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Treatment of Real Price Effects and Ongoing Productivity Improvement for the RIIO-T2 Price Control Review

Prepared for Scottish Power Transmission

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Executive Summary

In preparation for Ofgem's RIIO-T2 price control review, Scottish Power Transmission (SPT) has commissioned NERA Economic Consulting (NERA) to advise on the appropriate treatment of real input price inflation, known widely as Real Price Effects (RPEs), and ongoing productivity improvement over the RIIO-T2 control period from 2021/22 to 2025/26. RPEs capture expected changes in the input prices faced by SPT, relative to general inflation.

As well as forecasting how RPEs are likely to evolve over the RIIO-T2 control period, SPT has also asked us to consider how these cost pressures should be factored into its business plan, given Ofgem's recent consultation and decision on potential indexation of RPEs, and how the ongoing efficiency and RPEs targets are related.

Context

Network companies' price controls are set by Ofgem in constant prices and then indexed to changes in general inflation. However, network companies (including electricity transmission companies, such as SPT), may be subject to different cost pressures from those reflected in economy-wide inflation indices, since the price of the mix of inputs they purchase may rise or fall at a rate different from changes in CPIH. UK regulators (including Ofgem) have in the past controlled for this difference by setting an ex ante allowance for real input price inflation based on economic forecasts.

In recent determinations, Ofgem has (1) identified relevant indices that it deemed track the regulated companies' costs, and (2) formed a view of how these indices will change in the future relative to general inflation. Ofgem's approach has used a combination of third party forecasts (e.g. from the Office for Budget Responsibility, OBR) and extrapolation of long-term trends.

For the upcoming RIIO-T2 price control, Ofgem has indicated that it intends to include a forecast of RPEs in upfront allowances. However, it will also index RPEs, updating allowances annually using the latest available price indices. It will not set a fixed upfront allowance, as was its practice at the previous controls.

Ofgem has not yet set out its precise approach to indexation, in particular the choice of appropriate indices. Also, it has not yet decided how it will set targets for ongoing efficiency improvement, which economic theory shows is closely related to real input price inflation as we discuss below.

RPE Forecasts for RIIO-T2

The first step in producing RPEs forecasts is to identify the published price and cost indices that are most relevant to explaining changes in the input prices SPT faces for labour, materials, plant and equipment (P&E) and other costs. We have used three sets of indices to produce RPE forecasts: (1) Ofgem's input price indices applied to National Grid Electricity Transmission at RIIO-T1; (2) Ofgem's input price indices applied to the slow track companies at RIIO-ED1; and (3) the indices underpinning SP Distribution and SP Manweb's business plan RPE forecasts at RIIO-ED1 (referred to as "SP").

The next step is to forecast how the selected indices will change over the coming control period. We rely on reputable third-party forecasts where available, and otherwise extrapolate long-run trends in the price indices relative to CPIH. We have relied on the OBR's most recent forecasts of economy-wide earnings and public sector earnings to forecast private sector earnings growth, which we use to forecast RPEs for labour costs during the period to 2023/24 covered by the OBR's forecasts. For labour costs in the later years of RIIO-T2 and for other cost categories, we extrapolate long-run growth rates in selected price indices relative to CPIH. For the "other" cost category we have assumed that costs will rise in line with general inflation. Table 1 sets out our final RPEs forecasts for the individual categories, separately based on the Ofgem RIIO-T1, the Ofgem RIIO-ED1 and the SP RIIO-ED1 price indices.

Table 1
RPE Forecasts (Real Growth, i.e. above CPIH) (%)

Category	2021/22	2022/23	2023/24	2024/25	2025/2026	Average
Ofgem RIIO-T1						
Labour	1.2	1.2	1.4	1.0	1.0	1.2
Materials (opex)	2.2	2.2	2.2	2.2	2.2	2.2
Materials (capex)	1.9	1.9	1.9	1.9	1.9	1.9
P&E	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0	0.0	0.0	0.0	0.0	1.2
Ofgem RIIO-ED1						
Labour	1.2	1.2	1.4	1.4	1.4	1.3
Materials (opex)	2.2	2.2	2.2	2.2	2.2	2.3
Materials (capex)	1.4	1.4	1.4	1.4	1.4	1.4
P&E	0.2	0.2	0.2	0.2	0.2	0.2
Other	0.0	0.0	0.0	0.0	0.0	0.0
SP-RIIO-ED1						
Labour	1.2	1.2	1.4	1.6	1.6	1.4
Materials	0.6	0.6	0.6	0.6	0.6	0.6
P&E	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0	0.0	0.0	0.0	0.0	0.0

Source: NERA analysis.

As a final step in our analysis, we have aggregated these RPE forecasts to form a single RPE index for SPT, for operating expenditure (opex), capital expenditure (capex) and total expenditure (totex), based on data provided by SPT on the share of the various cost categories within its opex, capex and totex. Our analysis suggests that SPT's totex will increase by about 0.74 per cent to 1.13 per cent on average per annum in real terms (see Table 2), because the prices of the type of inputs used by SPT are expected to rise faster than general inflation.

Table 2
Aggregated RPE Forecasts for SPT (Real Growth, i.e. above CPIH) (%)

Category	2021/22	2022/23	2023/24	2024/25	2025/2026	Average
Ofgem RIIO-T1						
Opex	0.71	0.74	0.80	0.64	0.64	0.71
Capex	1.17	1.19	1.23	1.12	1.12	1.17
Totex	1.13	1.15	1.20	1.08	1.08	1.13
Ofgem RIIO-ED1						
Opex	0.72	0.74	0.80	0.82	0.82	0.78
Capex	1.00	1.01	1.06	1.07	1.07	1.04
Totex	0.99	1.01	1.06	1.07	1.07	1.04
SP-RIIO-ED1						
Opex	0.62	0.64	0.70	0.85	0.85	0.73
Capex	0.65	0.67	0.72	0.82	0.82	0.74
Totex	0.65	0.67	0.71	0.82	0.82	0.74

Source: NERA analysis.

We also calculate the average of the three aggregated RPE forecasts for opex, capex and totex (see Table 3 below). The average RPE forecasts suggest capex and totex will increase by slightly below 1 per cent on average per annum in real terms over the RIIO-T2 control period. While the average opex RPE forecast is slightly lower at 0.74 per cent per annum on average over the forecast period.

Table 3: Average of the Three RPE Forecasts for SPT (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Avg
Opex	0.68	0.71	0.77	0.77	0.77	0.74
Capex	0.94	0.96	1.00	1.00	1.00	0.98
Totex	0.93	0.94	0.99	0.99	0.99	0.97

Source: NERA analysis.

Ofgem's Proposals for RIIO2

In its RIIO-2 Sector Specific Methodology Decision, Ofgem has explained that it plans to index RPEs, i.e. to update RPE allowances using the latest available RPE indices annually, and to incorporate a final true-up in the RIIO-T2 close-out. This represents a significant change compared to Ofgem's previous methodology, under which it set fixed, ex ante RPE allowances, without indexation to account for differences between RPE forecasts made at the price control and outturn RPEs.

We understand that Ofgem's decision to introduce RPE indexation at RIIO-2 was influenced by the finding that the outturn values of the indices used to set RPEs at the RIIO-1 price controls were turned out below the forecasts Ofgem made when setting allowances (especially RIIO-T1 and RIIO-GD1), and Ofgem viewed this difference as a source of additional returns for regulated companies. We therefore understand that, by indexing RPEs, Ofgem intends to reduce the risk for customers and companies that costs will deviate from

allowed revenues due to unexpected real input price inflation that is beyond companies' control.

As noted above, Ofgem has not yet decided how it will implement this indexation mechanism, such as by selecting particular price or cost indices. We have assumed that the index choice will be based on those indices used at previous price controls which feed into our forecasts (see above). On this assumption, we have considered the practicalities of indexing SPT's allowances to these indices, and the interaction with its ongoing productivity target.

Practical Challenges of Indexing Allowed RPEs

Ofgem's decision to apply indexed allowances stems from its assertion that, if RPE indices turn out to be below or above the forecasts made at the price review, this causes out or underperformance by (and excessive or insufficient returns for) regulated companies. Its proposals to index RPE allowances aim to address this by keeping changes in allowances in line with changes in these indices.

However, we see several practical difficulties that undermine this line of reasoning.

First, the RPE indices Ofgem has used in the past do not necessarily capture accurately the input price pressures companies face *in the short run*. In other words, the fact that outturn RPEs were lower than Ofgem's RIIO-1 forecasts does not automatically mean this difference was a source of outperformance:

1. Regulated companies typically run tenders for contractors shortly after price control settlements are agreed, with either fixed prices or prices indexed to general inflation. Hence, companies would not benefit from lower-than-expected outturn RPEs for much of their contracted work, because contractors' rates would have reflected economic conditions (and inflation expectations) at the time of the price control determination;
2. RPEs, which are based on a range of input price indices, are only an imperfect proxy for the input price pressures that network companies like SPT actually face, because no index or combination of indices exactly captures the inputs used by electricity transmission companies. They only provide a guide as to the long-term inflationary pressures companies face, which supports the past use of their long-term average growth rates in ex ante RPE allowances.
3. Some price and cost indices that have fed into past RPE allowances are extremely volatile from year-to-year, and are therefore unlikely to capture the actual cost pressures facing companies within a price control period. For instance, Figure 1 below shows the year-on-year changes in the three totex RPE indices discussed above, while Figure 2 shows the compound annual growth rates (CAGRs) in the same indices over 5-year periods. The chart shows that input price inflation exceeded 6 per cent in several years, and even the rolling 5-year average growth rate that shows how costs could change over a single control period, was around 6 per cent in 2007-2009 based on Ofgem's index selection.

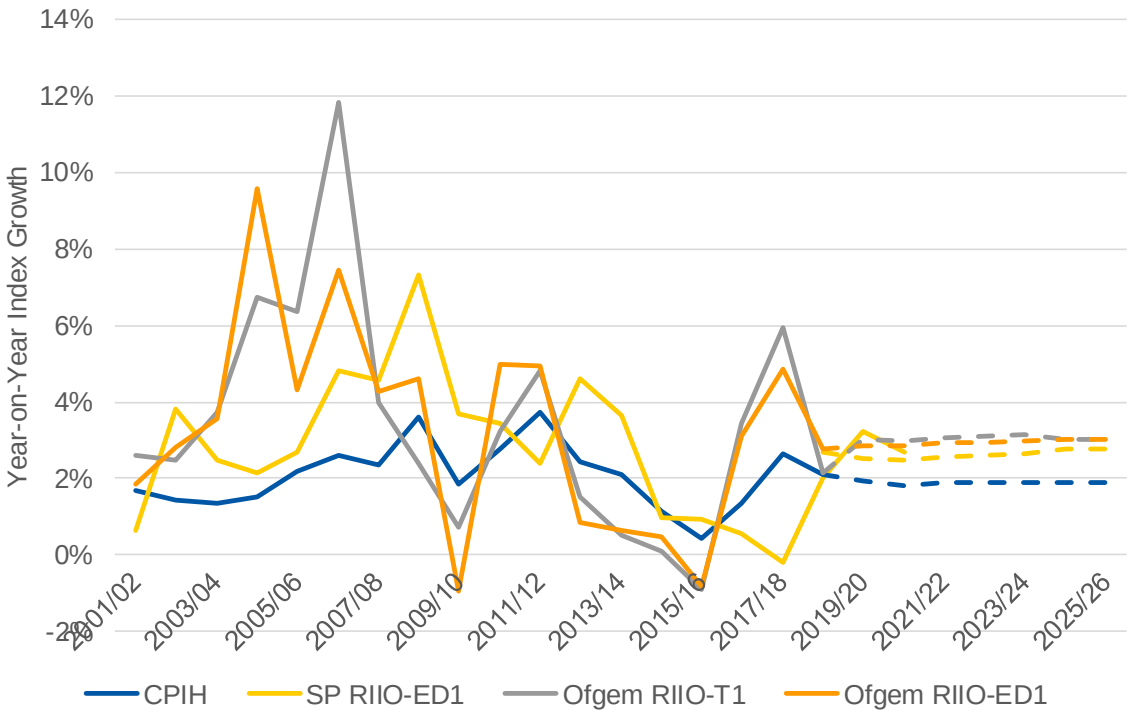
Additionally, empirical evidence and economic theory both suggest that real wages tend to grow in line with productivity improvement in the economy. Hence, if actual wage growth turns out to be lower than expected at the time of the price control, there is likely to be an off-setting effect on productivity; i.e. productivity is likely to have also increased more slowly

than expected (i.e. slower than Ofgem's ongoing productivity improvement target set at the time of the price control).

Productivity growth has slowed significantly in the UK since the financial crisis, from about 1.8 per cent per annum in the ten years before 2007 to about 0.7 per cent since 2009, based on ONS productivity data on output per worker.[1] Therefore, the incidence of lower-than-expected wage growth in the UK may not have led to outperformance in RIIO-1, as weaker-than-expected post-crisis productivity growth may have offset any benefit from weak real wage growth.

Because RPE indices may not track short-term movements in regulated companies' costs, indexing allowances to these indices is unlikely to reduce (and may increase) the scope for out or underperformance. Hence, contrary to Ofgem's intention, RPE indexation may increase risk for both customers and companies and is probably not workable with the same indices used to set allowed RPEs at previous price controls.

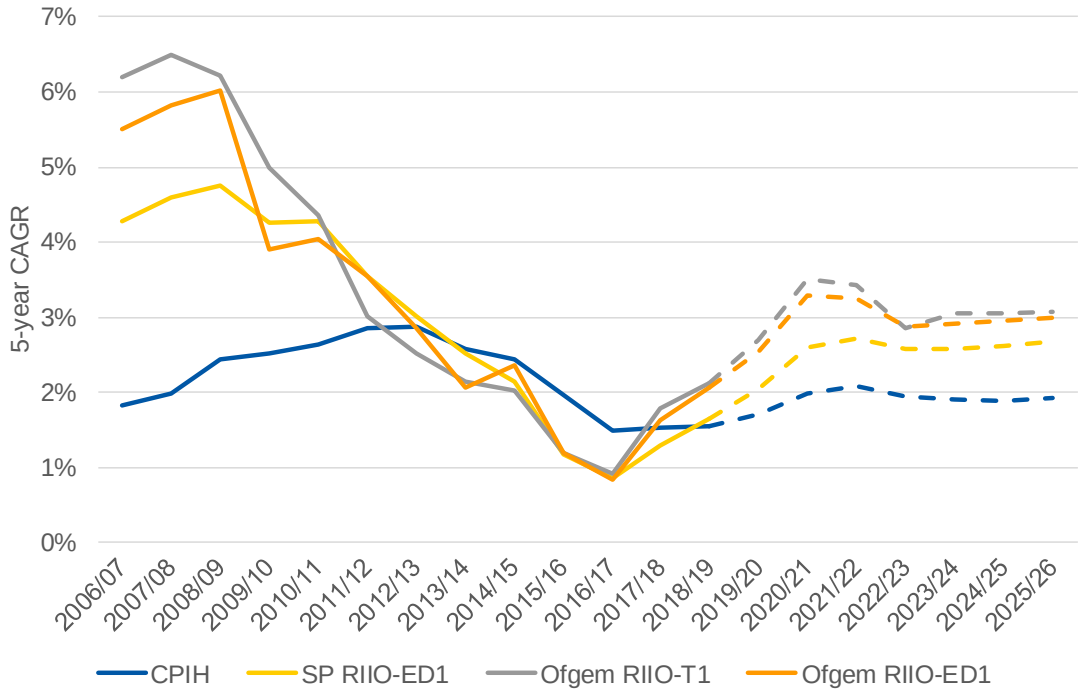
Figure 1: Year-on-year Nominal Changes in Totex RPE Indices



Source: NERA analysis.

[1] ONS Website, Output per Worker: Whole Economy SA: Index 2016=100: UK. Visited on 20 June 2016. URL: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/timeseries/a4ym/prdy

Figure 2: Rolling 5-year Average Nominal Changes in Totex RPE Indices



Source: NERA analysis.

