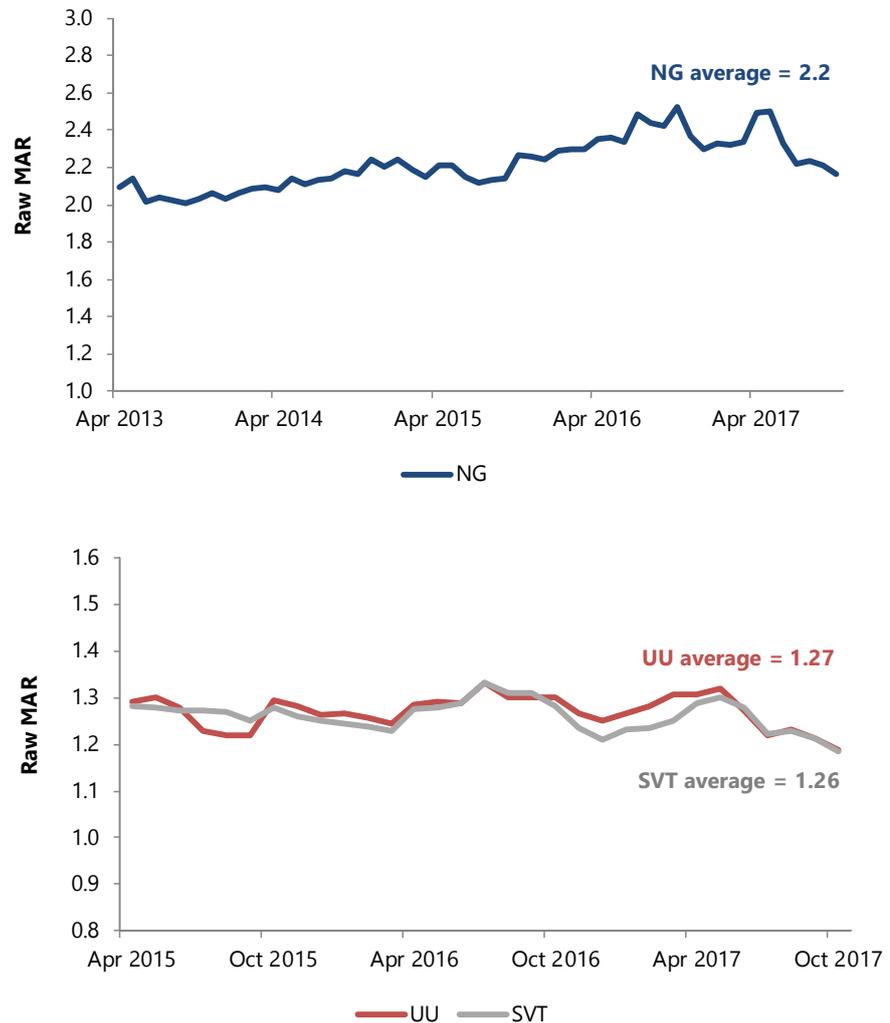
Source: NERA calculations based on Bloomberg, NG, Ofwat and ONS data
Note: We calculate raw MARs as enterprise value for each of the companies (as reported by Bloomberg), divided by the regulatory asset base for the UK regulated business. For NG, we take the value of the RAB for UK T&D activities as per NG published annual Factsheets (available at: http://investors.nationalgrid.com/news-and-reports/factsheets/2017). For water companies, we use the Ofwat annual updates of the RAB (available at: https://www.ofwat.gov.uk/publications/regulatory-capital-value-updates/)

As shown in Figure 2, the raw MAR for NG has been around 2.2 the since start of RIIO-T1/GD1. The relatively large raw MAR for NG is driven by the fact that around half of NG's market value relates to non-UK regulated activities, which are not reflected in the denominator, the UK RAB. The raw MAR for water companies has been around 1.3 since the start of PR14, but similarly to NG, this is before any adjustments for non-regulated activities and outperformance.

The MAR from raw stock market data must therefore be adjusted to remove the effect of factors which are unrelated to the cost of capital to calculate an adjusted

MAR for the UK regulated business, which is the relevant measure for assessing the relationship between the allowed rate of return and investors' cost of capital, as we discuss in the next section.

