An assessment of real price effects

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Prepared for Dŵr Cymru

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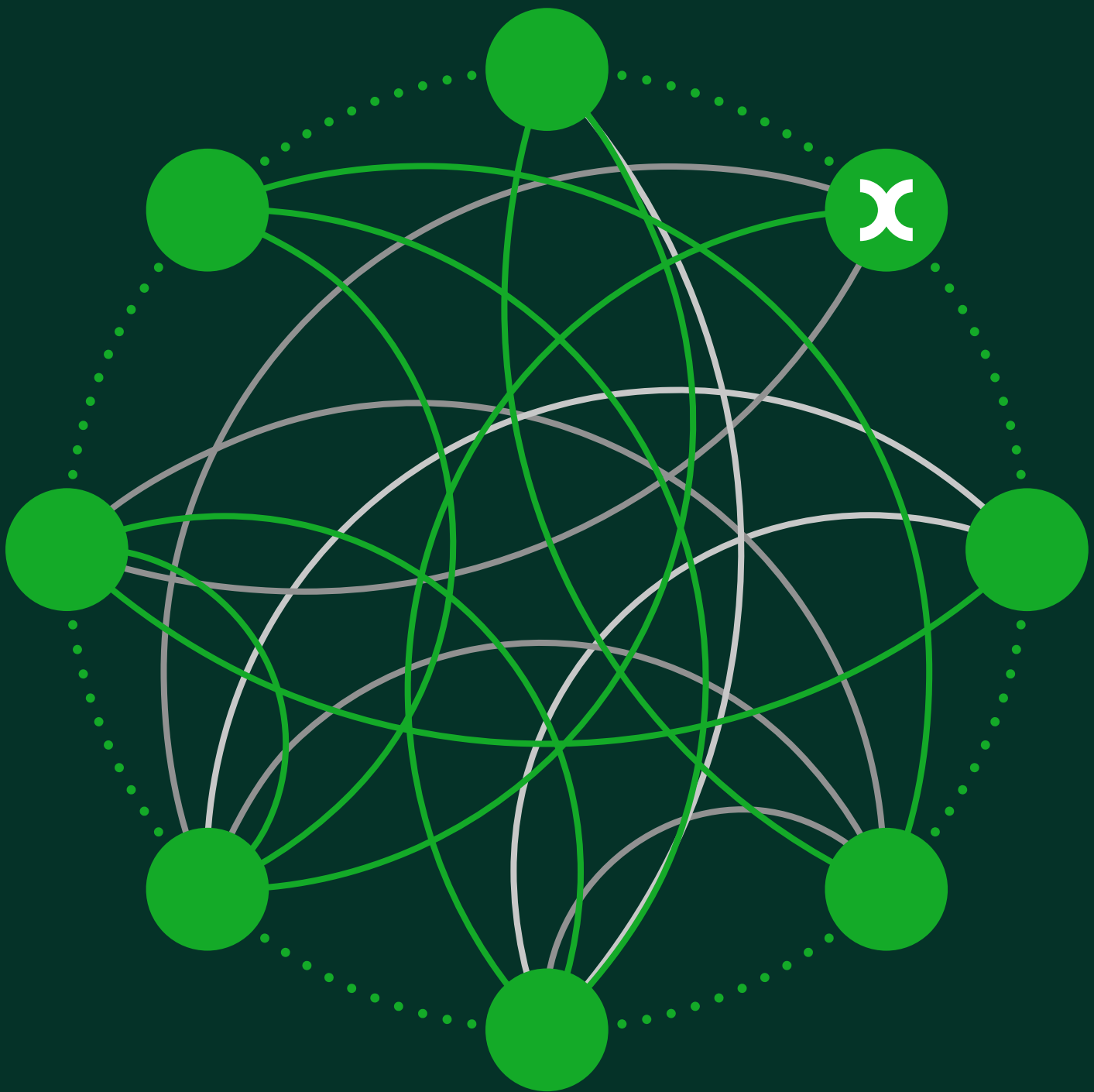

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Executive summary

Water companies and other regulated utilities are typically considered 'price takers' for the inputs they require in the production process. That is, water companies cannot exert market power to influence the prices of inputs (e.g. energy, chemicals) that are instead determined by wider market forces. While companies can mitigate the impact of input price increases in some cases (through fixed-price contracts, prudent managing, etc.), the medium- and long-term price of inputs is largely determined by the wider economy. As such, input prices are considered as exogenous in the cost assessment process.[1]

At PR19, Ofwat indexed wholesale revenues to CPIH inflation. That is, if outturn CPIH inflation in AMP7 was higher (or lower) than what Ofwat forecast at the time of the price review, companies' allowed wholesale revenues would be adjusted upwards (or downwards) to compensate them or their customers for unexpected changes in economy-wide inflation.[2] Moreover, Ofwat undertook an assessment of real price effects (RPEs) to determine the expected changes in the input prices of specific inputs relative to CPIH for the upcoming price control (i.e. AMP7).