Conclusions and Recommendations

Ofgem seems to have decided not to set ex ante RPE allowances. There are also practical problems associated with the alternative approach of indexation, as set out above. Nonetheless, to set allowances that reflect the expected cost pressures companies face means Ofgem cannot ignore the tendency for the prices of network companies' inputs to rise faster than CPIH inflation.

As explained above, our RPE forecasts for RIIO-T2 show the systematic tendency for network companies' input costs to rise faster than general inflation in the long-run. Specifically, we estimate that SPT's input prices will rise by about 0.7 per cent to 1.1 per cent per annum faster than general inflation (as measured by CPIH) over the RIIO-T2 period.

To ensure Ofgem's allowances reflect the tendency for companies' efficient costs to change over time, its decision on RPEs also needs to be taken alongside its decision on ongoing efficiency targets. For instance, as noted above, real wage growth (a key driver of RPEs) is correlated with productivity improvement.

At present, long-term evidence of changes in productivity indices relevant to electricity network companies suggest long-term productivity improvement matches closely our totex RPE forecasts for RIIO-T2. Specifically, Ofgem set an ongoing efficiency target of 1 per cent for opex and 0.7 per cent for capex at RIIO-T1 by analysing long-term trends in productivity growth, and of 0.8 per cent to 1.1 per cent for RIIO-ED1 based on companies' submissions.

Long-run trends in productivity indices represent the most robust estimate of the scope for productivity improvement, so there is no reason to think these estimates from past price reviews would be less appropriate for the RIIO-T2 period than in previous decisions.[2]

We therefore recommend that Ofgem indexes allowances to CPIH, with no indexation to other input price indices, and sets an ongoing efficiency assumption of zero. This is consistent with its decision not to provide any ex ante allowance for RPEs. It is also consistent with Ofgem's plan to use indexation, but adopts CPIH as the index to which expenditure allowances would be linked. It also recognises the close link between the regulatory treatment of ongoing productivity and input price inflation.

This approach also has a number of other benefits. It will significantly simplify the price review process. It also allows companies to hedge their risk exposure to changes in input prices, because they can readily agree commercial terms with contractors and suppliers at prices indexed to general inflation. It also avoids the volatility in revenues and customers' bills that would come from some other indices that capture real input price inflation.

Finally, while the combination of a zero ongoing productivity target and zero RPEs is a simple and appropriate approach in current economic conditions, this may change at future price reviews. In particular, if economic conditions changed and the outlook for real input price growth were materially higher or lower than long-term productivity trends, it may be appropriate to take another approach to ensure recovery of efficient costs and prevent significant outperformance. In these conditions, given the volatility associated with indexation (demonstrated above) and regulated companies' use of forward contracts for various inputs, we consider ex ante RPE allowances are more likely to result in revenues that reflect companies' efficient costs than an indexation approach.

[2] Ofwat has proposed a higher target for the PR19 price control period of 1.5 per cent, with no allowances for RPEs. Both these decisions rely on economic evidence that contains serious flaws, as we explain in an appendix to this report. Relying on this precedent would therefore be inconsistent with the need for Ofgem to set allowances for the RIIO-T2 control period that reflect the anticipated changes in regulated companies' efficient expenditure over this control period.

1. Introduction

NERA Economic Consulting (NERA) has been commissioned by Scottish Power Transmission (SPT) to advise on the appropriate treatment of real input price inflation and ongoing efficiency improvement in the RIIO-T2 period, which runs from 2021/22 to 2025/26.

Real Price Effects (RPEs) are a determinant of allowed revenues that capture the input price pressures regulated companies face, in addition to the indices of consumer price inflation to which their price controls are linked.[3] Along with RPE allowances, Ofgem sets an ongoing efficiency assumption, which is Ofgem's assumption of the rate at which regulated companies are able to increase their productivity. Ofgem's explanation of these two concepts is:

> "Our ongoing efficiency assumptions represent the reduction in the volume of inputs required to produce a given volume of output. Whereas RPEs relate to the changes in the price of inputs used by network companies, ongoing efficiencies relate, in part, to changes in the volume of those inputs used to provide services to users".[4]

Ofgem sets RPE allowances and ongoing efficiency assumptions to fulfil its remit to "protect the interests of existing and future consumers in relation to gas conveyed through pipes and electricity conveyed by distribution or transmission systems".[5] Ofgem pursues this remit by allowing regulated gas and electricity transmission and distribution companies to recover their costs plus the lowest level of profitability sufficient to secure finance for ongoing investment. To achieve this, when setting allowances Ofgem seeks to reflect the input cost pressures facing companies and the productivity improvements they can achieve.

In this report we discuss Ofgem's approach to RPEs and ongoing efficiency in this report making recommendations about appropriate targets for SPT to build into its RIIO-T2 business plan. The remainder of this report has the following structure:

- Chapter 2 discusses the context for Ofgem's RPE and ongoing efficiency determinations. We explain Ofgem's approach to setting RPE allowances and ongoing efficiency assumptions in its previous RIIO-1 determination and its statements to date in the RIIO-2 process.
- Chapter 3 presents our RPE forecasts and details our forecasting methodology, which relies on the analysis of input cost indices (or 'RPE indices') used in previous price control determinations and business plans.
- Chapter 4 evaluates Ofgem's RIIO-2 strategy decision on its approach to RPEs and ongoing efficiency and presents our recommendations on how it can develop its proposed approach when setting allowances.

[3] In other words, RPEs are the rise in the price of regulated companies' inputs over and above inflation if input prices rise more than inflation, and the shortfall between input prices and inflation if input prices rise by less than inflation.

[4] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 67.

[5] Ofgem Website (19 July 2013), Powers and duties of GEMA

2. Context for Ofgem's RPE and Ongoing Efficiency Determinations at RIIO-2

Ofgem determines regulated network companies' price controls in constant prices and then indexes them to changes in inflation. Companies may be subject to price pressures that are not accurately captured by general inflation – RPEs – and may also increase their productivity throughout a price control period, so Ofgem adjusts companies allowances to account for these two factors.

In the RIIO-1 determination, Ofgem accounted for RPEs by forecasting input price pressures and setting an ex-ante allowance. In the subsequent RIIO-2 price determination, Ofgem has indicated that it will use an indexation approach where it updates allowances on the basis of outturn input cost indices, though it has not yet set out its precise approach. For instance, Ofgem has not clarified its choice of indices to which it will index allowances.

Ofgem set ongoing efficiency targets by analysing long-term trends in historical productivity data at RIIO-1 and has indicated that it will follow the same approach at RIIO-2.

2.1. Ofgem's Approach to RPEs in RIIO-1

Ofgem's December 2018 consultation sets out its approach to RPEs at RIIO-1.[6] Ofgem followed different approaches for fast-track and slow-track companies when setting RPE allowances at RIIO-1. For the fast track companies, Ofgem allowed the ex-ante RPE forecasts included in the companies' business plans, whereas slow track companies received ex-ante allowances for RPEs based on Ofgem's own forecasts.

To set RPE allowances for slow-track companies, Ofgem first selected appropriate indices, listed in Table 2.1. It forecast future changes in the listed indices and combined its forecasts into composite forecasts for the categories in Table 2.1 (labour, opex materials, capex/repex materials, and plant and equipment).

[6] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 136 – 138.

Table 2.1: Indices Selected in RIIO-1 for RPEs Allowances

Index	Source	Sector(s) applied in
RPI	ONS	ED, ET, GD, GT
Labour		
Average earnings index for private sector incl. bonus	ONS	ED, ET, GD, GT
Average weekly earnings (AWE) Private sector incl. bonus	ONS	ED, ET, GD, GT
AWE construction incl. bonus	ONS	ET, GD, GT
AWE transport and storage	ONS	ET, GD, GT
PAFI Labour and Supervision in Civil Engineering	BCIS	ED, ET, GD, GT
BEAMA labour cost index: electrical engineering	BEAMA	ED, ET
Materials – opex		
FOCOS Resource Cost Index of Infrastructure: Materials	BCIS	ED, ET, GD, GT
Materials – capex / repex		
PAFI Plastic Pipes And Fittings	BCIS	GD
PAFI Pipes and Accessories: Copper	BCIS	ED, ET, GD
PAFI Pipes and Accessories: Aluminium	BCIS	ED
PAFI Structural Steelwork - Materials: Civil Engineering Work	BCIS	ED, GD, GT
Equipment and plant		
PAFI Plant and road vehicles	BCIS	ET, GD, GT
Machinery & equipment (Output PPI)	ONS	ED, ET, GD, GT
Manufacture of machinery & equipment (Input PPI)	ONS	ET, GD, GT
Plant and road vehicles: providing and maintaining	BCIS	ED

Source: Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 137, Table 11.
Note: ED, ET, GD, and GT stand for electricity distribution, electricity transmission, gas distribution, and gas transmission, respectively.

Ofgem prepared these forecasts in nominal terms, so to compute an RPE allowance it subtracted[7] a forecast of Retail Price Index (RPI) inflation, to which it indexed allowed revenues at RIIO-1. Ofgem then created composite indices (for labour, materials, etc) using "notional" weights that it selected to reflect the average cost structures reported in

[7] More specifically, Ofgem made the following adjustment: $RPE_{C,t}(\%) = \frac{1+IPI_{C,t}(\%)}{1+RPI_t(\%)} - 1$, where:

$RPE_{C,t}(\%)$ is the real change in an input price index

$IPI_{C,t}(\%)$ is the percentage change in an input price index

$RPI_t(\%)$ is RPI, which is expressed in percentage change terms.

See: Ofgem (2018), RIIO-t1 Electricity Transmission Price Control – Regulatory Instructions and Guidance, p. 27

companies' business plans.[8] The weights were calculated as the share of totex spent on a particular cost category for a "notional" company, reflecting companies' average expenditure.

Ofgem used the resulting weighted totex indices to set ex-ante allowances for RPEs. At RIIO-1, Ofgem found that RPE indices generally exceeded RPI, and therefore Ofgem's RPE adjustment increased companies' allowances. For example, Table 2.2 shows Ofgem's cumulative RPE assumptions for slow-track ED1 companies. Ofgem increased or decreased companies' efficient cost allowances by the cumulative RPE assumptions shown in Table 2.2.[9]

Table 2.2: Ofgem's Cumulative RPE Assumptions for ED1 Slow Track Companies (%)

2015/16	2016/17	2018/19	2019/20	2021/22	2022/23
-0.3	0.3	0.9	1.5	2.1	2.7

Source: Ofgem (28 November 2014), RIIO-ED1: Final determinations for the slow-track electricity distribution companies, p.30

2.2. Ofgem's Assessment of Outperformance due to RPEs

For the RIIO-2 price controls, Ofgem proposed RPE indexation "to mitigate the impact of uncertainty at the level of input price inflation in RIIO-2".[10] This follows Ofgem's assessment that "input price inflation has been lower than forecast [for RIIO-1] and this has had a material impact on companies' costs and returns".[11] Cambridge Economic Policy Associates (CEPA) has estimated the effect on RIIO-1 outperformance due to RPEs.[12] Figure 2.1 from CEPA's report shows the difference between the outturn indices used to set RPE allowances at RIIO-GD1, RIIO-T1, and RIIO-ED1, as compared to the forecasts Ofgem made when setting allowances.

8 Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 67.

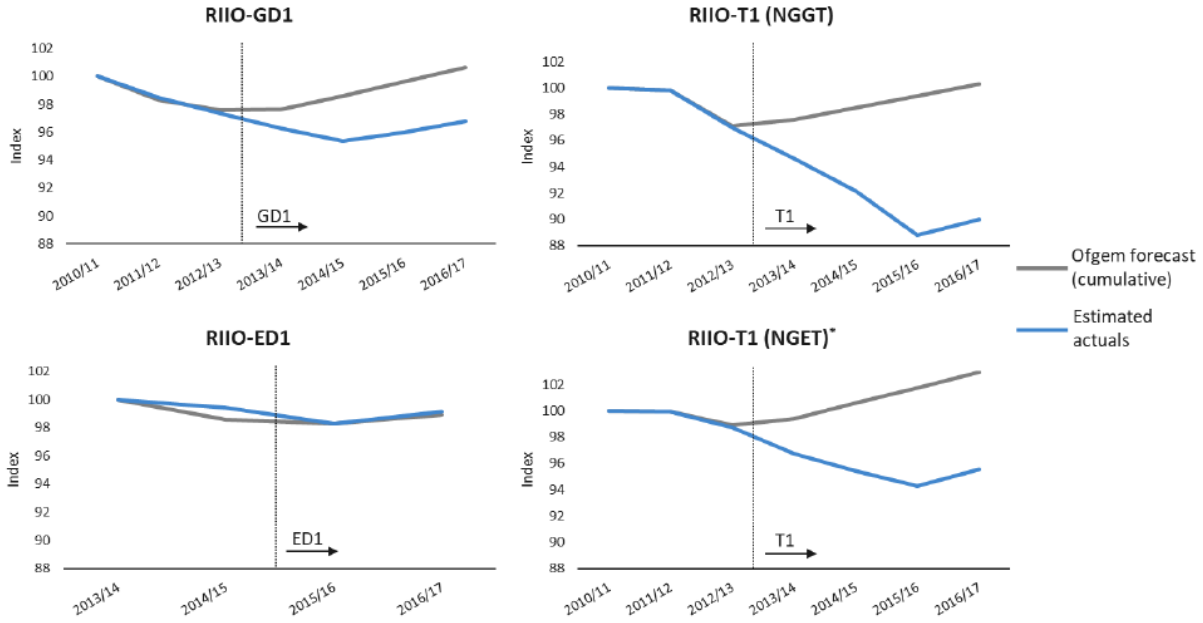
9 Ofgem (28 November 2014), RIIO-ED1: Final determinations for the slow-track electricity distribution companies, p.30

10 Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 58

11 Ofgem (28 September 2018), RIIO-2 Business Plans Initial Guidance Document, p. 10

12 CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance.

Figure 2.1: Difference Between Ofgem's Forecast and Outturn RPE Indices



Source: CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance, p. 27
Note: We understand that Figure 2.1 uses the average of the indices used to set allowed RPEs in each price determination, but we cannot confirm this from the CEPA report.

Ofgem employed a similar methodology to forecast RPEs and set RPE allowances at RIIO-ED1, RIIO-T1, and RIIO-GD1, but these price control determinations took place at different times, as indicated by the dotted grey vertical lines in Figure 2.1, and it selected different indices in each determination, leading to the different comparisons of outturn and forecast RPEs in Figure 2.1.

Figure 2.1 shows that outturn RPEs have been predominantly below Ofgem's forecasts. CEPA further estimates the impact of this difference on companies' out/under performance:

- "RIIO-T1 (electricity) – RPEs account for around 80 basis points of additional RoRE [Return on Regulatory Equity] for NGET [National Grid Electricity Transmission] over the first four years of the price control period. 21
- RIIO-T1 (gas) – RPEs account for around 40 basis points of additional RoRE for NGGT [National Grid Gas Transmission] (TO only) over the first four years of the price control period.
- RIIO-GD1 – RPEs account for around 70 basis points of additional RoRE across the GDNs [Gas Distribution Networks] (on a weighted average basis) over the first four years of the price control period.
- RIIO-ED1 – RPEs broadly had a neutral impact on RoRE over the first two years of the price control period."[13]

However, CEPA caveats this analysis, describing RPEs as a "regulatory construct" that do not necessarily reflect companies' input costs, which may vary independently from RPEs

[13] CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance, p. 27.

depending on factors such as companies' approach to contracting for labour, materials, and equipment.[14]

2.3. Ofgem's Proposed Approach to RPEs in RIIO-2

Under Ofgem's proposed RPE indexation approach, its RPE allowances will be adjusted to reflect the outturn values of RPE indices such as those listed in Table 2.1 as opposed to having a fixed ex-ante allowance based on forecast RPEs made at the time of the price control. Ofgem's December 2018 consultation set out Ofgem's options for implementing indexed RPE allowances at RIIO-2, focusing on three considerations:[15] the frequency with which to update RPE allowances , whether to include forecasts of RPEs in upfront allowances, and other considerations such as the adoption of CPIH instead of RPI as Ofgem's general inflation measure.