Adjustments to MARs for NG are subject to substantial uncertainty due to large share of non-regulated/non-UK businesses, but consistent with an adjusted MAR of 1 for UK T&D business

The enterprise value of NG is driven by a number of factors which are unrelated to the cost of capital for UK regulated networks and which need to be removed from the raw MAR estimates to calculate an adjusted MAR for NG's UK T&D business. These factors include:

- **US regulated businesses**: The NG enterprise value includes the company's assets and operations in the United States, which include electricity transmission and distribution facilities, as well as gas distribution networks.[4]

- **Non-regulated activities**: The NG enterprise value also includes the impact of the company's non-regulated activities, such as interconnectors, LNG operations, UK gas metering, UK property management, and US non-regulated businesses.[5]

- **Outperformance for UK T&D businesses**: Expected outperformance of regulatory assumptions, such as totex and incentives,, represents an additional source of shareholder return, which is unrelated to the cost of equity.

The value of the adjustments for these factors is inherently uncertain, which represents one of the key practical difficulties with estimating MARs for the purpose of gauging investor expectations of the cost of capital/equity. Nevertheless, to assess the likely value impact of the above adjustments on NG's valuation and MAR, we collected estimates for each of the above factors from independent equity analyst reports, as summarised in Figure 3 below.

We use analyst valuations for each of the factors reported in £m terms and express these values as a percentage of the UK T&D RAB as reported by each analyst for comparability with the calculated MAR premium in Figure 2. We present separate estimates for the value of the adjustments for the period prior to, and post, NG's partial sale of its gas distribution business in March 2017. The partial sale of its gas distribution businesses resulted in a reduction of the UK T&D RAB and in turn increased the estimates of the value of the adjustments (all else equal).

Figure 3. **Total value of adjustments based on analyst estimates (75 to 148 per cent pre-GDN sale and 139 to 196 per cent post-GDN sale) more than explains the observed RAB premium for NG**
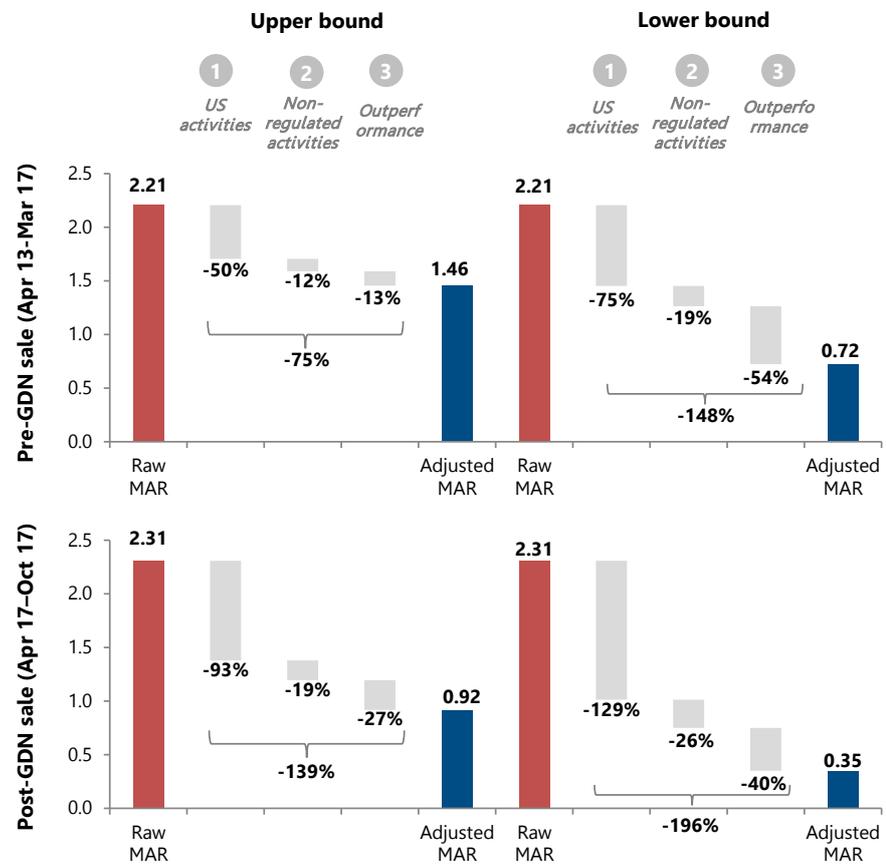
Source: Equity analyst reports, see Appendix A for detail.
Note: Ranges for adjustments for each of the factors based on min and max of all analyst estimates.

As shown in Figure 3, analysts' estimates of the value of the adjustments are subject to a large degree of uncertainty. The wide dispersion of the estimates reflects the fact that a substantial portion of NG's market value is related to its US and non-regulated activities (around half post NG's GDN sale). As a result, even a small difference in the value of these activities will result in a large difference in the estimated adjustment, which is expressed as a percentage of the UK T&D RAB and which reflects only around half of NG's total business. Figure 3 shows that the adjusted MAR for NG's UK T&D business since the start of RIIO-T1/GD1 lies in a very wide range between 0.35 and 1.46, which does not allow us to draw any reasonable inferences regarding the cost of equity. This highlights one of the key issues with undertaking MAR analysis for companies like NG, which derive a substantial portion of earnings from activities which are unrelated to the regulated business for which the MAR is being calculated, resulting in substantial uncertainty around the value of the adjusted MAR.