For the residential retail price control, Ofwat had no such indexation mechanisms. At the Initial Assessment of Plans (IAP) stage, Ofwat's consultant, Europe Economics, undertook an assessment of input price pressure (IPP) in nominal terms (i.e. without regard to CPIH). Ultimately, Ofwat did not provide a separate allowance for IPPs, and companies were expected to absorb changes in input prices that were not implicitly accounted for in its cost modelling framework.[3]

Dŵr Cymru (Welsh Water, 'WSH') has asked Oxera to assess the impact of input price pressure on its allowed revenues for PR24. As part of our analysis, we have drawn on precedent from PR19 and external data sources. To the extent possible, our analysis is intended to align with how Ofwat has requested such information in the PR24 business plan

[1] For example, Ofwat included regional wages as an exogenous cost driver in its PR14 models; see CEPA (2014), 'Cost assessment—advanced econometric models', March.
[2] In the wholesale price controls, labour costs were further indexed to a labour cost index—if real labour costs were higher (lower) than what Ofwat forecast at PR19, companies' revenues would be adjusted upwards (downwards).
[3] Ofwat used a combination of forward-looking and backward-looking benchmarks to set residential retail allowances at PR19. The use of a forward-looking benchmark captures (to some extent) the IPPs assumed by the companies that were assessed to be efficient under Ofwat's models.

data tables. In this respect, we have examined the price pressure associated with the following inputs:

- labour (wholesale and residential retail separately);
- energy (wholesale only);
- chemicals (wholesale only);
- materials, plant and equipment (wholesale only).

Our approach to assessing the RPEs associated with these inputs is discussed in more detail below.

Wholesale labour

Labour is typically the largest single input (by share of TOTEX) in the wholesale and residential retail price controls. At PR19, labour was the only input for which Ofwat made an RPE allowance. The ex ante allowance was estimated using Office of Business Responsibility (OBR) forecasts for average real earnings. However, Ofwat acknowledged that the OBR forecasts had historically been inaccurate, and it would be inappropriate to reward or penalise companies on the basis of inaccurate forecasts. Therefore, Ofwat also indexed labour costs to the 'Annual Survey of Hours and Earnings' (ASHE) manufacturing index.

For wholesale labour, we undertake analysis similar to that undertaken by Ofwat at PR19. In particular, we use OBR forecasts to predict the labour RPE for the first few years of AMP8. As the OBR forecasts do not cover all of AMP8 (which ends in 2029/30), we supplement them with an analysis of the historical evolution of the ASHE manufacturing index in the years for which we do not have forecast data.

The table below shows the estimated RPE in wholesale labour costs.

Labour RPE

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	AMP8 average
Labour RPE	1.10%	1.70%	1.70%	1.30%	0.80%	0.90%	0.90%	1.11%

Source: Oxera analysis.

The estimated RPE is c. 1.1% p.a. on average for AMP8. However, the estimated RPE is based on a combination of OBR forecasts and

historical analysis, both of which are estimated with some degree of uncertainty. Indeed, Ofwat itself forecast that the ASHE manufacturing wage growth would outpace CPIH inflation at PR19,[4] yet in the first few years of AMP7, inflation has been above the ASHE manufacturing wage growth. Therefore, we consider that, apart from an ex ante allowance for the estimated RPEs, an indexation mechanism akin to the PR19 true-up mechanism could be appropriate at PR24.

Energy

Energy prices have been particularly volatile in recent years, owing to post-COVID-19 economic growth and geopolitical events. While companies can mitigate the impact of short-term energy price fluctuations (e.g. through hedging), sustained increases in energy prices will feed into higher costs in the medium and long term.

At PR19, Ofwat did not make an allowance for energy RPEs. It examined the evolution of the energy price index published by the Department for Business, Energy & Industrial Strategy (BEIS) compared to CPIH, and concluded that there was insufficient evidence that energy price trends materially differed from CPIH. Moreover, Ofwat did not have faith in external energy price forecasts (again from BEIS). In the first few years of AMP7, energy prices have increased materially in relation to CPIH, and companies have had to largely absorb this IPP.[5]

We have explored the use of forecasts provided by BEIS. These typically show a decline in energy prices from the current high levels, although there is significant uncertainty regarding these price trends. As such, and as the BEIS forecasts have been historically inaccurate, we do not use them to assess energy RPEs.