Ofgem set out two options for the frequency of updating allowances:[16]

- Option 1: annually, or
- Option 2: at the end of the price control period.

Ofgem also considered three options for setting allowed RPEs in the period until it implements these adjustments based on the outturn value of indices: [17]

- Option 1: To forecast RPEs as zero – i.e. to assume that input price inflation is the same as general inflation.
- Option 2: To fix a forecast of RPEs for the duration of the price control (using the same broad approach as for the RIIO-1 price controls).
- Option 3: To annually update RPE forecasts with latest available input price data (assuming that RPE allowances are updated annually).

The other issued raised in Ofgem' consultation included which indices to include in the RPE indexation approach, the information provided by companies business plans, and governance arrangements. As mentioned above, Ofgem also proposed to use CPIH as its inflation measure instead of RPI.[18]

In its May 2019 decision, Ofgem decided on option 1 for the frequency of updating allowances and on option 3 for the inclusion of forecasts in RPE allowances.[19] Hence, it will set upfront RPE allowances at RIIO-2 price control and will update allowances annually based on updated forecasts. It will correct annually for any difference between the previous year's allowance and the allowance that it would have set if it had known the outturn value of the RPE indices .

[14] CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance, p. 27.

[15] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 139 – 141.

[16] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 139 – 140.

[17] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 139 – 140.

[18] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 140 – 141.

[19] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 67 – 71.

Ofgem cites four reasons for choosing to annually update RPE allowances:[20]

- "It will provide a better balance of charges between existing and future consumers by enabling a more frequent recalibration of allowances, within-period.
- It will reduce risk and volatility compared to an ex-ante approach and reduce any final true-up
- It will provide us with the opportunity to update forecasts for RPEs annually using the latest available RPE price indices.
- It will better facilitate other aspects of our framework, such as reporting a more up to date RoRE, reflecting allowances updated for RPEs."

Ofgem cites two further reasons for its decision to forecast RPEs when setting up-front RPE allowances:[21]

- "It is more likely to lead to more accurate cost allowances, which better reflect our view of future expenditure.
- It is more likely to increase bill predictability and reduce bill volatility, given our intention to update both allowances and forecasts annually."

Ofgem intends to consult further on its RPEs procedure, stating that it intends "to consult further on both RPEs and ongoing efficiency in our summer consultation on tools for cost assessment, focussing on the index criteria and materiality thresholds we will look to employ in our assessment of RPEs and the interactions between RPEs and ongoing efficiency".[22]

2.4. Ongoing Efficiency

At RIIO-GD1 and RIIO-T1, Ofgem developed ongoing efficiency assumptions from the EU-KLEMS database, focusing on productivity data from comparable sectors.[23] Ofgem set a target of 1 per cent annual opex reduction and 0.7 per cent annual capex and repex reduction for slow track RIIO-GD1 and RIIO-T1 companies.[24] For RIIO-ED1, Ofgem accepted the proposals in DNOs' business plans,[25] in the range of 0.8 per cent to 1.1 per cent.[26]

Table 2.3 and Table 2.4 below list ongoing efficiency assumptions from previous regulatory decisions from Ofgem and other regulators. Ofgem's recent decisions, as well as those of other regulators, demonstrate that ongoing efficiency assumptions are usually close to 1 per cent improvement per year.

[20] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 70.

[21] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 70.

[22] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 71.

[23] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 138 – 139.

[24] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 139.

[25] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 138 – 139.

[26] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 139.

Table 2.3: Recent Productivity Decisions in UK Utilities for Opex

Regulator	Industry	Year	% Ongoing Efficiency
UR	Electricity & Gas Distribution	2017	1.0
UR	Water and Wastewater	2015	0.9
Ofgem	Electricity Distribution	2014	0.8 - 1.1
Ofgem	Gas Distribution and Elec. and Gas Transmission	2012	1.0
Competition Commission	Water	2010	0.9
PPP Arbiter	Tube Lines - opex	2010	0.9
PPP Arbiter	Tube Lines - central costs	2010	0.7
ORR	Rail - maintenance	2008	0.9
ORR	Rail - opex	2008	0.2
Ofgem	Electricity Distribution	2009	1.0

Source: NERA analysis of UK regulatory decisions.

Table 2.4: Recent Productivity Decisions in UK Utilities for Capex

Regulator	Industry	Year	% Ongoing Efficiency
UR	Electricity & Gas Distribution	2017	1.0
	Water and Wastewater	2015	0.6
Ofgem	Electricity Distribution	2014	0.8 - 1.1
Ofgem	Gas Distribution and Elec. and Gas Transmission	2012	0.7
PPP Arbiter	Tube Lines	2010	0.5 - 0.6
ORR	Rail - renewals	2008	0.9
Ofgem	Electricity Distribution	2009	1.0

Source: NERA analysis of UK regulatory decisions.

For RIIO-2, Ofgem has proposed to continue to use the latest EU-KLEMS dataset running from 1995 to 2015 to assess ongoing efficiency improvements, focusing on comparable industries.[27] Ofgem reiterated this approach in its 2019 decision document, but has stated that it "will continue to think about whether further sources of data – such as from ONS, Bank of England and OBR – may also be of use".[28]

At the PR19 price control, Ofwat has proposed a zero allowance for RPEs and ongoing efficiency target of 1.5% per annum. However, as set out in Appendix A and Appendix B, economic analysis in reports by Europe Economics and KPMG/Acqua Consulting, and Ofwat's use of them in its Initial Assessment of Plans at PR19, contain a number of flaws that mean its proposed approach to ongoing efficiency and RPEs will not reflect changes in water companies' efficient costs. Indeed, due to the same flaws discussed in more detail in the

[27] Ofgem (8 December 2018), RIIO-2 Sector Specific Methodology, p. 141.

[28] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 70.

appendices, these targets would materially understate the costs that energy network companies would expect to incur over the upcoming RIIO2 control periods.

2.5. Conclusions

In its RIIO-1 determination, Ofgem set ex-ante allowances for companies on the basis of forecast RPEs, but it has indicated that it will not continue this approach in the upcoming RIIO-T2 price control. Instead, Ofgem intends to index RPEs, updating allowances annually using the latest available price indices, though it will set up-front allowances by forecasting RPEs. Ofgem will continue its RIIO-1 approach of relying on historical productivity data to set ongoing efficiency assumptions.

Ofgem has not yet set out its precise approach to indexation, in particular the choice of appropriate indices. It has not decided how it will set targets for ongoing efficiency improvement, which economic theory shows is closely related to real input price inflation.

3. Forecasting RPEs over the RIIO-T2 Control Period

As an input into SPT's business planning process, and to inform the regulatory debate about the appropriate treatment of RPEs in the RIIO-2 price controls, we have prepared a forecast of RPEs for the period to financial year 2025/26. In this chapter we explain the methods we have followed and present our results.

As set out below, we have prepared three different forecasts, which vary according to the choice of indices used to track movements in electricity network companies' input prices. We used the same indices as those in the RPE forecasts in SP Distribution and SP Manweb's RIIO-ED1 business plans (We refer to these sources as "SP RIIO-ED1"), and in Ofgem's RIIO-T1, and RIIO-ED1 slow-track determinations.

To forecast RPEs, we rely on reputable third-party forecasts where available, and otherwise extrapolate long-run trends in selected price indices relative to CPIH. As described further below, we have relied on the OBR's most recent forecasts of economy-wide earnings and public sector earnings to forecast private sector earnings growth, which we use to forecast RPEs for labour costs during the period to 2023/24 covered by the OBR's forecasts. For labour costs in the later years of RIIO-T2 and for other cost categories, we extrapolate long-run growth rates in selected price indices relative to CPIH.

3.1. Choice of Published Indices to Reflect Transmission Costs

Table 3.1 summarises the indices used in SP RIIO-ED1, in the RIIO-T1 determination, and in the RIIO-ED1 determination. The 'OLS Growth' column also provides an estimate of the long-term average growth rate of the indices, calculated using the methodology discussed in Section 3.2.2.

For each of the cost categories shown in the table, we have taken average forecast growth rates for each index over the financial year, using actuals (for all but four indices[29]) up to March 2019. The ONS' Cold Drawn Wire index, which was used in the SP RIIO-ED1 forecast, was discontinued in 2017 so we have excluded it from this analysis.

The indices used come from three sources: the Office for National Statistics (ONS), the Royal Institute for Chartered Surveyors (RICS), and British Electrotechnical and Allied Manufacturers' Association (BEAMA). The labour indices from the ONS estimate average weekly earnings for the indicated sectors and include bonuses but exclude arrears of pay.[30] The BCIS indices in Table 3.1 are provided by the RICS.

[29] 'ONS AWE Private Sector incl. Bonus', 'ONS AWE Construction', and 'ONS AWE Transport and Storage', are all monthly indices with data extending to February 2019. The 'BCIS FOCOS RCI Infrastructure Materials' index is a quarterly index with data extending to November 2018.

[30] ONS Website, URL: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/averageweeklyearningsearn01. Visited on 7 June 2019.

Table 3.1: Summary of Indices Used in SP RIIO-ED1, RIIO-T1, and RIIO-ED1

Category	Index	Index Start Year[31]	OLS Growth	SP RIIO-ED1	RIIO-T1	RIIO-ED1
Labour	ONS AWE Private Sector incl. Bonus[32]	1992	1.26	✓	✓	✓
Labour	ONS AWE Construction	2002	0.24	×	✓	×
Labour	ONS AWE Transport and Storage	2002	0.60	×	✓	×
Specialist Labour	BCIS Labour and Supervision in Civil Engineering	1990	2.03	×	✓	✓
Specialist Labour	BCIS Electrical Installations – Cost of Labour	1990	2.10	✓	×	×
Specialist Labour	BCIS Electrical Labour	1992	2.07	✓	×	×
Specialist Labour	BEAMA Electrical Labour	2001	1.11	×	✓	✓
Materials (Opex)	BCIS FOCOS RCI Infrastructure Materials	1992	2.22	✓	✓	✓
Materials (Capex)	BCIS Pipes and Accessories: Copper	1993	1.92	✓	✓	✓
Materials (Capex)	BCIS Pipes and Accessories: Aluminium pipes	1993	1.13	×	×	✓
Materials (Capex)	BCIS Structural Steelwork Materials: Civil Engineering Work	1993	1.28	×	×	✓
Materials	BEAMA CPA Large Power Transformer Materials	2003	-0.34	✓	×	×
Materials	BEAMA CPA Basic Electrical Equipment Index	1990	-0.80	✓	×	×
Materials (Opex)	ONS Electricity Distribution and Control Apparatus	1998	-0.28	✓	×	×
Materials	ONS Electric Motors, Generators and Transformers	1998	-1.63	✓	×	×
Materials	ONS Other Electronics and Electric Wires	1998	2.90	✓	×	×
P&E	BCIS Plant and Road Vehicles[33]	1993	0.66	✓	✓	✓
P&E	ONS Machinery and Equipment Output PPI	1998	-0.26	✓	✓	✓
P&E	ONS Machinery and Equipment Input PPI	1998	-0.18	✓	✓	×

Source: NERA analysis
Note: Ticks indicate that the index in the corresponding row was used by the source from the corresponding column, and crosses indicate that the index was not used by the source.

[31] This column lists the start of our analysis of the index, not necessarily the start of the index itself.

[32] We rely on the ONS private Sector Average Earnings Index – including bonuses – from 1990 to 2000, and use the Average Weekly Earnings including bonuses from 2000 to 2019.

[33] We have assumed that, for ED1 and T1, 'Plant and road vehicles: providing and maintaining' and 'PAFI Plant and road vehicles' refer to the same index

3.2. Forecasting Inflation in Relevant Indices

3.2.1. Published forecasts of wage and CPIH inflation

The Office for Budget Responsibility (OBR) publishes an average hourly earnings index which it has forecast until the financial year 2023/24.[34] The OBR's average hourly earnings index represents nominal earnings growth for both the public and private sector. We adjust the average hourly earnings index forecasts to represent private sector pay growth only, using employment data from the OBR[35] and OBR CPI forecasts to further adjust the index to obtain real private sector wage growth forecasts.

We use these adjusted private sector wage growth forecasts to forecast labour costs for the financial years 2021/22 to 2023/4. For the financial years 2024/25 and 2025/26, we forecast labour costs by extrapolating long-term trend growth rates, as described in Section 3.2.2.

The OBR CPI forecasts also extend to the financial year 2023/24. We therefore assume that inflation for the financial years 2024/25 and 2025/26 will equal the OBR's CPI forecast for the financial year 2023/24.

3.2.2. Estimating trend growth rates in relevant indices

Our OLS approach starts by aggregating the RPE indices into annual data (for each financial year).[36] We then deflate these nominal indices using CPIH, and perform an OLS regression in using the following equation, in which "Time" represents years:

$$Ln(Real\ Deflated\ Index_t) = \alpha + \beta \times Time + \varepsilon_t$$

The β parameter resulting from the regression estimates the average annual percentage change in the real ("deflated") index.

For each of the SP RIO-ED1, RIIO-T1, and RIIO-ED1 indices, we average the β parameter from the regressions within each input cost category to estimate the long-run average growth rate in SPT's categories of costs. We use these average growth rates to forecast RPEs for 2021/22 to 2025/26, except:

1. The forecasts of labour costs are derived from OBR forecasts for the financial years 2021/2022 through to 2023/2024, as explained in Section 3.2.1, with no differentiation between specialist and non-specialist labour.
2. For 2024/25 and 2025/26, our forecasts rely on long-term growth rates, with different calculations reflecting the methods used in the SP RIIO-ED1, and Ofgem ED1/T1 forecasts:

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34 OBR Website, URL: https://obr.uk/efo/economic-fiscal-outlook-march-2019/. Visited on 7 June 2019.

35 The OBR provides a breakdown of public and private sector employment numbers and public sector pay. Given the proportion of workers in the private sector, public sector pay, and economy-wide pay growth, we can derive the private sector contribution to economy wide pay growth.

See: OBR Website, URL: https://obr.uk/efo/economic-fiscal-outlook-march-2019/. Visited on 7 June 2019.

36 For the four indices with data that does not extend to March 2019, we applied the nominal year-on-year growth rate to the preceding year's index value using the annual growth rate implied by the year-to-date data.

A. Using the SP and Ofgem RIIO-ED1 approaches, our forecasts use a weighted average of long-term growth rates (the β parameters) for the 'Specialist Labour' and 'Labour' RPE indices. The weights are based on the shares of specialist and non-specialist labour in the cost structure for the notional company that Ofgem used at RIIO-ED1.

B. For the forecasts prepared using the Ofgem RIIO-T1approach, we used an unweighted average of the long-term growth rates (the β parameters) resulting from regressions of both 'Specialist Labour' and 'Labour' indices.

Our forecasts are shown in Table 3.2. The OBR forecasts (described by point 1 above) are highlighted in light blue, whereas the forecasts described in point 2 are highlighted in grey. The other forecasts are constant through the financial years 2021/22 to 2025/26, as they are based on the β parameters from the regressions described above. We assign any costs falling outside the categories listed in Table 2.1 to the 'other' category and assume that these costs rise in line with CPIH inflation, leading to RPE forecasts of zero for this category.

Table 3.2: RPE Forecasts (Real Growth, i.e. above CPIH) (%)

Category	2021/22	2022/23	2023/24	2024/25	2025/2026	Avg
Ofgem RIIO-T1						
Labour	1.2	1.2	1.4	1.0	1.0	1.2
Materials (opex)	2.2	2.2	2.2	2.2	2.2	2.2
Materials (capex)	1.9	1.9	1.9	1.9	1.9	1.9
P&E	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0	0.0	0.0	0.0	0.0	0.0
Ofgem RIIO-ED1						
Labour	1.2	1.2	1.4	1.4	1.4	1.3
Materials (opex)	2.2	2.2	2.2	2.2	2.2	2.2
Materials (capex)	1.4	1.4	1.4	1.4	1.4	1.4
P&E	0.2	0.2	0.2	0.2	0.2	0.2
Other	0.0	0.0	0.0	0.0	0.0	0.0
SP RIIO-ED1						
Labour	1.2	1.2	1.4	1.6	1.6	1.4
Materials	0.6	0.6	0.6	0.6	0.6	0.6
P&E	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0	0.0	0.0	0.0	0.0	0.0

Note: Figures highlighted in light blue are OBR forecasts. Figures highlighted in grey are a weighted average of the averages of the β parameters from regressions of the 'Specialist Labour' and 'Labour' RPE indices.
Source: NERA analysis of RPE indices and OBR forecasts.