Nevertheless, Figure 3 shows that the value of the adjustments when taken together fully explains the observed RAB premium for NG. For example, the

calculated average raw MAR of 2.21, that is a MAR premium of 121 per cent, observed prior to the GDN sale is fully explained by the values for the required adjustments, which lie in the range between 75 and 148 per cent. Taking into account these adjustments, the NG adjusted MAR lies in the range 0.72 to 1.46. Over the period since the GDN sale, we observe that the analyst estimates of the adjustments (139 to 196 per cent) lie above the observed premium of 131 per cent, implying an adjusted MAR of less than 1.

In summary, we conclude that MAR evidence is not a reliable method for backing out the cost of equity for NG's UK T&D business, given the magnitude and variation of the required adjustments to take into account NG's non-UK regulated activities. Nevertheless, we find there is no evidence that the adjusted MAR for NG's UK T&D businesses is greater than 1 and therefore that the allowed return on equity differs from the investors' expected cost of equity.

Similarly to NG, value of adjustments for UK water companies can explain their observed MAR premium in full

Similarly to NG, the enterprise value of water companies is driven by a number of factors which are unrelated to the cost of capital and which need to be removed from the raw MAR estimates to calculate an adjusted MAR for the wholesale business (for which the water RAB is measured). These factors include both non-regulated activities as well as out or underperformance of regulatory assumptions, as for NG. There are also two further material factors that we consider for water companies:

- **Non-wholesale regulated activities**: In PR14, Ofwat introduced separate wholesale and retail controls, with the RAB going forward only relating to wholesale controls. As a result, the value of all other non-wholesale regulated activities[6] needs to be removed to arrive at a market value for the wholesale regulated business only, which is relevant for making comparisons to the wholesale RAB.

- **Pension deficit**: Another important factor affecting water companies' market valuations is the value of any pension deficit/surplus. Ofwat allows companies to recover 50 per cent of the assumed pension deficit in 2009 over a 10-15 year period, with the remaining pension deficit costs borne by shareholders.[7] The value of any residual deficit/surplus represents an additional loss/revenue for shareholders, unrelated to the cost of capital, which we need to adjust for.

Similarly to our analysis for NG, we collected estimates of the value of the adjustments from independent equity analyst reports, as summarised in Figure 4 below.[8]

Figure 4. **Total value of adjustments based on analyst estimates (21 to 37 per cent for SVT and 18 to 31 per cent for UU) more than explains the observed RAB premium for water companies**
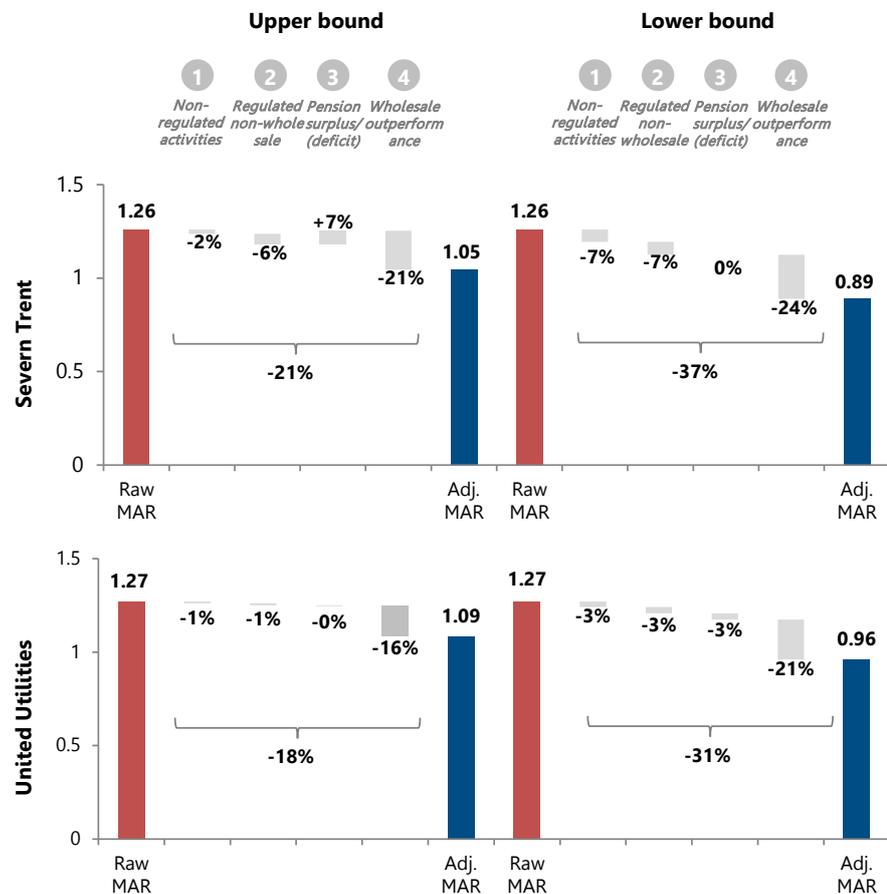
Source: Equity analyst reports, see Appendix B for detail.
Note: Ranges for adjustments for each of the factors based on min and max of all analyst estimates.