In this regard, WSH has undertaken a detailed assessment of the likely energy RPE in AMP8. The table below summarises its findings.

[4] See Ofwat (2019), 'PR19 final determinations: Securing cost efficiency technical appendix', December, Table 22.
[5] Ofwat's cost-sharing mechanisms mean that some overspend is shared with consumers in the form of higher bills. The extent to which companies are protected from overspend depends on the value of the cost sharing rate that Ofwat applied at PR19 (or that applied by the CMA for the appellant companies.

Energy RPE

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	AMP8 average
Energy RPE	-12.70%	-5.00%	-4.00%	1.40%	-4.60%	-1.60%	-0.90%	-1.94%

Source: Oxera analysis.

The analysis shows that WSH expects energy prices to fall on average in AMP8. However, we note that the forecasts of energy prices are particularly uncertain—the BEIS forecasts are materially different under different scenarios, and both of these 'external forecasts' are materially different to the analysis of historical trends in real energy prices. Given the material uncertainty in predicting energy prices in AMP8, a prudent option could be to index energy costs to an appropriate energy price index.

Chemicals

Chemicals are a key input in the water and wastewater treatment processes. While 'chemicals' is a somewhat broad category—and there may be different price pressures for different types of chemicals—we consider that the use of the Office for National Statistics' (ONS) 'chemicals and chemical products' price indices is a proportionate method for modelling chemical RPEs.

Ofwat used the same index to assess RPEs in chemicals expenditure at PR19. However, it deemed that the share of chemicals within TOTEX was immaterial such that no RPE was required. However, the price of chemicals has increased materially in recent years, in part driven by the increase in real energy prices.[6] As such, as with increased energy prices, companies have had to absorb this cost pressure in the absence of appropriate indexation.

Unlike labour and energy, we are unaware of well-established institutions that provide forecasts of the 'chemicals and chemical products' indices, and Ofwat did not explore third-party forecasts of chemicals prices at PR19. However, as the chemicals industry is one of the most energy-intensive industries in the economy,[7] one would expect

[6] The cost of chemicals is materially affected by the cost of energy. See ING (2022), 'The sectors most affected by soaring energy prices', Economic and Financial Analysis, 3rd June
[7] See ING (2022), op. cit.

the prices of chemicals to be strongly associated with energy prices. Indeed, we estimate a strong correlation between chemicals price inflation and energy price inflation.[8] We use the estimated statistical relationship between chemicals prices and energy prices alongside WSH's energy price forecasts to estimate a forward-looking chemicals RPE.

The table below shows the estimated chemicals RPE on the basis of this analysis.

Chemicals RPE

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	AMP8 average
Chemicals RPE	-8.37%	-4.01%	-3.28%	-1.31%	-2.92%	-1.87%	-1.65%	-2.21%

Source: Oxera analysis.

Given the anticipated decline in real energy prices, real chemical prices are also expected to fall in AMP8. However—alongside the uncertainty associated with the energy price forecasts outlined above—there is additional uncertainty relating to the modelled relationship between chemicals prices and energy prices. Therefore, the estimated decline in chemicals prices should be interpreted with caution. As with energy prices, we recommend that appropriate mechanisms should be in place to adjust allowances if the outturn environment differs to what is currently anticipated.

Materials, plant and equipment

Materials, plant and equipment (MPE) is the second-largest material input in wholesale TOTEX. As with chemicals (or even more so), MPE covers several distinct inputs that may be subject to different price pressures. At PR19, Ofwat examined a series of indices representing different types of materials.[9] While some were found to materially deviate from CPIH, Ofwat concluded that the there was insufficient

[8] Specifically, the BEIS industrial energy price index.
[9] These include two Building Cost Information Service (BCIS) indices and several ONS indices. As BCIS indices are not in the public domain, we do not consider them in this report.

evidence that a significant wedge existed between materials prices and CPIH and therefore did not provide an RPE allowance at PR19.

Building on the PR19 approach, we examine the following three publicly available input price indices.

- The Construction Output Prices Indices (COPIs) provide an estimate of inflation within the UK construction industry.
- The Construction Material Price Indices (CMPIs) give a measure of the notional trend of input costs to a contractor in terms of changes in the cost of building materials, i.e. factory gate prices charged by materials manufacturers.
- An average index comprising the following indices: the 'All Work' COPI, the 'All Construction' CMPI, the 'Other pumps and compressors for domestic market' index and the 'Machinery and equipment n.e.c for domestic market' index.