3.3. Conclusion

The final step in our analysis is to combine the forecasts shown in Table 3.2 using weights representing the shares of each input category included in SPT's opex, capex, and totex (see Table 3.3).

Table 3.3: Scottish Power Cost Breakdown (%)

Type	Opex	Capex	Totex
Labour	49.6	36.3	37.7
Materials	5.5	38.2	34.9
Equipment/Plant	2.2	7.2	6.7
Other	42.6	18.3	20.8

Source: Scottish Power

Our forecast RPEs for 2021/22 to 2025/26 are shown in Table 3.4 to Table 3.6.

Table 3.4, based on the SP RIIO-ED1 indices, shows very similar forecasts for opex, capex, and totex, with year-on-year increases ranging from 0.62 per cent to 0.85 per cent. The forecasts in Table 3.5, which use the Ofgem RIIO-T1 indices, predict higher capex forecasts than opex. The forecasts in Table 3.6 based on Ofgem's RIIO-ED1 indices also predict higher capex RPEs than opex RPEs. All the forecasts show a consistent, real increase in costs above CPIH, suggesting a tendency for electricity transmission companies' input costs to rise faster than inflation that Ofgem should factor into its price control determination.

Table 3.4: Forecast RPEs Based on Indices from SP-RIIO-ED1 (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Average
Combined Opex	0.62	0.64	0.70	0.85	0.85	0.73
Combined Capex	0.65	0.67	0.72	0.82	0.82	0.74
Combined Totex	0.65	0.67	0.71	0.82	0.82	0.74

Source: NERA analysis

Table 3.5: Forecast RPEs Based on Indices from RIIO-T1 (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Average
Combined Opex	0.71	0.74	0.80	0.64	0.64	0.71
Combined Capex	1.17	1.19	1.23	1.12	1.12	1.17
Combined Totex	1.13	1.15	1.20	1.08	1.08	1.13

Source: NERA analysis

Table 3.6: Forecast RPEs Based on Indices from RIIO-ED1 (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Average
Combined Opex	0.72	0.74	0.80	0.82	0.82	0.78
Combined Capex	1.00	1.01	1.06	1.07	1.07	1.04
Combined Totex	0.99	1.01	1.06	1.07	1.07	1.04

Source: NERA analysis

We also calculate the average of the three aggregated RPE forecasts for opex, capex and totex (see Table 3.7 below). The average RPE forecasts suggest capex and totex will increase by slightly below 1 per cent on average per annum in real terms over the RIIO-T2 control period. While the average opex RPE forecast is slightly lower at 0.74 per cent per annum on average over the forecast period.

Table 3.7: Average of the Three RPE Forecasts for SPT (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Avg
Combined Opex	0.68	0.71	0.77	0.77	0.77	0.74
Combined Capex	0.94	0.96	1.00	1.00	1.00	0.98
Combined Totex	0.93	0.94	0.99	0.99	0.99	0.97

Source: NERA analysis

4. Assessment of Ofgem's Proposals and NERA's Recommendation

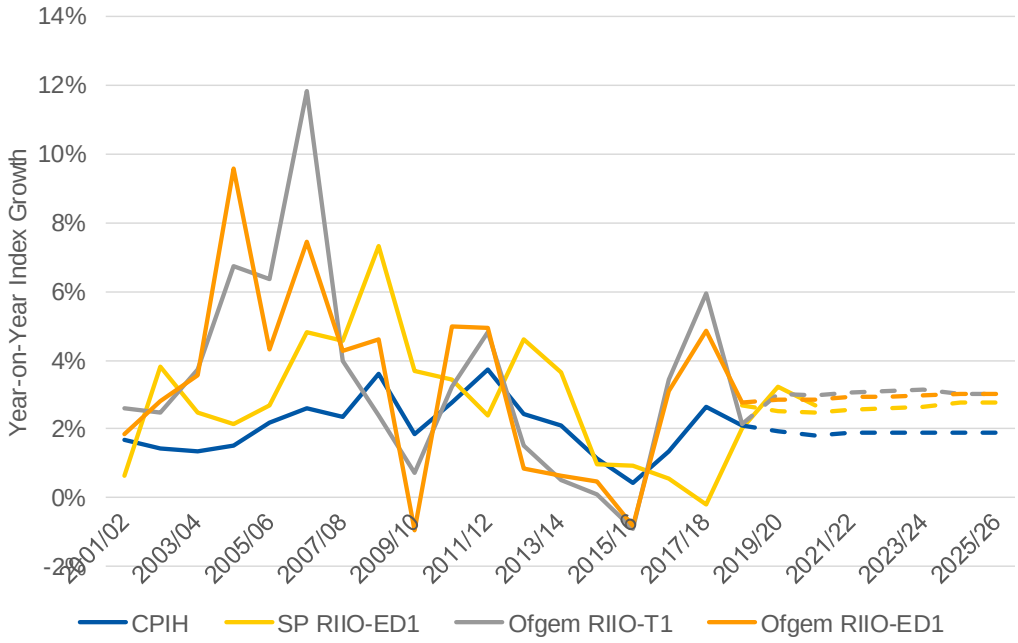
In this chapter, we assess the basis for Ofgem's proposals to use indexed RPE allowances, and evaluate the implications for how SPT should factor in the expectation of real input price inflation over the T2 control period (demonstrated by the analysis in the previous chapter) into its RIIO-T2 business plan.

4.1. Price Volatility

Both Ofgem's previous approach of setting ex ante RPE allowances and its new proposals to index price controls to changes in relevant price indices could, in the long-run, lead to equivalent allowances that reflect the tendency for the input prices used by electricity network companies to rise faster or slower than inflation. However, in the shorter-term over single price control periods, updating companies' RPE allowances on the basis of outturn indices as opposed to forecasts based on long-term trends is likely to lead to more volatile network prices than Ofgem's previous approach of setting ex ante allowances. As Figure 4.1 and Figure 4.2 show, average growth in RPE indices tends to be materially more volatile than CPIH:

- Figure 4.1 shows the average year-on-year growth of selected RPE indices Ofgem has used previously when setting RPE allowances; whereas
- Figure 4.2 shows a five-year rolling average growth rate of these indices.[37]

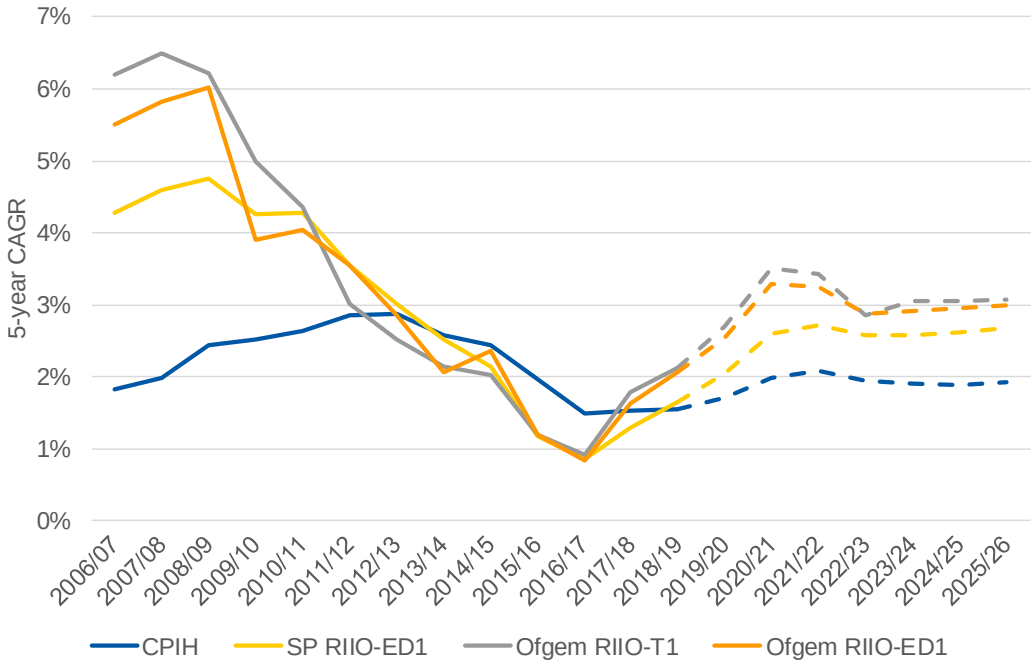
Figure 4.1: Average Annual Growth of CPIH and RPE Indices used by Ofgem at RIIO-T1, RIIO-ED1, and by SP at RIIO-ED1



Source: NERA analysis of RPE Indices

[37] The indices used in these figures are listed in Table 3.1.

Figure 4.2: 5-year Compound Average Growth Rates of CPIH and RPE Indices used by Ofgem at RIIO-T1, RIIO-ED1, and by SP at RIIO-ED1



Source: NERA analysis of RPE Indices

The figures show that, even after aggregating several indices together to create a totex index, the totex RPE indices developed by Ofgem in the past to capture the impact of input price inflation may result in large swings in allowances if used for indexation. Hence, if the RIIO-2 control periods coincide with a period of volatile input price inflation (net of CPIH), real allowances could be volatile and potentially rise or fall very quickly.

CEPA's report for Ofgem also notes this, stating that "the main advantage of the current approach [ex ante allowances] is that customers are protected from unexpected increases in real input prices".[38] CEPA's report further points out that, by transferring the risk of input price increases to companies themselves, an ex-ante allowance incentivises companies to manage cost increases efficiently.[39]

Ofgem also notes this effect in the context of the choice over whether to update allowances annually rather than at the end of the price review period. Ofgem acknowledges that annually updating RPE allowances creates volatility in the short term, though it also points out that opting for a final adjustment at the end of the price review period could lead to a much larger, sudden price adjustment at the end of the price review period.[40] However, this discussion does not acknowledge that even 5-year CAGRs (see Figure 4.2) are materially more volatile than CPIH.

[38] CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance, p. 83.

[39] CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance, p. 83.

[40] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 71.

4.2. Relevance of RPE Indices to Companies' Costs Within Control Periods

The potential for large upward or downward swings in allowed RPEs are not necessarily a problem if they reflect changes in companies' costs. However, in the short-term, they may not do so. For instance, companies can hedge their year-to-year exposure to price fluctuations by signing multi-year contracts with their materials and equipment suppliers and their contractors. They may also reach multi-year wage settlements governing in-house labour.

Even without long term contracts, RPE indices are already imperfect proxies for regulated companies' input price pressures, since they capture input prices for broad categories of inputs, rather than input prices of the exact inputs used by regulated companies.

Ofgem's previous approach of setting ex ante allowances, because the allowances applied for several years at a time and drew primarily on long-term average growth rates, reflected the long-term tendency for the prices of network companies' inputs to rise faster or slower than general inflation. This approach meant that it was not important whether short-term movements in price and cost indices tracked network companies' input costs, as long as they captured similar long-term trends.

However, switching to indexation (using any of the approaches mooted by Ofgem) would expose companies and customers to short-run changes in these indices. Given the analysis in Section 4.1 demonstrating the volatility of the most relevant published price and cost series suggests they may not keep track of network companies' actual costs which we would expect to be much more stable. Indeed, if Ofgem is contemplating indexing allowances to changes in costs, we would suggest assessing the reasonableness of that decision by comparing published indices to its historical data on companies' outturn unit costs.

Rather than using RPE indexation to reduce the scope for out or underperformance of price controls, as Ofgem seems to be targeting, indexing price controls to volatile price indices with an imperfect short-term relationship with network companies' costs may increase the potential for out or underperformance.

The CEPA report prepared for Ofgem also suggests RPE indexation lessens companies' incentives to efficiently manage input costs.[41] This statement is incorrect. Companies' incentives to efficiently manage input costs by minimising those input costs arises from the independence of revenues from costs and this does not change with indexation. The need for companies to "efficiently manage" their exposure to variation to volatile input costs by hedging their exposure to shocks in input prices does not change with indexation. Indeed, given the wide fluctuations in the indices Ofgem has used to set allowed RPEs in the past, the need to hedge input price fluctuations may even become more acute.

4.3. Link Between RPEs and Ongoing Efficiency

Ofgem has acknowledged the links between ongoing efficiency and RPEs and has stated it intends to consult on them.[42] For instance, economic theory shows a clear link between

[41] CEPA (March 2018), Review of the RIIO Framework and RIIO-1 Performance, p. 83.

[42] Ofgem (24 May 2019), RIIO-2 Sector Specific Methodology – Core document, p. 71.

productivity and real input prices (such as wages), as demand for individual factor inputs is proportional to their marginal revenue product,[43] and the demand for inputs determines their price along with their supply.

Productivity improvements imply that each unit of an input can produce more output, increasing the marginal revenue product of inputs[44] and companies' demand for inputs. Absent increases in supply of the input, productivity improvements therefore increase input price inflation in proportion to the productivity improvement, creating a theoretical link between Ofgem's 'ongoing efficiency' target and RPEs.

There is also an empirical link between productivity and input prices. Our RPE forecasts in Table 3.4 through to Table 3.6, which are predominantly composed from growth in historical RPE indices, are in the order of one per cent, as are the historical ongoing efficiency assumptions discussed in Section 2.4. Another illustration of this link is that wage growth in the UK slowed after the financial crisis, so has labour productivity growth, from about 1.8 per cent per annum in the ten years before 2007 to about 0.7 per cent since 2009, based on ONS productivity data on output per worker.[45]

Ofgem's previous approach at RIIO-1 addressed this link, basing both allowed RPEs and ongoing efficiency targets on long-term evidence. However, indexing RPEs to short-run changes in input price indices leaves open the question of how it will maintain consistency with the ongoing efficiency target at RIIO-2.

Maintaining its previous approach of setting a fixed ex ante productivity target while indexing allowances to RPE indices would control for the long-term tendency for companies' input prices and productivity to rise faster or slower than CPIH. However, fixing a productivity target ex ante would not reflect the correlation between productivity and RPEs within price control periods.