As can be seen from Figure 4, the analyst estimates of the value of the adjustments are uncertain, albeit to a lesser extent than NG, given the smaller share of non-UK regulated activities for water companies in overall market value compared to NG. Similarly to NG, we find that the sum of all the adjustments (21 to 37 per cent for SVT and 18 to 31 per cent for UU) is able to explain the observed RAB premium of 26 and 27 per cent for SVT and UU respectively.

As with NG, we conclude there is no evidence that the adjusted MAR for UK water wholesale businesses is greater than 1 and therefore that the allowed return on equity differs from the investors' expected cost of equity.

PwC's MAR analysis fails to adjust for key factors of water companies' market valuations that can fully explain the observed RAB premium

In its recent report for Ofwat, PwC estimated MARs for listed UK water companies (Severn Trent and United Utilities) to infer investor views of the cost of equity for the water sector at PR19.[9]

Specifically, PwC estimated a raw MAR of 1.24 for UU and 1.27 for SVT and adjusted it downwards by 0.14 for UU and 0.15 SVT, to remove the effect of expected outperformance on the companies' market valuations. PwC then assumed that the residual observed RAB premium of 10 and 12 per cent reflects cost of equity outperformance (i.e. that the allowed return on equity is set above investors' expected cost of equity) and used this to derive an implied nominal cost of equity of 6.7 per cent to 6.8 per cent (3.8 per cent to 3.9 per cent real) for the water sector, and an implied nominal total market return (TMR) of 7.6 per cent to 8.1 per cent (4.7 per cent to 5.2 per cent real).[10, 11]

As we explain above, once the raw MAR for water companies is adjusted to take into account all the relevant factors that explain water company valuations (see Figure 4), we find no evidence to conclude that the adjusted MAR for the UK water wholesale businesses is above 1 and therefore that the allowed return on equity exceeds investors' expected cost of equity.

By contrast, PwC's analysis only makes a single adjustment to the observed RAB premium to account for wholesale outperformance of 14 and 15 per cent for UU and SVT respectively. PwC fails to take into account the other adjustments for non-regulated activities, non-wholesale regulated activities as well as pension deficits which explain part of PwC's residual RAB premium. In addition, PwC also fails to take into account the substantial uncertainty around its estimate of the value of future expected outperformance, which also appears understated compared to analysts' estimates (as shown in Figure 4).

PwC's calculations include two material errors – correcting for these but retaining PwC's other assumptions implies a TMR of between 6.4 and 6.9 per cent in real terms

As discussed above, we consider that there is no evidence that the adjusted MAR for the UK water wholesale businesses is greater than 1 and therefore that the allowed return on equity differs from the investors' expected cost of equity.

Notwithstanding this conclusion, we also note that PwC made two errors in calculating the implied cost of equity and TMR from its adjusted MAR of around 1.1 for the two listed UK water companies:

- *PwC's calculations assume that the MAR for water companies measures the ratio of the allowed rate of return and investors' expected cost of capital in nominal terms.*[12] This is incorrect, because the MAR for UK water companies, which operate under an indexed RAB regime, reflects a ratio of AROR and WACC in real terms, as we explain in Appendix C. This error results in PwC understating its implied TMR by around 80 to 100 bps (as shown in Figure 5).

- *PwC's calculations fail to take into account the impact of real growth in the RAB on the MAR for UK water companies, implicitly assuming zero real growth in backing out the implied cost of equity and TMR.* In reality, water companies' RABs have grown in real terms over successive price reviews by around 2 per cent per annum, as shown in Appendix D. PwC's failure to

take into account future real RAB growth results in a further understatement of the TMR by 60 to 70 bps (as shown in Figure 5).