We find that the three indices follow broadly similar trends until c. 2021, where CMPI diverges from the other two indices. This underscores the uncertainty with respect to how MPE input prices have evolved historically, as well as the uncertainty associated with forecasting such input prices into the future.

We are unaware of external forecasts relating to MPE-related price indices, and Ofwat did not explore such forecasts at PR19. Therefore, one approach to estimate the RPE in MPE could be to examine the historical trends in relevant price indices. However, different indices lead to materially different estimated RPEs, and some of the indices may have been affected by the recent increase in energy prices. As such, based on the price indices we have considered, an ex ante RPE for MPE does not appear to be robustly motivated.

Nonetheless, given the volatility in historical trends, a well-designed indexation mechanism for MPE may be required.

Retail labour

Labour constitutes a material proportion of residential retail costs. At the IAP stage, Europe Economics recommended that an ex ante allowance based on projected CPIH should be applied to residential retail labour costs. Ultimately, Ofwat did not provide an explicit allowance for labour IPP in residential retail. However, Ofwat used a combination of forward-looking and backward-looking benchmarks to set residential retail cost allowances. As such, the IPP assumed by

companies that were assessed to be efficient by Ofwat were partially reflected in all companies' cost allowances.

Unlike in the wholesale controls, Ofwat did not index revenues to a retail labour cost index at PR19. Therefore, companies are required to absorb the impact of increasing (nominal) wages in the residential retail price control, to the extent that nominal wage growth has been higher than that assumed by the companies estimated to be efficient at PR19.

As in the wholesale price controls, water companies are price-takers with respect to the inputs they use in the residential retail price control. Therefore, an investigation into the likely evolution of residential retail input prices is warranted, and Ofwat has requested such information in the PR24 business plan data tables.[10]

We have explored the following ASHE indices to assess residential retail labour cost pressures:

- average hourly wages for workers in a retail trade, except for motor vehicles and motorcycles;
- average hourly wages for workers involved in office administrative, office support and other business support activities;
- average hourly wages for workers involved in administrative and support service activities;
- average hourly wages for workers involved in business support service activities n.e.c;
- the average of all four of the above indices.

Following a similar approach to our assessment of wholesale labour, we use OBR forecasts of average earnings for the years in which forecast data is available, and use the historical average RPE for the four retail labour indices outlined above for the remaining years.

The estimated RPE for residential retail labour costs is shown in the table below.[11]

[10] There is no option in the business plan data tables to provide a separate price assumption in the residential retail price control and the wholesale price controls. The implicit assumption is that wholesale labour and retail labour are subject to the same cost pressures, which is a testable hypothesis. In this report, we treat wholesale labour and retail labour as separate inputs.
[11] Residential retail is a nominal price control and Ofwat should therefore account for nominal price pressure (as opposed to real price pressure) when setting AMP8 allowances. However, given that the data tables do not allow companies to submit nominal IPP, the figures presented in the table below show the real IPP.

Retail labour RPE

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	AMP8 average
Labour RPE	1.10%	1.70%	1.70%	1.30%	0.80%	0.30%	0.30%	0.88%

Source: Oxera analysis.

The analysis shows that real labour prices are expected to increase by c. 0.9% p.a. throughout AMP8.

Concluding remarks

While the tables above represent appropriate estimates of the RPEs that companies are likely to face in AMP8, these are measured with considerable uncertainty. Indeed, the general uncertainty associated with macroeconomic forecasts is well understood, as forecasts from several established institutions (including BEIS and the ONS) have differed materially from the eventual outturn figures. As such, a fixed ex ante allowance for input prices could create windfall gains and losses unless there are mechanisms in place to adjust allowances if the outturn differs from expectations.

To mitigate these risks, regulators often consider providing an ex ante allowance for input price pressures where a material wedge between IPP and CPIH is expected, and subsequently indexing revenues to input price indices to account for forecasting uncertainties. Indeed, Ofwat indexed wholesale revenues to a labour price index at PR19, and Ofgem indexed 87.9% of electricity distribution network operators' TOTEX to price indices other than CPIH in the latest energy price control.[12] Therefore, we consider that it would be both practical and prudent for Ofwat to index revenues to appropriate external price indices, especially in the particularly uncertain context of PR24.