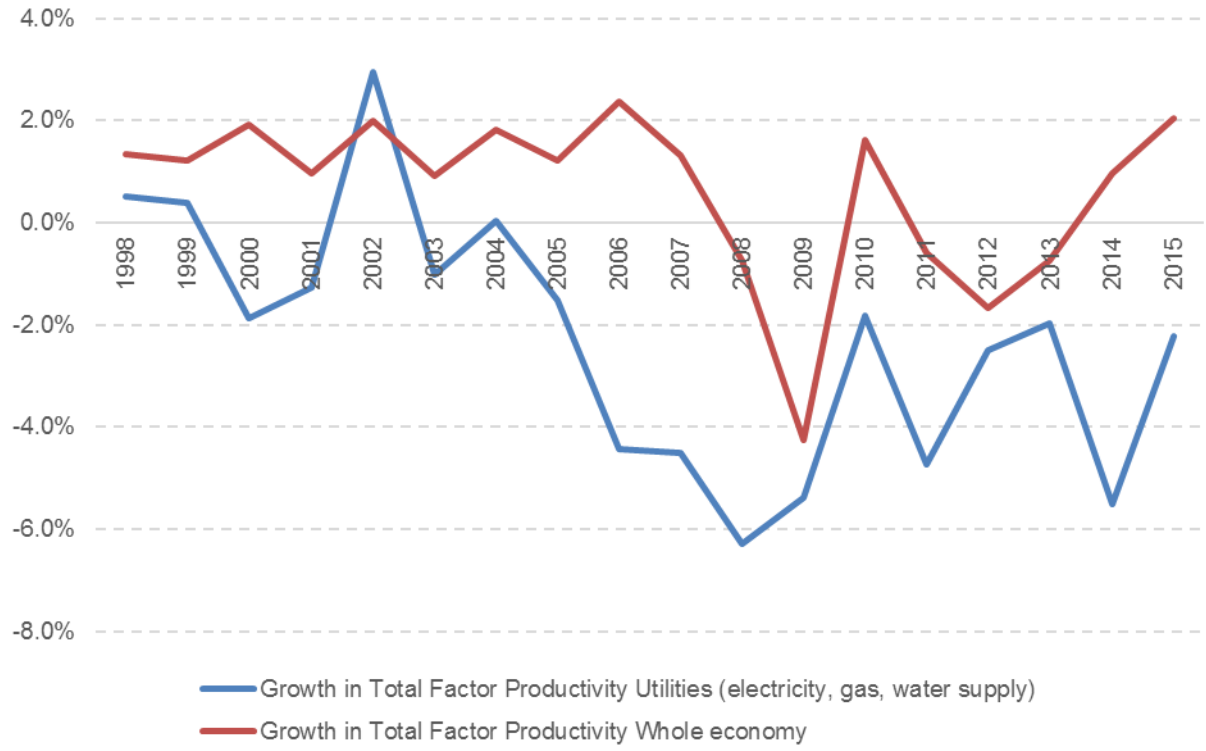
The alternative approach of indexing allowances to changes in productivity would also be problematic, as productivity indices are volatile and do not necessarily characterise productivity changes in the energy network industries, as Figure 4.3 shows.

[43] This is the extra revenue that an additional unit of labour or capital can bring to the company

[44] The increase is greater than inflation since the price of Ofgem's regulated companies' output increases in line with inflation

[45] ONS Website, Output per Worker: Whole Economy SA: Index 2016=100: UK. Visited on 20 June 2016. URL: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/timeseries/a4ym/prdy

Figure 4.3: TFP Indices (Electricity, Gas and Water Supply vs. Whole Economy)



Source: EU KLEMS

4.4. NERA's Recommendation

Ofgem has decided not to provide companies with an ex ante allowance for RPEs based on economic forecasts. However, our analysis of the historical price indices used in the past to set ex ante allowances show considerable volatility, suggesting their year-to-year movements may not reflect changes in input costs actually experienced by energy network companies, and that Ofgem's proposals expose customers and companies to significant "shocks" in their costs and revenues.

Our analysis of the current outlook for RPEs over the T2 control period, as well as the long-term productivity evidence relied on in previous price control decisions, suggests these two determinants of transmission companies' costs will offset each other.

We therefore recommend that Ofgem does not use the same indices to set indexed RPE allowances as it has used in previous reviews to set ex ante allowances. Rather, we recommend that it indexes RPE allowances to CPIH.

However, to ensure allowances are aligned with expected costs over the control period, this approach requires that Ofgem recognise the long-term tendency for companies' input costs to grow faster than CPIH. The simplest way to achieve this would be to combine this approach of using CPIH as the sole index to which allowances are set with a zero ongoing efficiency target. This recommendation would be consistent with Ofgem's proposed approach to link its determinations on RPEs and ongoing efficiency.

In the future, this simplified approach of assuming RPEs and ongoing efficiency offset each other achieves the need for allowances to achieve expected costs, because the RPE outlook and long-term productivity growth estimates are closely aligned. At future price reviews, Ofgem may need to revisit this approach. For instance, if the macroeconomic outlook changes, leading to forecasts of wage or materials growth materially higher or lower than long-term trend rates of productivity indices, a different approach would be needed to protect customers' from excessive network charges, while ensuring firms can recover their efficient costs.

5. Conclusion

Despite Ofgem's apparent decision not to set ex ante RPE allowances and the practical problems associated with indexation, the need for Ofgem to set allowances that reflect the expected cost pressures companies face means it cannot ignore the tendency for input prices to rise faster than CPIH inflation. As explained above, our RPE forecasts for RIIO-T2 show the systematic tendency for network companies' input costs to rise faster than general inflation in the long-run. Specifically, we estimate that SPT's input prices will rise by about 0.7 per cent to 1.1 per cent per annum faster than general inflation (as measured by CPIH) over the RIIO-T2 period.[46]

Indexing allowances to changes in the RPE indices that Ofgem used to set ex ante allowances at previous price control reviews is likely to lead to volatile allowances, which on the face of it seems unlikely to capture changes in companies' costs. If Ofgem is contemplating indexing allowances to changes in costs, we suggest assessing the reasonableness of that decision and its eventual choice of indices by comparing published indices to its historical data on companies' outturn unit costs.

Moreover, to ensure Ofgem's allowances reflect the tendency for companies' efficient costs to change over time, its decision on RPEs also needs to be taken alongside its decision on ongoing efficiency targets. At present, long-term evidence of changes in productivity indices relevant to electricity network companies suggest long-term productivity improvement matches closely our totex RPE forecasts for RIIO-T2. Specifically, Ofgem set an ongoing productivity target of 1 per cent for opex and 0.7 per cent for capex at RIIO-T1, based on long-term trends in productivity growth, and of 0.8 per cent to 1.1 per cent for RIIO-ED1, based on companies' submissions.

We therefore recommend that Ofgem indexes allowances to CPIH, with no indexation to other input price indices, and sets an ongoing productivity target of zero. This is consistent with Ofgem's plan to use indexation, but adopts CPIH as the index to which expenditure allowances would be linked. It also recognises the close link between the regulatory treatment of ongoing productivity and input price inflation.

This approach also has a number of other benefits. It will significantly simplify the price review process. It also allows companies to hedge their risk exposure to changes in input prices, because they can readily sign contracts with contractors and suppliers at prices indexed to general inflation. Finally, it avoids the volatility in revenues and customers' bills that would come from some other indices that capture real input price inflation.

[46] While we have recommended that Ofgem indexes allowances to CPIH and sets an ongoing productivity target of zero, we have provided these forecasts separately an Excel file, in the format required by Ofgem's Business Plan Data Table A1.6. These have been provided for information only. SPT has not applied the RPE projections in its business plan cost forecasts.

Appendix A. Appraising Ofwat's Approach to RPEs

At PR19, Ofwat has proposed not to allow any RPEs, based on an appraisal by Europe Economics of the need for such adjustments over the AMP7 price control.[47]

Europe Economics appraised potential RPEs against the following criteria:

- Firstly, Europe Economics assessed the *materiality* of the cost, in terms of its proportion of water companies' totex.
- Secondly, Europe Economics assessed *whether CPIH does not adequately capture the input price*, examining (a), the share of a cost item in wholesale totex vs. the share of the most relatable cost item(s) in the CPIH basket, and (b) the indirect influence of the cost item on CPIH, compared with its influence on water company costs, e.g. where a cost (such as labour) accounts for a proportion of the costs of items included in CPIH.
- Thirdly, Europe Economics considers the *wedge relative to CPIH*, testing whether the difference between the index for the input price is statistically different from CPIH, and whether the volatility of the index (relative to CPIH) suggests that the wedge may be greater than zero over AMP7.
- Finally, Europe Economics considered whether the cost is under *management control*; i.e. whether a company can reduce exposure to input price movements.

However, for the reasons set out below, this appraisal is flawed and would not represent a sound basis for Ofgem to use as the basis for controlling for the effect of input price inflation increasing energy network companies' costs over time.

A.1. The Role of RPEs in Setting Price Controls

RPE adjustments are intended to account for the systematic tendency for companies' input costs to rise more or less quickly than the general measure of inflation by which Ofwat and Ofgem propose to index price controls, CPIH. RPEs allow companies to recover the costs stemming from changes in their input prices, just as a company operating in a competitive market would expect to.

Ofwat concludes that no allowance is required for the changes in companies' input prices relative to CPIH, since there is "no compelling evidence" for real input price pressures in wholesale totex.[48]

The overall protection afforded to regulated utilities regarding their ability to recover efficient costs is irrelevant to this assessment. The value of this protection to the regulated company is reflected in the level of allowed return afforded by the regulator, relative to those in competitive industries. This feature of utility regulation does not give Ofwat a justification to systematically ignore cost pressures facing the industry. Similarly, Europe Economics' assertions about information asymmetry between companies and regulators does not justify

[47] This report appraises the suitability of the methods Ofwat proposed in its January 2019 Initial Assessment of Business Plans for use in Ofgem's RIIO-T2 determination. Since then, Ofwat published its draft determination for PR19 in July 2019. While its approach is substantially similar to the Initial Assessment of Plans, it has allowed a labour RPE (subject to an ex post true up), as we mention below in Appendix C.

[48] Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.45.

Ofwat rejecting claims for RPEs, where they are supported by evidence that input prices are expected to rise more quickly than CPIH inflation.

A.2. Europe Economics' Arbitrary Materiality Threshold

Europe Economics' first criterion for assessing RPEs is whether the cost is 'material' as a proportion of wholesale totex: "Is the input cost item to which the RPE would be applied a material proportion of total company costs?".[49]

For wholesale water and wastewater, Europe Economics assesses whether the cost item makes up at least 10 per cent of wholesale totex, and, for retail costs, whether the cost item makes up at least 10 per cent of retail totex.[50]

Europe Economics' materiality threshold is prohibitively high and appears to be intended to prevent successful RPE claims. Firstly, the threshold is arbitrarily set at a high level which is markedly different from the materiality threshold Ofwat applies in other aspects of its decision; for instance, Ofwat considers special cost factors are material if they account for more than 1 per cent of either water network plus or wastewater network plus costs.[51]

Secondly, since the threshold is applied separately to wholesale and retail costs, the threshold varies markedly in absolute terms across the value chain. Because Europe Economics groups wholesale water and wastewater, and resources and network plus costs together. For instance, energy costs account for 13 per cent of water resources and 11 per cent of water network plus; however, because Europe Economics applies its materiality threshold across wholesale water and wastewater costs in aggregate, it finds energy costs are not material since they account 'only' for 8 per cent of wholesale totex.[52]

Europe Economics' threshold also applies inconsistently across water only and water and sewerage companies. If a cost accounts for more than 10 per cent of wholesale water totex, but not 10 per cent of wholesale water and wastewater totex, as is the case for energy costs, Europe Economics would not consider an RPE to be appropriate. This means that Ofwat rejects RPEs for costs which are likely to represent a 'material' proportion of water-only companies' costs, even according to Europe Economics' own criteria.

The materiality threshold is also sensitive to Europe Economics' choice of cost aggregation. For instance, its approach finds that, when considered together, materials, plant and equipment costs are 'material', but they would not be if Europe Economics had considered materials costs separately from plant and equipment costs.[53]

Applying any materiality threshold at all to RPE claims (in terms of proportion of totex) would require and incentivise companies to rely upon imprecise measures of input costs that span wide ranges of cost categories, ignoring evidence for particular line items that make up smaller percentages of totex.

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49 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.18.

50 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.18.

51 Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.23.

52 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.27.

53 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.37.

A.3. Irrelevance of Europe Economics' Comparison of Input Shares within CPI

Europe Economics' second criterion assesses whether companies' share of costs is similar to in CPIH, concluding that, if it is similar, then CPIH adequately captures this input price. To assess this criterion, Europe Economics considers two elements: (a), the share of a cost item in wholesale totex vs. the share of the most relatable cost item(s) in the CPIH basket, and (b) the indirect influence of the cost item on CPIH, compared with its influence on water company costs, e.g. where a cost (such as labour) accounts for a proportion of the costs of items included in CPIH.[54]

While it is reasonable only to allow RPEs for input costs which do not fully feed-through into CPIH, the application of Europe Economics' criterion does not test whether this is the case.

The case for Ofwat making an RPE adjustment is that the input price inflation experienced by water companies may differ from the rate of input price inflation observed across the economy as a whole (see Section A.1). This may be true even if the proportion of costs allocable to that category are similar. While water companies use a similar proportion of labour (around 35 per cent) as the share of labour used in the wider economy,[55] the specific types of labour employed by water companies may be subject to wage pressures that differ from average wage inflation in the wider economy.

For example, if there are particular shortages of the types of labour employed by water companies, an adjustment may still be necessary to ensure water companies can recover their efficient costs. The pressures on wages vary across sectors and types of labour, as the ASHE dataset (which Ofwat uses to estimate companies' regional labour costs) shows.[56] Wage inflation also varied between the private and public sectors. Europe Economics' conclusion that no labour RPE is needed because all companies in the economy use labour is unfounded.

In particular, Europe Economics notes but then dismisses the fact that imports account for a significant proportion of CPIH, because "imports will themselves be affected by labour costs in other countries".[57] Observing that imported goods require labour in their production is an illogical justification for assuming that CPIH adequately captures inflation in the labour costs faced by UK companies and/or water companies in particular; wage levels in foreign countries (particularly developing countries which export labour-intensive manufactured goods to Britain) are unlikely to be representative of labour cost pressures in the UK.

Imports are subject to markedly different cost pressures to domestic goods. Recent inflation analysis from the Bank of England demonstrates that inflation in less-import intensive CPI-components tends to be higher than inflation in more import-intensive components, as shown in the figure below. Therefore Europe Economics is wrong to argue that, because imports consist of the same factors of production as domestic goods, that CPIH is likely to capture domestic input price pressures.

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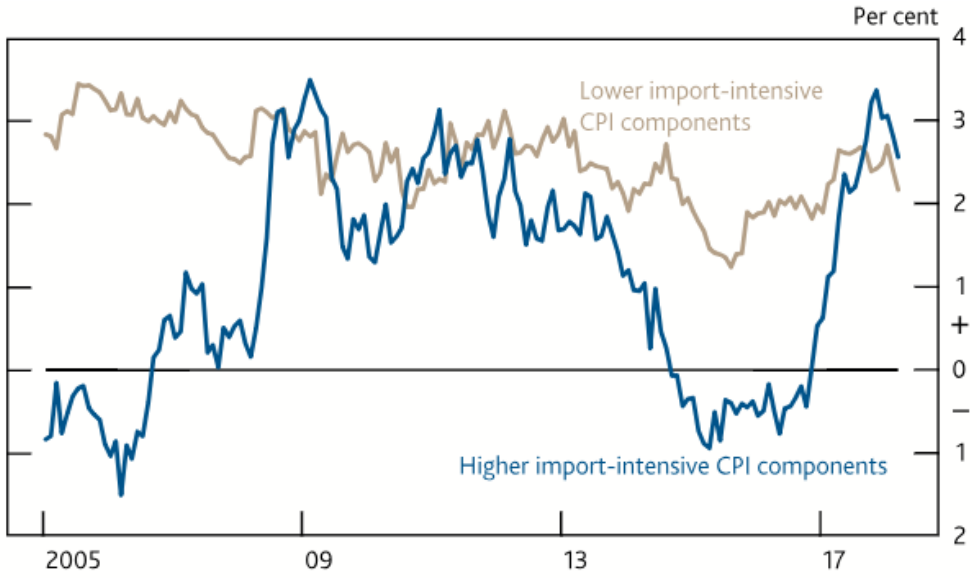
54 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.19.

55 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.19.

56 See Ofwat (January 2019), Supplementary technical appendix: Econometric approach *and* Ofwat (March 2018), Cost assessment for PR19: a consultation on econometric cost modelling.

57 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.21.

Figure 5.1: CPI inflation by import intensity



Source: Bank of England (2018).[58]

A.4. The Misleading and Inconsistent Use of Statistics

As part of its third pass/fail criterion for RPEs, Europe Economics assessed whether there is a statistically significant 'wedge' between input prices and CPIH, i.e. whether the difference between the index for the input price and CPIH is statistically significant. Europe Economics does not present any of the results of its statistical analysis, but it states that it tests for statistical significance by "perform[ing] a t test on the wedge to assess whether it is statistically significant from zero".[59]

This criterion is inconsistent with the need for regulated companies to recover (in expectation) their efficient costs. Even if there is not a large and stable wedge between input price indices relevant to the water industry and CPIH, failure to account for any tendency for water companies input prices to rise faster (or slower) than CPIH may result in allowances that under or overestimate efficient costs.