In total, correcting for PwC's errors, we calculate an implied TMR of between 6.4 and 6.9 per cent, assuming PwC's adjusted MAR of around 1.1 for the two listed UK water companies as well as PwC's assumed equity beta and risk-free rate, as shown in Figure 5.[13] (See Appendix E for the full derivation of our corrections to PwC's calculations.)

Figure 5. **PwC calculation errors lead to an understatement of the TMR by 140-170 bps**
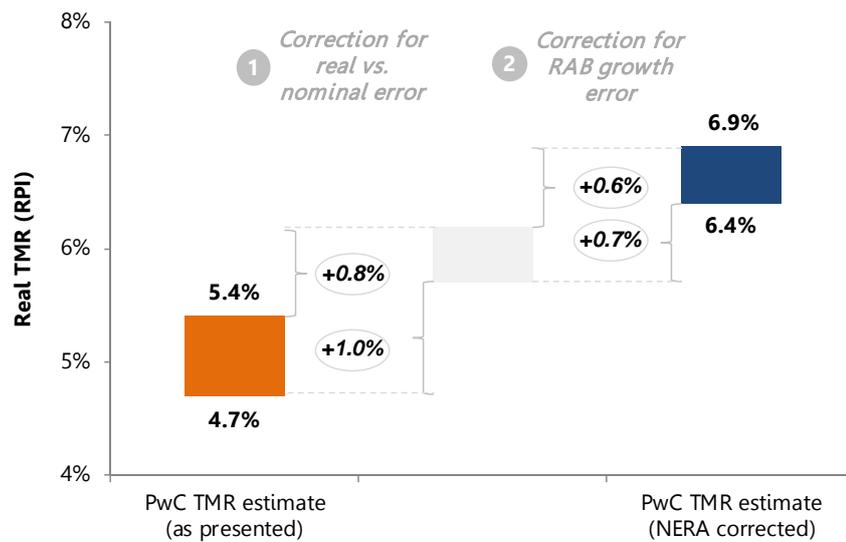
Source: NERA calculations

Conclusion

Our analysis shows that it is necessary to make sizeable and uncertain adjustments, notably in relation to NG's substantive US /non-regulated assets, to derive an adjusted MAR that relates to NG's UK regulated T&D assets only. We show that the relevant MAR for NG's UK T&D business lies in the range of 0.35 to 1.46 based on independent analyst valuations of NG's non-UK regulated activities, which demonstrates the implausibility of drawing on MAR evidence for NG to inform investors' expected cost of equity. Nevertheless, we find no evidence that the adjusted MAR for NG's UK T&D business is greater than 1.

The required adjustments are less acute in water, although still material and uncertain. For the two UK listed companies, United Utilities and SVT, we show that the MAR is approximately 1 having made adjustments for non-regulated, non-wholesale businesses, outperformance opportunities and pension deficit (surplus), suggesting that there is no evidence the investors' expected cost of equity is lower than the allowed returns for the water sector, and therefore providing no evidence that the returns are too high in energy.

Finally, we show that even if we were to accept PwC's adjusted MAR values for water companies (which we do not), correcting for errors in PwC's analysis supports a TMR of around 6.4 to 6.9 per cent in real terms, substantively above PwC's own reported evidence of 4.7 to 5.2 per cent.

Appendix A. Analyst Estimates of Adjustments to National Grid's Raw MARs

In this appendix, we summarise data we collected on analysts' estimates of the adjustments to National Grid's raw MARs. This includes the valuation of NG' total US businesses, non-regulated activities, and the expected outperformance for the UK T&D businesses. We separately report the estimates before and after the sale of the interest in NGGD, because the analysts' estimated adjustments as a percentage of the UK RAB have changed materially following the transaction.

Table A.1. **Analyst estimates of value of US businesses, non-regulated activities, outperformance as % of UK RAB (pre-NGGD transaction)**

Analyst	Report date	US activities	Non-regulated activities	UK T&D outperformance
JPMorgan	30-Jan-13	50%	15%	13%
RBC	25-Mar-13	62%	17%	23%
RBC	20-May-14	70%	18%	32%
Deutsche Bank	12-Jun-14	50%	12%	36%
RBC	11-Sep-14	66%	17%	32%
Societe Generale	09-Oct-14	59%	12%	24%
Societe Generale	12-Nov-14	59%	13%	25%
Deutsche Bank	19-Nov-14	53%	14%	54%
Edison	12-Jan-15	59%	15%	21%
Investec	10-Mar-15	54%	16%	35%
RBC	29-May-15	72%	16%	34%
JPMorgan	04-May-16	75%	16%	37%
Investec	27-May-16	74%	19%	37%
Range of estimates		**50% - 75%**	**12% - 19%**	**13% - 54%**

Source: JPMorgan (January 2013), p.14; RBC (March 2013), p.11; RBC (May 2014), p.8; Deutsche Bank (June 2014), p.6; RBC (September 2014), p.7; Societe Generale (Oct 2014), p.94; Societe Generale (November 2014), p.5; Deutsche Bank (November 2014), p.8; Edison (January 2015), p.14; Investec (March 2015), p.25; RBC (May 2015), p.9; JPMorgan (May 2016), p.7; Investec (May 2016), p.2.