With respect to the inputs assessed in this report, there is a clear wedge between wholesale labour costs and CPIH, both on an outturn and a forward-looking basis. As such, it may be appropriate for Ofwat to provide an ex ante allowance for labour RPEs on the basis of OBR forecasts (and historical information regarding the ASHE manufacturing index), and have an associated uncertainty mechanism to adjust

[12] Ofgem (2022), 'RIIO-ED2 Final Determinations Core Methodology Document', December, para. 7.610.

allowances if the outturn ASHE manufacturing index differs from expectations. This is aligned with Ofwat's approach at PR19.

For the other wholesale inputs (energy, chemicals and MPEs), the evidence regarding the wedge between input price inflation and CPIH is mixed. In the case of energy and chemicals, the outturn data suggests that input price inflation materially outpaces CPIH; however, forecast information provided by WSH suggests that input prices are expected to fall in real terms. With respect to MPE, there is no reliable, publicly available forecast information to set an ex ante allowance. As such, the case for an ex ante allowance for these inputs is more mixed than with energy. Nonetheless, given the volatility of these input prices and the inherent uncertainty associated with forecasting them, it would be prudent to provide mechanisms to adjust allowances based on the outturn evolution of these input prices.

Regarding the retail inputs examined in this report (specifically, labour), there is also a case for an ex ante allowance accompanied by an uncertainty mechanism—in particular, retail labour prices have increased materially (in nominal terms) in the outturn period and external forecasts suggest that this will continue in AMP8.[13]

A final consideration relates to what price level is implicitly funded through Ofwat's base cost models. Its models are estimated in real terms (on the basis of CPIH inflation) and do not include cost drivers that explicitly capture changes in real input prices. [14] As companies' costs are benchmarked using the last five years of outturn data (currently 2018–22), the models implicitly fund companies on the basis of the average (real) input prices faced by the industry in those five years.[15]

[13] Ofwat has stated that it will not index retail revenues at PR24. See Ofwat (2022), 'Creating tomorrow, together: Our final methodology for PR24', December, chapter 3.
[14] This discussion is based on the approach that Ofwat took to assessing wholesale base costs at PR19. The insights are similar for residential retail costs (in nominal terms instead of real), but the insight is complicated by: (i) Ofwat's use of time dummies in the PR24 consultation models; and (ii) its use of a forward-looking benchmark at PR19.
[15] Input prices can be seen as an omitted variable in Ofwat's models. Therefore, assuming that input prices are uncorrelated with the cost drivers included in the cost assessment models, the input prices would feed into the constant in the regression equation (in line with how other omitted variables would be captured in the models). Ofwat's benchmark corrections are, in practice, adjustments to the constant in the cost regression equation based on companies' average performances in the last five years. As such, the companies could be implicitly funded on the basis of the average input price levels in the last five years, rather than the complete modelling period over which the models are estimated. However, this insight may change if there are material changes to Ofwat's modelling framework (e.g. the incorporation of forward-looking data into the cost assessment models) or if the input prices are strongly correlated with some of the PR24 cost drivers.

However, under its PR19 approach, Ofwat applies RPEs from the first year of forecast data (currently 2023) when setting efficient cost allowances. This implicitly assumes that the cost models fund companies on the basis of the real input prices that companies face in 2022.[16] This is an assumption that holds only if the average real input prices that companies face in 2018–22 (i.e. over the last five years) are the same as those that they face in 2022. Specifically in the case of energy prices, this is not the case—the energy prices in 2022 were materially higher (c. 10%) than the average energy prices that companies faced in the last five years.[17]

Depending on the evolution of input prices for the remaining years of AMP7, and on Ofwat's approach to modelling historical data at PR24, companies may require an uplift to allowances to ensure that they are funded on the basis of 2025 prices before RPEs or appropriate true-up mechanism are applied.

[16] Note that Ofwat will have access to more outturn information at PR24. Therefore, Ofwat will need to assess how 2024 compares to 2019–23.
[17] See section 5 for details.

1 Introduction

Water companies and other regulated utilities are typically considered 'price takers' for the inputs they require in the production process. That is, water companies cannot exert market power to influence the prices of inputs (e.g. energy, chemicals) that are instead determined by wider market forces. While it is possible for water companies to better manage price pressures (at least in the short term) through planning and negotiation, the medium- and long-term prices of inputs are determined by the wider economy. As such, input prices are often considered as exogenous in the cost assessment process.[18]

Ofwat has general cost-sharing mechanisms in place that could partially mitigate the risk associated with changes in real input prices during a price control period. That is, if companies outperform their cost allowances because real input prices have fallen over that period, only part of the outperformance would be kept by the company as additional profit and some of it would be shared with the consumer directly in the form of lower bills. The reverse is true in the case of underperformance due to increasing real input prices. However, these mechanisms are not sufficiently targeted and work only in the context where there are no expected changes in input prices in future. If input prices are expected to change ex ante then the cost-sharing mechanism leads to a biased outcome.