This problem arises even if the wedge is volatile and/or small, since the expected costs still represent the average cost wedge that companies are expected to face, whether or not that wedge is statistically significantly different from zero. Indeed, the same statistical test would conclude that the wedge is not statistically significantly different from twice the average value of the wedge. Therefore, to conclude that the wedge is not statistically significant from zero and should thus be taken to be zero while ignoring its expected value, is arbitrary and unjustified.

Although Europe Economics' conclusions rely on its statistical tests of whether the wedge differs from zero, it presents no results or evidence of its analysis. It only makes

[58] Bank of England (May 2018), Inflation Report, Chart 4.6, p.25.

[59] Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.19.

unsubstantiated references to its statistical findings. For instance, Europe Economics does not state the time period and granularity/frequency of data it uses, or its chosen significance threshold. It does, however, appear to quote evidence of statistically insignificant wedges for particularly short and arbitrary time periods as its justification for concluding an RPE is not significantly different from CPIH.

For example, Europe Economics concludes that evidence of a statistically significant historical wedge on energy costs is inconclusive; referring we understand, to analysis of the wedge between 2006 and 2018:[60]

> "We find evidence of a significant positive wedge relative to changes in CPIH for both energy price indices. Since CPIH was introduced in 2006, we find an average wedge of +3.0 per cent for the BEIS gas price index and +4.8 per cent for the BEIS electricity price index. However, these significant wedges are largely driven by very high positive wedges prior to 2010.
>
> Focusing on data from 2010 onwards (i.e. excluding the period [sic.] of high volatility prior to 2010), we find that neither wedge (for electricity or gas) is significantly different from zero in statistical terms. This continues to be the case for the gas price index looking at data from 2011 or 2012 onwards. However, in the case of the electricity price index, we do find evidence of a statistically significant positive wedge since 2011 or 2012 of 1.4 and 1.7 per cent respectively. As such, evidence of a material real price effect based on historical wedge analysis is inconclusive."

While it is difficult to scrutinise Europe Economics' statistical analysis when it is not presented, this quote suggests Europe Economics restricted its analysis of electricity costs to 13 data points (i.e. the 'wedge' in each year from 2006 to 2018), and found a statistically significant wedge for the full time period. It also notes that it found a statistically significant wedge for the period since 2011 for electricity. However, because it failed to find a statistically significant wedge between 2010 and 2018, Europe Economics has concluded this cost category fails this criterion.[61]

Also, rather than restrict its analysis to the post-2006 period, which reduces the data available for its statistical tests, Europe Economics could have used a "back-casted" CPIH index, based on its observed wedge to CPI, which may have given more reliable statistical results regarding the wedge than its approach of drawing conclusions based on very few data points.

A.5. Europe Economics' Weak Justification for Overlooking Third Party Forecasts

Europe Economics' assessment of the wedge between price/cost indices and CPIH also dismisses evidence from third party forecasts of costs such as energy and labour. Europe Economics dismisses these forecasts on the basis of historical forecast errors, for instance concluding that the Office for Budget Responsibility (OBR) forecasts have predicted earnings growth above the outturn level in the past.[62] Europe Economics also dismisses forecasts of energy costs on the basis that the Department of Business Energy and Industrial Strategy

[60] Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.29.

[61] Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.37.

[62] Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.25.

(BEIS) forecasts have also overstated outturn energy price inflation in 2014 and 2015.[63] These observations regarding a small number of historical forecasts provides no basis for the conclusion that OBR and BEIS forecasts systematically over-forecast future cost inflation.

Outturn economic data can differ from projections made by economic forecasters such as the OBR for many reasons, most importantly the emergence of new information after the forecast was prepared. However, to ignore current expectations about future cost changes because some economic forecasts have turned out to be wrong in the past is not a reason to ignore the tendency for input prices to rise, but rather would justify the use of more objective means of setting allowed RPEs, for instance relying upon long-term trend growth rates set using the longest window of data available.

As we discuss further in Section A.7, this assumption also ignores the role of these current expectations in determining the costs that companies will face. Specifically, the costs that will be built into water companies' forward contracts for contractors and energy will reflect current market expectations about future costs and input prices over the course of the contract, given there is no reason to expect water companies to be able to better forecast economic conditions and input price pressures than reputable public organisations like OBR.

A.6. Europe Economics' Unjustified Focus on Volatility of the Wedge

As well as testing the statistical significance of the wedge between input costs and RPEs, Europe Economics also evaluates the volatility of the wedge over time:[64]

> "We evaluate the volatility of the wedge over five-year periods (the length of the price control), rather than looking at short-term (e.g. month-to-month) volatility that may average out over a price control period. We analyse this variability as a share of (wholesale or retail) totex, and consider that a wedge exhibits high volatility if the five-year rolling average wedge frequently exceeds 2 per cent of totex."

The stability of the wedge between CPIH and input costs is irrelevant to whether or not a factor imposes an input price pressure on water companies. As Europe Economics discusses in its assessment of the extent to which costs are under management control, companies can sign fixed price contracts with suppliers; this can reduce the company's exposure to volatility in input prices, but it does not allow the company to avoid the systematic tendency for input costs to rise faster than general inflation.

Finally, it appears Europe Economics' analysis of the volatility of the wedge relies on a very short-term time series which may fail to reflect for long-term historical trends in input prices and CPIH.

A.7. Europe Economics' Misleading Assessment of Management Control

Europe Economics' final criteria tests the extent to which a potential RPE is under management control, i.e. whether a company can insulate itself from input price

63 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.30.

64 Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.19.

movements.[65] Since there is no quantitative way of testing the extent to which costs are under management control, Europe Economics relies on a subjective judgement of whether or not companies can take action to avoid cost exposure.

While it is indeed true that management can respond to changes in input prices, for instance by changing the mix of input factors they use or profiling investment so that it occurs when prices are lower, these actions are not costless, so rising input prices unambiguously increases companies' costs. For instance, it is not costless to move investment plans forward to when wages are cheap; while doing so would reduce a companies' exposure to wages in periods of high labour cost inflation, it would increase companies' recruitment and training costs as they must employ more staff at one time. Similarly, an increase in market wages would require companies to incur higher wage costs, or alternatively choose not to match market wages, accept that some staff will leave as a result, and substitute labour for other input factors.

Europe Economics concludes that all input factors are partially within management control in this sense, except for chemicals costs. However, all it offers in support of this conclusion are hypothetical examples of ways in which management could change their use of particular factors, not any empirical evidence that they can in reality, or how much such measures would reduce companies' costs.

Europe Economics cites companies' ability to sign up to fixed contracts to avoid input price pressures, for example companies can hedge against energy price rises by applying for fixed energy tariffs.[66] However, this line of argument would require that energy suppliers, with which water companies could sign fixed price agreements in this example, are naively unaware of forecast increases in prices, and would not price in expected price rises to their fixed-price tariff offerings.

A.8. Conclusion on RPEs Approach

Ofwat has proposed not to allow any RPEs, based on an appraisal by Europe Economics of the need for such adjustments to the AMP7 price control. However, this appraisal is flawed. Europe Economics has used criteria that will systematically ignore the tendency for certain input costs to rise at a rate different from CPIH. It has also applied its criteria inconsistently and relied on flawed statistical and economic arguments.

The Europe Economics materiality threshold is arbitrary, and in principle would enable it to ignore all cost categories if they are examined at a granular enough level. Examining the representation of a particular input in the factors of production used in the whole economy is not relevant to assessing whether an adjustment to water sector price controls is required. It has also made a misleading use of statistics when examining the size and volatility of the wedge between input costs and CPI and dismissed reputable third-party forecasts of input cost inflation without good cause. Finally, its assessment of whether input price inflation is within management control ignores the cost impacts of altering the mix of inputs and contracting strategies to avoid particular input price rises.

[65] Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.19.

[66] Europe Economics (January 2018), Real Price Effects and Frontier Shift, p.31.

Ofwat's analysis on RPEs is therefore based on an extremely flawed economic assessment of the cost pressures utilities face, and as such is not a precedent on which Ofgem show draw when setting its RIIO-2 price controls.

Appendix B. Appraising Ofwat's Approach to Ongoing Efficiency

Ofwat has proposed to apply a frontier shift adjustment of 1.5 per cent per annum to base wholesale costs when setting the PR19 price controls.[67] In explaining this decision, it cites the combined effect of on-going productivity improvements and the one-off effect of the totex and outcomes regime on efficiency. Neither Ofwat's cost assessment appendix nor the frontier shift annex sets out the proportion of the frontier shift target that can be attributed to each effect. However, Ofwat's wholesale water benchmarking files specify that the frontier shift comprises a 1 per cent adjustment for "productivity improvement" and a 0.5 per cent adjustment for "Totex / outcomes efficiency challenge".[68]

In its' cost assessment appendix, Ofwat states its 1.5 per cent target is "based on a range of factors":[69]

- Ofwat states that Europe Economics recommends a value towards the upper-end of its range for ongoing productivity growth because "some weight should be placed on valued-added measures and to account for embodied technological change".
- Ofwat concludes that some factors indicate the totex and outcomes effect lies to the lower end of KPMG's recommended range, for instance that not all outperformance can be attributed to gains from the totex and outcomes framework, while other factors suggest the effect lies to the upper end, for instance because KPMG/Aqua assume diminishing marginal benefits of the totex and outcomes framework over time.
- Europe Economics and KPMG/Aqua consider efficiency due to the totex framework would be in addition to ongoing productivity improvements. Ofwat notes that its' conclusion is consistent with taking an ongoing productivity adjustment to the upper-bound of Europe Economics range "with a small additional increment to take account of the impact of the totex and outcomes framework". Ofwat states that its proposal is also towards the midpoint of KPMG/Aqua's estimate of the combined effect of productivity growth and the outcomes framework.

B.1. Summary of KPMG's Analysis

KPMG/Aqua begin their analysis by examining water companies' actual and forecast outperformance over AMP6, using data from annual reports published in the second years of AMP6 (2016-17).[70] KPMG/Aqua then calculate the distribution of RoRE across companies (adjusted for the effect of profiling of expenditure over the AMP).[71] they then calculate the inter-quartile range of RoRE, which ranges from 0.0 and 2.7 per cent per year, and takes this as an estimate of the efficiency benefits from introducing totex and outcome-based regulation

67 Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.11.

68 Ofwat (January 2019), "FM_WW4 - Final Allowances.xlsx", "Controls" Sheet, cells F8 and F9.

69 Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.39-40.

70 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.73.

71 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.144.

during the first regulatory period.[72] KPMG/Aqua conduct a similar exercise for the first Ofgem price controls to implement a totex and outcomes regime, including DPCR5 (for electricity distribution between 2010 and 2015).

KPMG/Aqua consider that, since PR19 is the second price control since Ofwat introduced its totex and outcomes framework, the gains from totex and outcomes are likely to be lower than over the last AMP, "part of the efficiency gains during the first totex control may represent catch-up efficiency for opportunities that were previously available but were not exploited".[73] Therefore, KPMG/Aqua examine actual outperformance over RIIO-ED1 (for electricity distribution between 2015 and 2023), the only UK example of a second price control after the introduction of a totex and outcomes framework. KPMG/Aqua estimate the interquartile range of outperformance during RIIO-ED1 to be between -0.3 per cent and 1.2. per cent (compared to between 0.7 per cent and 2.6 per cent during DPCR5).[74]

In its proposals, Ofwat assumes the *ratio* of outperformance between RIIO-ED1 and DPCR5 can be used to estimate the ratio of outperformance in the water sector in AMP7 relative to AMP6, so multiplies the AMP6 outperformance by this ratio. KPMG's procedure results in an interquartile range on predicted outperformance, which it takes to represent the benefits of the totex/outcome-based regime, of between 0.0 per cent and 1.2 per cent per annum.[75] We understand KPMG/Aqua then take a range between the median and upper quartile, resulting in an estimate of the gains from totex at 0.2 per cent - 1.2 per cent per annum over AMP7.[76]

KPMG/Aqua also conduct the above analysis under an alternative but similar approach. KPMG/Aqua describe their second approach as relaxing the implicit assumption that all outperformance is attributable to gains from the totex and outcomes framework, and should be attributing some observed outperformance to "persistent company-specific factors". Under this approach, KPMG/Aqua compared companies' outperformance in the price control before the introduction of the totex regime to their outperformance in the period after the introduction of the totex regime.[77] However, Ofwat takes KPMG/Aqua's first approach as its primary estimate of gains from the totex and outcomes framework, concluding that the second approach does not reflect Ofwat's approach to setting allowances, and because it asserts this alternative approach could lead to spurious results.[78]

KPMG/Aqua also compare their estimates against evidence from other sectors and other examples of "structural changes"; for instance the efficiency gains from the creation of

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72 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.85.

73 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.93.

74 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.95.

75 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.95.

76 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.24.

77 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.71-72.

78 Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.40.

Scottish Water, and the separation form Openreach from BT.[79] KPMG/Aqua also reviewed case study evidence from water companies over PR14 where specific efficiency schemes resulted in significant cost savings.[80] They conclude that this evidence "corroborate[s] the range of potential efficiency gains that might be expected during the second totex control".[81]

B.2. The Justification for KPMG/Aqua's Conclusion is Unclear

KPMG/Aqua's reasons for recommending a 0.2 – 1.2 per cent adjustment on top of the separate ongoing productivity target are opaque and fail to provide a robust justification for its conclusions. KPMG/Aqua's analysis of water and energy companies' totex performance lacks any transparent explanation on how it has derived the final outperformance numbers that Ofwat uses to set the frontier target. This is especially problematic considering the numerous adjustments that KPMG/Aqua have made to the raw data to control for "other factors", as we discuss further in Section B.7. The lack of any supporting tables and step-by-step calculations makes it difficult for third parties to scrutinise its approach and undermines Ofwat's consultants' results.

Also, as we explained in Section B.1, KPMG/Aqua's procedure results in an interquartile range of predicted outperformance over AMP7, which it takes to represent the benefits of the the totex/outcome-based regime, of between 0.0 per cent and 1.2 per cent per annum.[82] In setting out its recommended range, KPMG/Aqua take a range between the median (rather than the lower quartile) and the upper quartile, resulting in an estimate of the gains from totex at 0.2. per cent to 1.2 per cent per annum over AMP7.[83]

It appears that KPMG's decision to take the median as the lower bound and upper quartile as the upper bound of its estimated totex outperformance range is solely based on "previous regulatory decisions" by Ofwat and Ofgem which have set catch-up efficiency targets using median or upper quartile performance.[84] Its conclusion does not, however, reflect any substantive economic evidence that would demonstrate that this "more stretching" efficiency growth is reflective of potential efficiency gains from totex/outcome-based regulation in the water sector over AMP7.

Overall, KPMG's conclusion is neither well-justified nor explained, and introduces arbitrary upward bias in its efficiency gains estimates, especially considering that KPMG/Aqua acknowledges there is a "wide dispersion of efficiency gains that could be attributed

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79 Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.38, *and* KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.17.

80 Ofwat (January 2019), Technical Appendix 2: Securing cost efficiency, p.38.

81 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.20.

82 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.95.

83 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.24.