Table A.2. **Analyst estimates of value of total US businesses, non-regulated activities, outperformances as % of UK RAB (post-NGGD transaction)**

Analyst	Report date	US activities	Non-regulated activities	UK T&D outperformance
JPMorgan	31-Mar-17	112%	19%	40%
Edison	28-Apr-17	93%	26%	27%
JPMorgan	18-Aug-17	129%	22%	35%
Range of estimates		**93% - 129%**	**19% - 26%**	**27% - 40%**

Source: JPMorgan (March 2017), p.4; Edison (April 2017), p.11; JPMorgan (August 2017), p.4.

Appendix B. Analyst Estimates of Adjustments to Water Companies' Raw MARs

In this appendix, we summarise data we collected on analysts' estimates of the key adjustments to water companies' raw MARs. These include: valuation of companies' non-regulated activities (Table B.1), valuation of companies' non-wholesale regulated activities (Table B.2), valuation of companies' pension deficit/surplus (Table B.3) and valuation of expected wholesale outperformance (Table B.4).

Table B.1. **Analyst estimates of value of non-regulated activities**

Analyst	Report date	SVT	UU
Societe Generale	29-Mar-16	3%	1%
RBC	05-Oct-16	4%	2%
Societe Generale	13-Oct-16	7%	3%
RBC	30-Jan-17	n/a	2%
JPMorgan	23 & 25 May 2017	2%	1%
RBC	31-Jul-17	5%	2%
Range of estimates		**2% - 7%**	**1% - 3%**

Source: Societe Generale (March 2016), United Utilities, p.6; Societe Generale (March 2016), Severn Trent, p.2; RBC (October 2016), UK Water: RORE and valuations, p.12; Societe Generale (October 2016), United Utilities, p.11; RBC (January 2017), United Utilities Group, PLC, p.3; JPMorgan (May 2017), Severn Trent, p.2; JP Morgan (May 2017), United Utilities, p.2; RBC (July 2017), United Utilities Group PLC, p.4; RBC (July 2017), Severn Trent PLC, p.4.

Table B.2. **Analyst estimates of value of non-wholesale regulated activities**

Analyst	Report date	SVT	UU
RBC	05-Oct-16	6%	1%
RBC	30-Jan-17	n/a	1%
RBC	31-Jul-17	7%	3%
Range of estimates		**6% - 7%**	**1% - 3%**

Source: RBC (October 2016), UK Water: RORE and valuations, p.12; RBC (January 2017), United Utilities Group, PLC, p.3; RBC (July 2017), United Utilities Group PLC, p.4; RBC (July 2017), Severn Trent PLC, p.4

Table B.3. **Analyst estimates of value of pension deficit/surplus**

Analyst	Report date	SVT	UU
Societe Generale	29-Mar-16	-2%	1%
RBC	05-Oct-16	-4%	3%
Societe Generale	13-Oct-16	0.0%	3%
RBC	30-Jan-17	n/a	3%
JPMorgan	23 & 25 May 2017	-4%	0%
RBC	31-Jul-17	-7%	3%
Range of estimates		**-7% - 0%**	**0% - 3%**

Source: Societe Generale (March 2016), United Utilities, p.6; Societe Generale (March 2016), Severn Trent, p.2; RBC (October 2016), UK Water: RORE and valuations, p.12, Societe Generale (October 2016), United Utilities, p.11, RBC (January 2017), United Utilities Group, PLC, p.3; JPMorgan (May 2017), Severn Trent, p.2; JP Morgan (May 2017), United Utilities, p.2; RBC (July 2017), United Utilities Group PLC, p.4; RBC (July 2017), Severn Trent PLC, p.4

Table B.4. **Analyst estimates of value of wholesale outperformance**

Analyst	Report date	SVT	UU
Investec	29-Jan-15	n/a	17%
RBC	05-Oct-16	21%	21%
RBC	30-Jan-17	n/a	21%
RBC	31-Jul-17	24%	16%
Range of estimates		**21% - 24%**	**16% - 21%**

Source: Investec (January 2015), United Utilities Group, p.3; RBC (October 2016), UK Water: RORE and valuations, p.12; RBC (January 2017), United Utilities Group, PLC, p.3; RBC