For these reasons, regulators often provide ex ante allowances for input price pressure (IPP) or real price effects (RPEs) to incentivise outperformance, and, where prices are forecast to be volatile, further index revenues to input prices.

At PR19, Ofwat indexed wholesale revenues to CPIH inflation. That is, if outturn CPIH inflation in AMP7 was higher (lower) than what Ofwat forecast at the time of price review, companies' allowed revenues would be adjusted upwards (downwards) to compensate them or their customers for unexpected changes in inflation. Moreover, in the wholesale price controls, labour costs were further indexed to a labour cost index—if real labour costs were higher (lower) than what Ofwat forecast at PR19, companies' revenues would be adjusted upwards (downwards).

[18] For example, Ofwat included regional wages as a cost driver in its PR14 models; see CEPA (2014), 'Cost assessment—advanced econometric models', March.

For the residential retail price control, Ofwat had no such indexation mechanisms. Instead, it undertook an assessment of input price pressure in nominal terms (i.e. IPPs) at the initial assessment of plans (IAPs).[19] Ultimately, it did not include a separate allowance for IPPs and companies were required to bear all of the risk associated with unexpected changes in input prices.[20]

In its PR24 final methodology, Ofwat has noted that it will take a broadly similar approach to PR19, with the following exceptions:

- it will continue to index wholesale revenues to CPIH, but will consider whether RPE methodology remains appropriate (e.g. it is considering indexing revenues to other input price indices);[21]
- it will not index residential revenues to inflation,[22] but it is considering providing an ex ante allowance for input price pressure.[23]

Dŵr Cymru (Welsh Water, WSH) has asked Oxera to assess the impact of IPP on its allowed revenues for PR24.

This report is structured as follows.

- Section 2 outlines Ofwat's approach to RPEs at PR19.
- Section 3 provides an assessment of the RPEs that the water industry might face in AMP8.
- Section 4 evaluates the use of indexation mechanisms for RPEs.
- Section 5 explores whether Ofwat's cost assessment models adequately fund companies on the basis of the current high price levels.

[19] See Europe Economics (2018), 'Real Price Effects and Frontier Shift', January.
[20] Ofwat applied a forward-looking benchmark at PR19 in residential retail. Therefore, its cost models implicitly captured the IPP that the upper-quartile companies were anticipating in their business plans, as well as other forward-looking factors (e.g. anticipated productivity improvements, anticipated changes in operating environment). However, given the lack of indexation, companies still bore the risk if the outturn environment differed to what was forecast at the time of the price review.
[21] See Ofwat (2022), 'Creating tomorrow, together: Our final methodology for PR24 Appendix 9 – Setting expenditure allowances', December, p. 38.
[22] Ibid., p. 38.
[23] Ibid., section 3.6.

2 Ofwat's PR19 approach

At PR19, Ofwat commissioned Europe Economics to assess the impact of RPEs and nominal IPP in wholesale and retail, respectively. In its subsequent report,[24] Europe Economics followed a staged approach to assessing the need for an RPE adjustment. This approach is summarised below and a more detailed description can be found in the appendix.

Stage 1A: Are there any material RPEs outside management control that are not captured by CPIH indexation?

Europe Economics examined the following issues as part of this stage.

- The likelihood that the value of the wedge between the input price and CPIH will be substantially different from zero over the period of the price control. This assessed both the magnitude of the wedge and its volatility over time.
- The presence of sufficient and convincing reasons to consider that CPIH does not adequately capture the input price: this assessed whether the composition of CPIH mirrored the composition of companies' costs.
- The extent to which the input price and exposure to that input price will be outside management control for the duration of the price control. This assessed characteristics such as the company's ability to determine the prices it pays for inputs or its ability to adjust the quantities of the inputs used in its input mix.

Inputs that passed these criteria were progressed to stage 1B.

Stage 1B: What, if anything, should be done about these RPEs?

Europe Economics examined the robustness of the indices and (where data was available) forecasts associated with the input prices, the possible incentives that would be generated by an RPE mechanism, and an assessment of who should bear the risk of input price inflation.

Inputs that passed these criteria were progressed to stage 2.

[24] See Europe Economics (2019), 'Real Price Effects and Frontier Shift – Updated Assessment', July, https://www.ofwat.gov.uk/wp-content/uploads/2019/07/Europe-Economics-Real-Price-Effects-and-Frontier-Shift-%E2%80%93-Updated-Assessment.pdf, accessed 28/09/2023.