84 KPMG notes: "For example, Ofwat set the capital expenditure baseline for the capital expenditure incentive scheme at the median at PR09. At PR14, Ofwat set efficiency challenge at upper quartile efficiency when estimating the totex cost baseline at PR14. Ofgem also used the upper quartile when setting totex baseline most recently for the RIIO-ED1 price control". Source: KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.23.

specifically to totex and outcomes, even when the lower bound is based on the median as per previous regulatory decisions".[85]

B.3. KPMG/Aqua Conflate Catch-up Efficiency and Frontier Shift

KPMG/Aqua has assumed that the data on outperformance on which it relies to compute the benefits of totex/outcome-based regulation do not comprise any element of catch-up efficiency. However, KPMG/Aqua's analysis cannot separate catch-up efficiency from frontier shift. KPMG/Aqua acknowledge (but do not correct for) this short-coming in their own analysis, stating that the "evidence" cannot support the assumption that "there are no elements of catch-up efficiency during the first totex price controls".[86]

KPMG/Aqua address this limitation by explaining that "part of the efficiency gains during the first totex control periods represented catch-up efficiency, which will not persist into the second totex control.".[87] Likewise, when appraising electricity distribution companies' performance KPMG/Aqua note that due to "the lack of empirical data to separate catch-up efficiency from on-going efficiency from cost performance during the first totex price controls, the analysis relies on observed evidence from RIIO-ED1."[88]

KMPG/Aqua's report is also refers ambiguously to the concepts of catch-up efficiency by individual companies within the water industry moving closer to the frontier water company, and catch-up by the water industry to other industries in the wider economy. This ambiguity notwithstanding, KMPG/Aqua's analysis does not control for these effects separately, or demonstrate that the outperformance data on which its results are based reflects the gains from the introduction of totex/outcome-based regulation. As we explain in Section B.4 below, this conclusion relies on numerous "critical" assumptions that, as KPMG/Aqua acknowledge may not hold in practice.[89]

B.4. KPMG/Aqua Err in Assuming Outperformance Reflects the Benefits of New Regulatory Methods

As explained above, KPMG/Aqua's analysis of the efficiency gains associated with totex/outcome regulation is based on an assessment of water and energy companies' totex outperformance in previous price controls. As KPMG/Aqua themselves acknowledge, equating outperformance (0.0 – 1.2 percent p.a.) to the benefits of totex/outcome regulation however relies on "a number of critical assumptions",[90] namely:

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85 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.24.

86 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.14.

87 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.14.

88 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.94.

89 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.22.

90 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.22.

1. "The lack of bias and accuracy of regulatory cost models, and that the only difference between the totex and non-totex price controls is the introduction of the totex and outcomes framework itself;
2. For energy, that the companies accurately predict their cost performance through to the end of the on-going price controls; and for water, that the companies adjust their outperformance for profiling effects on the same basis;
3. That there are no other external factors affecting outperformance beyond those that have been quantified and adjusted for in the analysis; and that other factors affecting realisable efficiency gains are under companies' control; and
4. That the same impacts are seen from totex and outcomes in different sectors."[91]

These assumptions are unlikely to hold in reality, and therefore its estimated benefits of new regulatory methods are entirely unreliable.

The first assumption that KPMG/Aqua acknowledge is that, for its approach to be valid, the efficiency gains achieved in the previous AMP (prior to totex/outcome-based regulation) would need to be fully captured in the regulatory allowance set by Ofwat for the AMP in which totex/output-based regulation was introduced. In practice, this is unlikely. Efficiency gains achieved in the previous AMP may not be fully reflected in allowances set at PR14, because the modelling to inform them took place before the end of the AMP (as is usual at price reviews).[92]

The second assumption is also unlikely to hold in practice because companies in regulated sectors have historically tended to "beat" their own forecasts of cost performance over price controls, as we discuss further below in Section B.6.

The third assumption that KPMG/Aqua make is that there are no external factors affecting companies' cost performance beyond the change in regulation, except for those for which KPMG/Aqua have controlled. As we further explain in Section B.7 below, KPMG/Aqua acknowledge that it is not possible to identify and control for *all* factors that may affect companies cost performance: outperformance may be due to factors outside companies' control (e.g. favourable weather conditions) and because cost performance analysis may not capture quality improvements.[93] Hence the inability to control for these other factors implies that it is not possible to equate cost outperformance to the benefits of a new regulatory model. KPMG/Aqua themselves agree with this conclusion, stating that it would therefore not "be appropriate to attribute all of the outperformance observed during the totex and outcomes price controls to efficiency gains".[94]

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91 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.22.

92 Linked to this assumption, another major limitation is that KPMG/Aqua assume the regulatory cost models, and resulting cost allowances, are "accurate" and "without bias". We discuss this assumption further in Section B.5. Source: KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.71.

93 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.83.

94 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.83.

KPMG/Aqua's fourth assumption suggests that the benefits from totex/outcome regulation are the same across all industries. For this assumption to hold, energy network companies and water companies would need to have the same scope for making improved capex/opex trade-offs, which is unlikely given the inherent differences in the technology and structure of the industries. For instance, it is possible that the potential for opex/capex substitution is greatest in the electricity industry because of huge technological change driven, amongst other things, by government subsidies aiming to decarbonise the energy system. These trends have resulted, for instance, in the emergence of more/cheaper distributed energy resource and smart grid technologies.

Also, as KMPG/Aqua also note, a faster take-up of the opex/capex trade-offs may have been possible in the water sectors than in the energy sector because of learning effects from the earlier adoption at DPCR5. If this is the case, the remaining effect (if any) of totex and outcome-based regulation in AMP7 might be lower than experience from electricity would suggest.[95]

Overall, based on the above, it is implausible to believe that any of the assumptions (on which KPMG/Aqua themselves state that their analysis relies) hold in practice. Therefore, by relying on KPMG/Aqua's results, Ofwat has not accurately estimated the "true" frontier shift that water companies can plausibly achieve over AMP7.

B.5. KPMG/Aqua's Approach Requires Accurate Cost Models

As described above, KPMG's conclusion relies upon the assumption that the regulatory cost models used at periodic reviews are unbiassed and accurate, and that the only difference between the totex and non-totex price controls is the introduction of the totex and outcomes framework itself. This assumption does not hold in reality, which can be illustrated, for example, by the marked changes in such models between price controls. Such changes demonstrate the material inaccuracies in the extent to which models accurately forecast efficient costs.

In particular, there is evidence that the cost models used at PR14 may have led to a particularly inaccurate assessment of companies' costs, and therefore outperformance of allowances cannot be attributed to the totex and outcomes framework.

Firstly, the Competition and Markets Authority's (the CMA) decision on the Bristol Water's referral at PR14 found that Ofwat's cost assessment models failed to adequately reflect Bristol Water's costs, and identified a series of issues with Ofwat's cost assessment approach.[96] While the CMA's determination only assessed the ability of the benchmarking models to predict Bristol Water's costs, the CMA's findings demonstrated material failings with the cost assessment approach that would have affected all companies. Ofwat has revised its cost assessment approach at PR19 in part to address comments made by the CMA.[97]

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95 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.15.

96 CMA (October 2015) Bristol Water plc – A reference under section 12(3)(a) of the Water Industry Act 1991: Report, p.7 and p.70-73.

97 Ofwat (January 2019), Assessment of RIIO-ED1 business plans and fast-tracking.

To illustrate the change in benchmarking models between PR14 and PR19, we have estimated the efficiency scores for all companies using Ofwat's and the CMA's PR14 models with the PR19 dataset.[98] For Ofwat's PR14 models, we have limited our analysis to its botex models, since its "totex" models are not comparable with Ofwat's approach at PR19. Our results are shown below in Table B.1.

Table B.1: Efficiency According to Alternative Cost Assessment Models in England and Wales Water Sector

	Triangulated PR19		Triagulated Ofwat PR14		Triagulated CMA PR14	
Company	Efficiency score	Rank	Efficiency score	Rank	Efficiency score	Rank
PRT	0.82	1	0.49	1	0.79	1
YKY	0.86	2	0.93	6	0.83	3
DVW	0.86	3	1.02	12	0.90	7
WSX	0.95	4	0.96	8	1.07	10
SWB	0.95	5	0.90	5	0.83	2
SRN	0.96	6	1.01	11	1.09	12
SSC	0.98	7	0.83	2	0.86	4
NES	0.98	8	0.96	9	0.89	6
ANH	0.99	9	0.87	3	0.88	5
TMS	1.02	10	0.94	7	1.15	16
SEW	1.02	11	1.00	10	0.96	9
SVT	1.02	12	1.08	14	1.10	14
AFW	1.05	13	1.02	13	1.08	11
NWT	1.07	14	1.12	15	1.21	17
BRL	1.07	15	1.31	17	1.14	15
SES	1.11	16	0.87	4	0.94	8
WSH	1.18	17	1.15	16	1.09	13

Source: NERA analysis of Ofwat data.
Note: Efficiency scores are shaded from yellow (largest) to green (smallest).

As the table shows, the range of efficiency scores, as well as individual companies' ranks, vary markedly between the models. For instance, the results obtained using the PR19 models suggest that the efficiency scores range between 1.18 and 0.82 while Ofwat's PR14 models estimate that efficiencies range between 1.31 and 0.49. The differences in results between the models show that the models PR14 models performed relatively poorly at explaining variation in costs across firms.

As companies' cost allowances are based on the upper quartile efficiency value (i.e. the efficiency score of the 5th ranked company in this case), we look specifically at the differences between these values in the models, as shown in Table B.2.

[98] CMA models: CMA (6 October 2015) Bristol Water plc – A reference under section 12(3)(a) of the Water Industry Act 1991: Report, ch.4

Ofwat models: Ofwat (20 March 2014) Cost assessment – Advanced Econometric Models, ch.2

Table B.2: Upper Quartile Efficiency Scores

	Triangulated PR19	Triangulated CMA PR14	Triangulated Ofwat PR14
UQ	0.95	0.88	0.90
UQ company	SWB	ANH	SWB

Source: NERA analysis of Ofwat data.

The results show that the upper quartile efficiency score, which defines the scale of efficiency challenge for the industry over the following AMP, varies markedly depending on which model is applied. This analysis shows that KPMG's assumption that the models used by regulators at previous price reviews provides an accurate assessment of companies' costs over the following control period is simply not credible. As such, its analysis of expenditure outperformance will conflate the effects of model error and the impact of totex and outcome-based regulation.

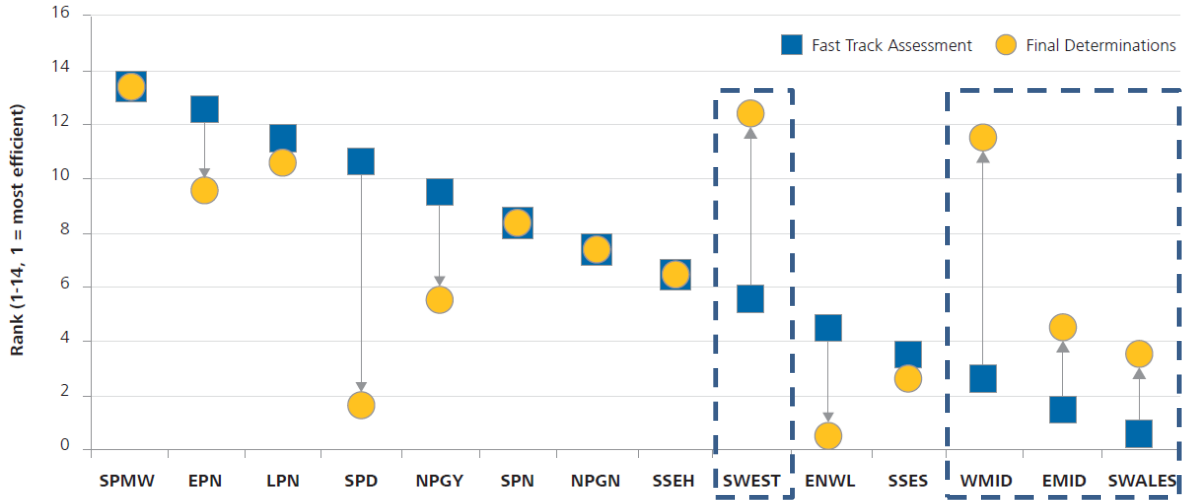
Similar evidence on the inaccuracy of regulatory cost models is available for electricity distribution. Ofgem granted fast-track status to the four DNOs owned by Western Power Distribution at RIIO-ED1, meaning that their price control was settled early, before final determinations were published for the remaining 10 networks.[99] Between its fast-track assessment and its final determination, Ofgem's modelling changed materially, altering DNOs' modelled efficiency gaps (see Figure B.2). Since the fast-track efficiency assessment was binding for the DNOs selected for fast-tracking (WMID, EMID, SWALES and SWEST), they were granted allowances based on their business plans, which Ofgem accepted in full. However, Ofgem's subsequent analysis suggested these allowances were materially higher relative to the allowance WPD would have received from application of the updated benchmarking models Ofgem used in the final determination.[100]

Therefore, Ofgem's own analysis (at a later stage of the same Price Control) shows that the regulatory cost models which Ofgem used to set some companies' allowances are inaccurate.

[99] Ofgem (November 2013), RIIO-ED1: Final determinations for the slow-track electricity distribution companies.

[100] Ofgem (2014), *"RIIO-ED1: Final determinations for the slow-track electricity distribution companies Business plan expenditure assessment"*, Table 2.5.

Figure B.2
At RIIO-ED1 Companies' Relative Efficiency Ranking Changed Markedly Between Fast-Track Assessment and Final Determination
(Dashed box highlights the fast-tracked WPD companies)



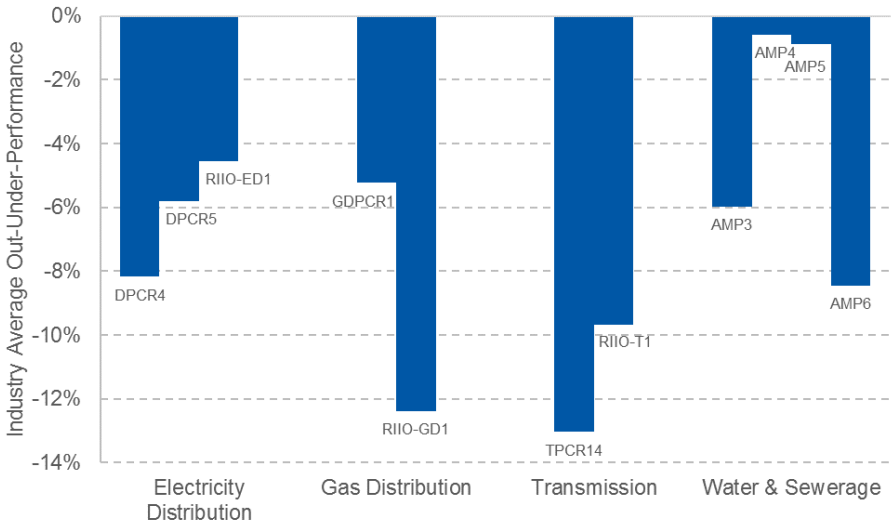
Source: NERA analysis of Ofgem data.

B.6. Outperformance has Been Common Before and Since the Introduction of Totex/Output-based Regulation

As noted above, KPMG/Aqua's results rest on the assumption that all "outperformance observed during the price control period where totex and outcomes framework is in place reflects efficiency gains due to the introduction of the framework itself".[101] This assumption is not realistic and unlikely to hold in practice as evidence of historical cost performance across the regulated industries shows. Since the inception of incentive regulation in the UK in the 1990s, companies have regularly out-performed the allowances set by regulators, responding to the incentives under ex-ante regulation to minimise costs. Hence, as Figure B.3 shows for recent price controls in the energy and water sector, it should not come as a surprise that companies have on average outperformed across regulated industries in the most recent price controls set by Ofwat and Ofgem since the introduction of totex/outcome-based regulation.

[101] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.30.

Figure B.3: Historical Average Cost Performance Across Regulated Industries in GB



Source: NERA analysis of Ofgem and Ofwat data.

Also, as Figure B.3 shows, cost outperformance has changed over time in a way that is not obviously caused by the introduction of totex and outcome-based regulation. For example, in the period before the introduction of totex regulation average outperformance was substantially larger than outperformance following the introduction of the new regulatory methods in both electricity transmission and distribution (TPCR14 and DPCR4). The gas sector is experiencing higher cost outperformance under RIIO-GD1 on average compared to the period before the introduction of totex/outcome regulation (GDPCR). However, as KPMG/Aqua note, this is largely explained by the lower than expected unit costs associated with companies' replacement programme.[102] Even if the totex regime supported reductions in the unit cost of GDNs' repex programmes, the magnitude of outperformance reflects the degree to which Ofgem anticipated this effect when setting targets, and the absolute value of the outperformance cannot be mapped onto the water sector directly due to the specific circumstances in which this was achieved.