Appendix C. MAR for UK water companies reflects the ratio of AROR and WACC in real terms

The MAR formula for UK water companies is derived by expressing market value (MV) of the company as the sum of future expected cash-flows, discounted at the investors' expected cost of capital. Assuming no outperformance of regulatory assumptions and no real growth in the RAB, the future cash-flows earned by investors in UK water companies <u>in nominal terms</u> are represented by the real allowed rate of return ($AROR_R$) applied to the RAB at time zero (RAB_0) indexed over time with inflation (π). These nominal cash-flows are then discounted by investors' expected cost of capital <u>in nominal terms</u> ($WACC_N$) to calculate market value as shown in Equation C1.

$$(C1) \quad MV_0 = \sum_{k=1}^{\infty} \frac{AROR_R * RAB_0 * (1+\pi)^k}{(1+WACC_N)^k}$$

Recognising that the expression for 1 plus the nominal WACC in the denominator can be de-composed into the real WACC ($WACC_R$) and inflation components as $(1+WACC_R)*(1+\pi)$, the inflation term $(1+\pi)^k$ can then be cancelled out from the numerator and denominator and the market value formula is simplified as shown in Equation C2.

$$(C2) \quad MV_0 = \sum_{k=1}^{\infty} \frac{AROR_R * RAB_0^k}{(1+WACC_R)^k}$$

Applying the formula for a sum of an infinite geometric progression, the market value and MAR can be then derived as shown in Equation C3.

$$(C3) \quad MV_0 = \frac{AROR_R * RAB_O}{WACC_R} \longleftrightarrow MAR = \frac{AROR_R}{WACC_R}$$

The formula above shows that the MAR calculated for UK water companies, which are regulated under an indexed RAB regime, represents a ratio of the AROR and investors' expected WACC in real terms (assuming no outperformance and zero real growth in the RAB, as explained above).

Appendix D. Water companies' RABs have historically grown at 2 per cent per annum (real)

Water companies' RABs have historically exhibited growth in real terms over successive price reviews of around 2 per cent per annum, as shown in Table E.1 below.

Table E.1. **Average growth in real allowed RAB for UK water companies was around 2% per annum over successive price reviews**

	PR99 (2000-2004)	**PR04** (2005-2009)	**PR09** (2010-2014)	**PR14** (2015-2019)	**Whole period** (2000-2019)
Industry	2.9%	2.7%	2.4%	1.4%	**2.4%**
SVT	2.3%	2.1%	0.7%	1.9%	**1.8%**
UU	2.7%	2.1%	2.7%	0.5%	**2.0%**

Source: Ofwat (September 2005), Financial performance and expenditure of the water companies in England and Wales 2004-05 report, Table 9, p.31; Ofwat (2010), Financial performance and expenditure of the water companies in England and Wales 2099-10, Table 9, p.19; Regulatory capital value update 2009-10 and 2014-15 available at http://www.ofwat.gov.uk/publications/regulatory-capital-value-updates/

Appendix E. PwC errors lead to an understatement of TMR by 140-170bps

In this appendix, we present corrections of PwC's calculations for the incorrect application of the MAR formula (Table E.1) and taking into account real RAB growth (Table E.2).

Table E.1. **PwC's incorrect application of the MAR formula understates implied TMR by 80-100bps**

	SVT		UU	
PwC (nominal calculations)				
MAR	1.12		1.1	
Assumed AROR (nominal)		6.6%		
Implied WACC (nominal)	5.9%		6.0%	
Assumed COD (nominal)		5.5%		
Assumed gearing		62.5%		
Implied COE (nominal)	**6.7%**		**7.0%**	
Assumed equity beta		0.80		
Assumed RFR (nominal)	1.5%	3.0%	1.5%	3.0%
Implied TMR (nominal)	**8.0%**	**7.6%**	**8.4%**	**8.0%**
PwC (nominal results converted to real)				
Implied COE (real)	3.8%		4.1%	
Implied TMR (real)	5.1%	4.7%	5.4%	5.1%
Correct approach (real calculations)				
	SVT		UU	
MAR	1.12		1.1	
Assumed AROR (real)		3.7%		
Implied WACC (real)	3.3%		3.4%	
Assumed COD (real)		2.6%		
Assumed Gearing		62.5%		
Implied COE (real)	**4.6%**		**4.7%**	
Assumed equity beta		0.80		
Assumed RFR (real)	-1.3%	0.2%	-1.3%	0.2%
Implied TMR (real)	**6.0%**	**5.7%**	**6.2%**	**5.9%**
PwC understatement				
Real COE understatement	**0.8%**		**0.7%**	
Real TMR understatement	**1.0%**	**1.0%**	**0.8%**	**0.8%**

Source: NERA calculations.