Stage 2: Check on the overall 'package' implied by stage 1 results

Europe Economics assessed RPEs for the following inputs:

- labour;
- energy;
- chemicals;
- materials, plant and equipment (MPE).

To assess the validity of RPEs that might arise during AMP7, Ofwat and Europe Economics considered a select group of indices and forecasts associated with each input. Their approach is discussed in more detail below.

2.1 Labour: RPE granted

Europe Economics found a material wedge (i.e. the index – CPIH) of 1.1%, but only when assessing forecasts produced by the Office for Budget Responsibility (OBR). Nevertheless, Europe Economics argued that the OBR forecasts had overestimated future earnings growth, and that reliance on these forecasts might cause the RPE estimate to be upwardly biased. Ultimately, it stated that the basis of concluding that there was a material price effect rests on the reliability of the OBR forecasts.

Europe Economics also deemed that CPIH did not accurately capture labour and that water companies had some, but limited, management control over their exposure to labour costs.

In the PR19 Final Determinations,[25] Ofwat granted an RPE equal to 1.1% p.a. on the basis of the OBR labour forecasts, and this was subject to a true-up at the end of the year on the basis of the 'Annual Survey of Hours and Earnings' (ASHE) manufacturing index. Ofwat deemed this to be the most appropriate index for an ex post adjustment mechanism as it provided wages on an hourly basis, which allowed for the RPE to be isolated from other effects.

2.2 Energy: RPE denied

Europe Economics found a statistically significant wedge of 5.2% between energy inflation and CPIH when looking at historical data, although this was largely driven by pre-2010 data. Moreover, it reported

[25] Ofwat (2019), 'PR-19 Final Determinations – Securing cost efficiency technical appendix', December, https://www.ofwat.gov.uk/wp-content/uploads/2019/12/PR19-final-determinations-Securing-cost-efficiency-technical-appendix.pdf. accessed 28/09/2023.

that the forecasts predicted a wedge of 1.4%, but also indicated that the forecasts were unreliable as they systematically failed to correctly predict outturns.

Europe Economics found that the historic wedge met its criterion of being deemed volatile, but also said that this was driven by pre-2010 data. In addition, it concluded that there was some scope for companies to protect themselves against energy price volatility (e.g. increasing energy efficiency and energy generation), but that this would be feasible only in the long run.

Ofwat decided not to grant an RPE due to the aforementioned factors, in addition to the small share of energy total expenditure (TOTEX), the uncertainty of the energy price forecasts, and the net zero objectives indicating a transition towards green energy and a reduction in carbon emissions.[26]

2.3 Chemicals: RPE denied

Europe Economics found a negligible wedge of 0.1% in the historical data for chemicals, and also deemed that the volatility of the chemicals RPE was immaterial. These findings were sufficient to nullify its further findings that CPIH did not adequately capture this input and that there was little management control over exposure to chemicals prices. Thus, Ofwat concluded that there was insufficient evidence to justify a real price adjustment for chemicals.

2.4 Materials, plant and equipment: RPE denied

Europe Economics considered a plethora of indices to assess the validity of an RPE for MPE due to the wide scope of inputs that fall into this category. It found mixed evidence of a wedge in the historical data, and altogether argued that there was no robust evidence of a material or volatile price effect on average.

Europe Economics argued that CPIH did not fully capture the price of MPE costs. However, it concluded that water companies would be able to mitigate their exposure to MPE input prices during the price control period, as substitutability across MPE resources allowed for the input mix to be adjusted. Ofwat concluded that there was insufficient evidence to justify a real price adjustment for MPE.

[26] Ofwat (2019), 'PR-19 Final Determinations – Securing cost efficiency technical appendix', December, p. 206.

2.5 Limitations with the PR19 framework

The PR19 framework for assessing RPEs may provide a reasonable starting point, but has several limitations that can cause the estimated RPEs to be inaccurate and unrepresentative of the cost pressures that companies face. For example, we note the following.

Ofwat assesses the extent to which input prices are within management control. Specifically, it argues that: (i) companies could leverage buying power to reduce the input prices that they face; and (ii) companies could reduce the volume of inputs used in response to a rise in prices through greater efficiency savings.

On (i), there is minimal evidence that companies have substantial buying power in relation to the inputs they use. For example, chemicals, energy and labour are all traded nationally or internationally, such that any individual water company has a very small (negligible) market share when purchasing these inputs, such that management has little ability to deviate materially from the market price.