What this evidence suggests is that other factors, beyond a new regulatory framework, explain companies' cost outperformance over time, as KPMG/Aqua themselves acknowledge (see Section B.7 below). Therefore KPMG/Aqua's key assumption that cost performance equates to the efficiency gains from totex/outcome regulation is unproven and unlikely to hold in practice.

B.7. Other Drivers of Outperformance Controlled for by KPMG/Aqua Are Limited to those the Companies Identified

As explained in Section B.4, KPMG/Aqua's analysis rests on the assumption that "no other external factors" affect companies outperformance "beyond those that have been quantified"

[102] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.79.

by the companies in their regulatory reporting.[103] This assumption is fundamentally flawed in three respects.

First, KPMG's approach is driven primarily by what water companies report rather than by any robust economic and statistical analysis that demonstrates which factors significantly drive cost performance between price controls.[104] For regulated energy network companies, KPMG/Aqua state that they make adjustments for additional factors unrelated to totex/outcome only "to the extent that they are identified and quantified by Ofgem in various performance reports".[105]

However, KPMG/Aqua note there are indeed other factors (e.g. falling unit prices for replacement programs at DPCR5 and RIIO-GD1) that affect companies' cost performance which have not been quantified and do not relate to totex/outcome regulation.[106] In limiting its adjustment to what companies or Ofgem report, KPMG/Aqua admit that "it is unclear […] whether these adjustments are exhaustive".[107] This limited range of adjustments undermines KPMG/Aqua's ability to measure the effect of totex/outcome related efficiency gains.

Second, KPMG/Aqua adopt an inconsistent approach to applying adjustments across price controls. For example, KPMG/Aqua have adjusted energy companies' cost performance figures to control for the ongoing outperformance on RPEs in ED1. However, it fails to apply the same adjustment to companies' cost performance during earlier price controls. KPMG/Aqua's results are therefore distorted by assuming that RPEs did not have any influence on cost performance in previous price controls (e.g. DPCR5).

Likewise, KPMG/Aqua have adjusted baseline DPCR5 revenues to account for the closeout adjustment made by Ofgem for load-related and High Value Projects re-openers and "cost allowances associated with output gaps".[108] From their report, it is unclear how exactly they have applied these adjustments. However, assuming they have adjusted baseline allowances in DPCR5, there is a risk that KPMG/Aqua have not considered the impact of DPCR5 closeout adjustments on allowed revenue during the RIIO-ED1 control period.[109]

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103 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.140.

104 KPMG states: Companies' cost performance are adjusted for these additional factors to the extent that they are identified and quantified by companies in their annual performance reports.". Source: KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.73.

105 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.73 and p.78.

106 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.79.

107 KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.73.

108 KMPG/Aqua report the following adjustment for DPCR5: Adjustments to baseline revenue allowances for 1) the differences between efficient qualifying expenditures and cost allowances for load-related expenditures and high-value projects; and 2) cost allowances associated with output gaps. These are quantified by Ofgem in its consultation and decision documents on DPCR5 Closeout. Source: KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.78.

109 Ofgem states: "Final adjustments will be made through RIIO-ED1 allowed revenues, and we will determine revised OLREV and RIREV values by 30 November 2017, for the purpose of the Annual Iteration Process (AIP)". Source: Ofgem (15 September 2017), DPCR5 Closeout: decision on adjustments to allowances, p.3.

Finally, KPMG/Aqua cannot possibly control for all factors influencing outperformance besides the introduction of totex and outcome-based regulation. KPMG/Aqua acknowledge this important limitation by providing examples of the factors that may affect companies' performance that are not associated with totex/outcome regulation, including:[110]

- Factors during the price control that are outside companies' control, such as favourable weather conditions which may reduce maintenance costs but also, as KPMG/Aqua mention, features of the regulatory framework such as "the quality of the efficiency challenge and the robustness of the cost baseline set by the regulator including any forecast allowances".
- Cost performance analysis may not capture improvement in quality of other non-monetised goods such environmental benefits (e.g., through reduced leakage) or social costs/benefits.

It follows that KPMG/Aqua's inability to control for these other factors undermines the fundamental assumption that "outperformance during the current price control therefore purely reflects efficiency gains" and therefore KPMG/Aqua's results.[111] KPMG/Aqua themselves agree with this conclusion stating that it would therefore not "be appropriate to attribute all of the outperformance observed during the totex and outcomes price controls to efficiency gains".[112]

B.8. KPMG/Aqua's "Cross-checks" Provide No Evidence on the Impact of Totex/Outcome-based Regulation

According to their report, KPMG/Aqua carried out two additional cross-checks of their conclusions: they (i), reviewed examples of efficiency gains arising after "significant changes in different sectors and contexts", and (ii), reviewed case study evidence of efficiency gains which companies attribute to the totex and outcomes framework.[113] KPMG/Aqua conclude that this evidence "corroborate[s] the range of potential efficiency gains that might be expected during the second totex control".[114]

KPMG/Aqua's examples of structural change range from changes of ownership (such as nationalisation and privatisation), the introduction of competition in previously regulated sectors, and changes in regulatory regime, such as the legal separation of Openreach from BT.[115] By comparing costs before and after these wide-ranging examples, KPMG/Aqua find a range of changes in costs, which KPMG/Aqua "generally" measured in terms of operating

[110] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.83.

[111] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.83.

[112] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.83.

[113] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.10.

[114] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.20.

[115] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.101-116.

costs, between -0.8 per cent per year over five years to 13.4 per cent.[116] Based on this analysis, KPMG/Aqua concludes that gains from the establishment of Scottish Water sets an upper bound estimate of the gains from the totex and output regime, at 6.7 per cent per annum.[117] However, KPMG/Aqua provide no evidence or comment as to why the creation of Scottish Water is comparable to the introduction of the totex and outcomes framework.

KPMG/Aqua's review of case study evidence from the water sector consists of a qualitative review of schemes which companies submitted in response to Ofwat's data request, which sought "examples of innovative activity by companies making use of the totex and outcomes framework to derive results".[118] KPMG/Aqua conclude that, because the 48 schemes represent around 3.8 per cent of capex spend over AMP6, and led to 35.4 per cent cost savings on average, that these schemes demonstrate that a 1.3 per cent totex saving over AMP6 can be attributed to frontier shift due to the totex and outcomes framework.

KPMG/Aqua's analysis of these schemes provides no explanation of why or how these schemes relate to the gains from the totex and outcomes framework.[119] In particular, it is not clear why these schemes do not represent catch-up efficiency, ongoing productivity growth (e.g. due to technological change), or other types of innovation that would have happened under the AMP5 regulatory framework.

Furthermore, while there may be reason to think companies had an incentive to favour capex over opex solutions under the previous regime, it is not reasonable to assume all projects which involve opex-capex substitution would not have happened prior to PR14, since companies still faced strong incentives to minimise their expenditure across both capex and opex.

B.9. Conclusion on KPMG/Aqua Report

We have identified serious problems with the KPMG/Aqua consulting study that informed Ofwat's proposals. The hypothesised effect of a regulatory change to totex benchmarking is not proven in KPMG/Aqua's analysis.

Indeed, the form of analysis used to derive Ofwat's proposed target cannot identify this hypothesised effect. KPMG/Aqua analyse outperformance data and label this as the benefits of totex/outcome-based regulation without offering any evidence that the two concepts are equivalent. To KPMG/Aqua's credit, they do list a number of assumptions that need to be satisfied for their approach to be accurate. Unfortunately, none of these assumptions are likely to apply in reality, so their analysis does not identify the effect of introducing totex/outcome-based regulation.

[116] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.115.

[117] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.116.

[118] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.39.

[119] KPMG and Aqua Consultants (June 2018), Innovation and efficiency gains from the totex and outcomes framework, p.39-69.

This precedent therefore provides no evidence that utilities subject to totex/outcome-based regulation should be able to achieve an ongoing productivity target higher than the rates of change in TFP indices discussed in Section 2.4 of this report.

Appendix C. Forecast of Labour RPEs over RIIO-T2

Our recommendation in Section 4.4 is that Ofgem does not use the same indices to set indexed RPE allowances as it has used in previous reviews to set ex ante allowances. Rather, we recommend that it indexes RPE allowances to CPIH (i.e. net zero RPEs and productivity across all categories over the RIIO-T2 control period).

However, we are aware that Ofwat's Draft Determination (DD) at PR19 takes a different approach to our recommendations, which Ofgem might decide to adopt. In the DD, Ofwat changed its initial recommendation of awarding no RPEs, as discussed in Appendix A, to recommending a specific labour RPE with a productivity target attached to it.

While we do not recommend this as the correct approach for Ofgem to take at T2, this appendix sets out what the labour RPEs for SPT would be over the RIIO-T2 control period should Ofgem apply this alternative approach. We apply the same forecast methodology, as set out in Section 3. In addition to the RPEs reported in this Appendix, there would need to a productivity target attached to it. We have not estimated this productivity target at this time.

C.1. Ofwat PR19 Draft Determination Labour RPEs

In its PR19 DD, Ofwat explains that it is considering allowing an RPE adjustment for labour cost inflation based on OBR real wage forecasts.[120] Ofwat's explains its decision as follows:

> "Labour costs are a material element of company costs, making up around 35% of wholesale totex. While there has not been a material wedge in wage costs over recent years, there is a material wedge in the OBR forecasts based largely on the assumed growth in labour productivity".[121]

Ofwat also concludes that manufacturing and water sector labour markets have similarities and are closely correlated to water sector wage growth. Therefore, it considers including an RPE adjustment for wages based on OBR real wage forecasts with a true up for manufacturing wages at the end of the period.

C.2. Labour RPEs Forecasting Methodology

As set out below, we have prepared three different labour RPE forecasts, which vary according to the choice of indices used to track movements in electricity network companies' input prices. We used the same index selections presented in Table 3.1 for the analysis in this Appendix: SP RIIO-ED1, and Ofgem RIIO-T1, and Ofgem RIIO-ED1.

For the period 2021/22 to 2023/24, we use the OBR's forecasts of labour cost inflation for each of the SP RIO-ED1, RIIO-T1, and RIIO-ED1 forecasts. We have relied on the OBR's most recent forecasts of economy-wide earnings and public sector earnings to forecast private sector earnings growth. We adjust the average hourly earnings index forecasts to represent

[120] Ofwat (July 2019), PR19 draft determinations, Securing cost efficiency technical appendix, p.144

[121] Ofwat (July 2019), PR19 draft determinations, Securing cost efficiency technical appendix, p.143

private sector pay growth only, using employment data from the OBR[122], and OBR CPI forecasts to further adjust the index to obtain real private sector wage growth forecasts.

For the period 2024/25 to 2025/26, we estimate the RPEs for labour cost using data published by ONS, BCIS and BEAMA. We extrapolate long-run growth rates in selected price indices relative to CPIH, as described in Section 3.2.2. The labour indices from the ONS estimate average weekly earnings for the indicated sectors and include bonuses but exclude arrears of pay.[123]

For the period 2024/25 to 2025/26, our forecasts using the SP and Ofgem RIIO-ED1 index selections use a weighted average of long-term growth rates for the 'Specialist Labour' and 'Labour' RPE indices (see Section 3.2.2). The weights are based on the shares of specialist and non-specialist labour in the cost structure for the notional company that Ofgem used at RIIO-ED1.

For the forecasts prepared using the Ofgem RIIO-T1 approach for the period 2024/25 to 2025/26, we used an unweighted average of the long-term growth rates resulting from regressions of both 'Specialist Labour' and 'Labour' indices.

C.3. Forecasting Labour RPEs over the RIIO-T2 Control Period

We display our labour RPEs forecast in Table C.1. The OBR forecasts are highlighted in light blue, whereas the forecasts based on a weighted average of the averages of the β parameters from regressions of the 'Specialist Labour' and 'Labour' RPE indices are highlighted in grey.

Table C.1: Labour RPE Forecasts (Real Growth, i.e. above CPIH) (%)

Category	2021/22	2022/23	2023/24	2024/25	2025/26	Average
Ofgem RIIO-T1						
Labour	1.2	1.2	1.4	1.0	1.0	1.2
Ofgem RIIO-ED1						
Labour	1.2	1.2	1.4	1.4	1.4	1.3
SP RIIO-ED1						
Labour	1.2	1.2	1.4	1.6	1.6	1.4

Note: Figures highlighted in light blue are OBR forecasts. Figures highlighted in grey are a weighted average of the averages of the β parameters from regressions of the 'Specialist Labour' and 'Labour' RPE indices.
Source: NERA analysis of RPE indices and OBR forecasts.

The final step in our analysis is to combine the forecasts shown in Table C.1 using weights representing the labour share of each input category included in SPT's opex, capex, and totex (see Table C.2).

[122] The OBR provides a breakdown of public and private sector employment numbers and public sector pay. Given the proportion of workers in the private sector, public sector pay, and economy-wide pay growth, we can derive the private sector contribution to economy wide pay growth.

See: OBR Website, URL: https://obr.uk/efo/economic-fiscal-outlook-march-2019/. Visited on 7 June 2019.

[123] ONS Website, URL: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/averageweeklyearningsearn01. Visited on 7 June 2019.

Table C.2: Scottish Power Cost Breakdown (%)

Type	Opex	Capex	Totex
Labour	49.6	36.3	37.7
Materials	5.5	38.2	34.9
Equipment/Plant	2.2	7.2	6.7
Other	42.6	18.3	20.8

Source: Scottish Power

Our forecast RPEs, based on only labour growth rates, for 2021/22 to 2025/26 are shown below (see Table C.3, Table C.4 and Table C.5). The results predict higher opex forecasts than capex and totex, whereas the results including materials, P&E and other RPE growth rates (see Table 3.4 in Section 3.3) show very similar forecasts for opex, capex, and totex. This change is driven by the lower share of the labour cost category in capex and totex, compared to opex, as shown in Table C.2.

The results show year-on-year increases in labour costs ranging from 0.38 per cent to 0.81 per cent. The forecasts show consistent, real increases in costs above CPIH, suggesting a tendency for electricity transmission companies' labour input costs to rise faster than inflation.

Table C.3: Forecast RPEs Based on Indices from SP-RIIO-ED1 (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Avg
Combined Opex	0.59	0.61	0.67	0.81	0.81	0.70
Combined Capex	0.43	0.45	0.49	0.60	0.60	0.51
Combined Totex	0.45	0.46	0.51	0.62	0.62	0.53

Source: NERA analysis

Table C.4: Forecast RPEs Based on Indices from RIIO-T1 (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Avg
Combined Opex	0.59	0.61	0.67	0.52	0.52	0.58
Combined Capex	0.43	0.45	0.49	0.38	0.38	0.43
Combined Totex	0.45	0.46	0.51	0.40	0.40	0.44

Source: NERA analysis

Table C.5: Forecast RPEs Based on Indices from RIIO-ED1 (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Avg
Combined Opex	0.59	0.61	0.67	0.70	0.70	0.65
Combined Capex	0.43	0.45	0.49	0.51	0.51	0.48
Combined Totex	0.45	0.46	0.51	0.53	0.53	0.50

Source: NERA analysis

If Ofgem decides to set a specific labour RPE allowance for SPT over the RIIO-T2 control period, we recommend using an unweighted average of the three forecasts presented above, as shown in Table C.6.

Table C.6: Average of the Three Forecast RPEs (%)

	2021/22	2022/23	2023/24	2024/25	2025/26	Avg
Combined Opex	0.59	0.61	0.67	0.68	0.68	0.64
Combined Capex	0.43	0.45	0.49	0.50	0.50	0.47
Combined Totex	0.45	0.46	0.51	0.51	0.51	0.49

Source: NERA analysis

Should Ofgem adopt allow a specific RPEs for labour costs, it needs to be accompanied by a productivity target. We have not estimated this productivity target at this time.

Qualifications, assumptions and limiting conditions

NERA Economic Consulting ("NERA") was commissioned by SP Energy Networks to provide advice on Real Price Effects and ongoing productivity improvement in the context of its "RIIO-T2" business planning process. The primary audience for this report includes Ofgem and other parties with an interest in the utilities industry.

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