Note: Assuming AROR=PR14 allowed WACC (as per PwC). For illustrating the impact of the corrections, we use the PR14 AROR of 3.74% (real, vanilla) calculated by Ofwat for the appointed business, to allow for comparisons of the calculated cost of equity with PR14 assumptions. We note a more relevant comparison should be to the AROR for the wholesale business of 3.6%, but Ofwat did not publish a decomposition of the wholesale AROR into its constituent elements and hence comparisons to PR14 would be difficult.

Table E.2. **Assuming 2 per cent real growth in the RAB (in line with historical data) increases PwC's implied TMR by 60-70bps**

Calculations assuming 0% real RAB growth				
	SVT		**UU**	
MAR	1.12		1.1	
Assumed AROR (real)		3.7%		
Assumed real RAB growth		**0.0%**		
Implied WACC (real)	3.3%		3.4%	
Assumed COD (real)		**2.6%**		
Assumed Gearing		62.5%		
Implied COE (real)	4.6%		4.7%	
Assumed equity beta		0.80		
Assumed RFR (real)	-1.3%	0.2%	-1.3%	0.2%
Implied TMR (real)	**6.0%**	**5.7%**	**6.2%**	**5.9%**
Calculations assuming 2% real RAB growth				
	SVT		**UU**	
MAR	1.12		1.1	
Assumed AROR (real)		3.7%		
Assumed real RAB growth		**2.0%**		
Implied WACC (real)	3.6%		3.6%	
Assumed COD (real)		2.6%		
Assumed Gearing		62.5%		
Implied COE (real)	**5.2%**		**5.2%**	
Assumed equity beta		0.80		
Assumed RFR (real)	-1.3%	0.2%	-1.3%	0.2%
Implied TMR (real)	**6.8%**	**6.4%**	**6.9%**	**6.5%**
PwC understatement				
Real COE understatement	**0.6%**		**0.5%**	
Real TMR understatement	**0.7%**	**0.7%**	**0.6%**	**0.6%**

Source: NERA calculations

Note: Calculated based on MAR formula which allows for real growth in the RAB (g) as follows:

$$MAR = \frac{AROR_R - g}{WACC_R - g}$$

Notes

[1] PwC (June 2017) Refining the balance of incentives for PR19.

[2] Throughout the report, we consistently refer to the value of regulated assets for UK networks as the Regulatory Asset Base (RAB). We note that different regulators use different terminology, e.g. Ofgem refers to the asset base as the RAV (Regulated Asset Value) while Ofwat uses the term RCV (Regulated Capital Value).

[3] Derived from the following formula for the MAR which takes into account RORE outperformance (RORE) and real RAB growth (g):

$$MAR = \frac{AROR_R + RORE * (1 - gearing) - g}{WACC_R - g}$$

[4] National Grid Annual Report and Accounts 2016/17, p.3.

[5] National Grid Annual Report and Accounts 2016/17, p.3.

[6] Most notably household retail, as non-household retail is typically classified by analysts as a non-regulated activity following recent market opening.

[7] Ofwat (October 2013), IN13/17: Treatment of companies' pension deficit repair costs at the 2014 price review.

[8] As for NG, we use analyst valuations for each of the factors reported in £m terms and convert them into a percentage measure by dividing the £m amount by the wholesale RAB as reported by each analyst (for comparability with the calculated MAR premium in Figure 2).

[9] PwC (June 2017), Refining the balance of incentives for PR19.

[10] PwC (June 2017), Refining the balance of incentives for PR19, Table 15, p.86.

[11] Real values for the implied COE and TMR calculated from PwC reported figures assuming 2.8% RPI inflation, in line with PwC.

[12] This is not explicitly stated, but our replication of PwC's calculations suggests this is the case.

[13] As can be seen in Table 3, despite the calculated implied cost of equity of 5.2 per cent which is lower than the PR14 allowed cost of equity of 5.65 per cent, the implied TMR calculated using PwC's assumptions is 6.4 per cent to 6.9 per cent, with the top end lying above the PR14 allowed TMR of 6.75 per cent, which appears counterintuitive. The reason for this result is that PwC

assumes a lower RFR compared to the PR14 allowance of 1.25 per cent real. Given PwC's assumed equity beta of 0.8 is below 1, a lower RFR requires a disproportionate increase in the ERP (and therefore the TMR) to compensate for this reduction in the RFR. Had PwC used an RFR of 1.25 per cent real consistent with PR14, its implied cost of equity of 5.2 per cent would have resulted in a TMR of 6.1 to 6.2 per cent.

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