On (ii), we note that through its benchmarking models and frontier shift assumptions, Ofwat already assesses the extent to which companies can make efficiency improvements, such that RPEs are only applied to Ofwat's view of companies' efficient costs. If the regulator expects that companies could make further efficiency improvements beyond this, then it would need to provide evidence that further efficiency gains are achievable and account for these directly in the cost assessment framework, rather than relying on an incorrect assessment of RPEs to produce an efficiency target that has not been supported by evidence.

Ofwat's assessment of the extent to which the input prices trends are already captured within CPIH is flawed. First, CPIH is an output price index—not an input price index—and therefore captures both the IPP and the productivity improvements achieved in the wider economy. On the assumption that productivity growth is positive, CPIH is likely to underestimate the input prices faced by companies. Second, a particular input were already captured within CPIH, this would be apparent from an analysis of the wedge between CPIH and the particular input price index—if a material wedge exists (on an outturn or forward-looking basis), there is evidence that the input is not captured by CPIH.

Ofwat's assessment of the materiality of the RPE is somewhat arbitrary and is likely to lead to an inaccurate assessment of the input prices that companies face. This flaw arises from two key decisions made under this criterion: (i) the assessment of the contribution of the input to

overall TOTEX; (ii) the assessment of whether there was a 'likelihood' that the input price would substantially deviate from CPIH. On (i), the materiality threshold is somewhat arbitrary and does not take into account the likelihood that the contribution of an input to overall TOTEX will raise the price of the input.

On (ii), we note that Ofwat's assessment relies on an analysis of the historical wedge between CPIH and the input price and, where possible, the forecast wedge between the CPIH and the input price. However, forecasts of input prices are intrinsically uncertain, particularly in times of macroeconomic uncertainty. The reliance on point estimates of the wedge between CPIH and the input price without considering the intrinsic uncertainty has led Ofwat to make decisions that were incorrect.

For example, Ofwat did not provide an RPE for energy prices, arguing that (among other things) there was no conclusive evidence that a historical wedge existed. Ofwat and Europe Economics further argued at the PR19 CMA appeal that energy prices might fall in response to COVID-19. However, real energy prices have clearly increased materially in AMP7 (see section 3.2), and companies have had to largely absorb this input price pressure.[27]

For these reasons, we do not strictly adhere to the PR19 framework when assessing RPEs.

[27] Efficient companies can absorb the IPP by overspending allowances or reducing services and investments.

3 An assessment of RPEs

To assess the degree to which RPEs are likely to evolve in AMP8, we follow a framework broadly similar to that used by Ofwat and Europe Economics at PR19, noting the limitations with the framework outlined in section 2.5. In particular, we assess the following.

- We explore labour, energy, chemicals and MPE as inputs for the wholesale price controls. We look at this set of inputs in particular for various reasons. First, this is a well-established set of inputs for the wholesale category, as they are the same inputs that Ofwat explored at PR19 and the inputs we have explored in previous Oxera assessments.[28] These inputs also collectively represented a majority of the average share of wholesale TOTEX among all water companies at PR19 (approximately 65%).[29] Finally, these inputs are also aligned with Ofwat's guidance on business plan data tables for PR24.[30]
- The inputs used in the residential retail price control are less clearly defined. At PR19, Ofwat requested cost-share data on only two inputs (labour and 'other'), although it allowed companies to submit data on other inputs. Labour constituted a significant proportion of retail costs for WSH at PR19,[31] and WSH also submitted cost shares for other inputs that do not appear in the wholesale categories, such as postage and bad debt. Given that the current reporting guidelines do not allow for the introduction of new inputs (e.g. postage and bad debt), we explore a retail-specific labour RPE.
- We comment on the materiality and the volatility of the RPE over relevant historical periods. However, as noted in section 2.5, the materiality criterion at PR19 was overly stringent and misapplied such that some material IPPs were omitted from Ofwat's assessment. Therefore, we do not place a significant weight on this criterion.
- Where good quality data is available, we provide independent forecasts of RPEs from external sources, and assess the

[28] For example, see Oxera (2018), 'South East Water Wholesale BOTEX assessment', August, section 4.1.
[29] Europe Economics (2019), 'Real Price Effects and Frontier Shift – Updated Assessment', July, section 2. Europe Economics defined the average share of each input as follows: 'This share has been calculated as an unweighted average across companies and across the years of the next price control period, based on data submitted by companies in App24'.
[30] Ofwat (2023), 'Creating tomorrow, together: Our final methodology for PR24 Submission table guidance Section 10: Supplementary tables', February, section 13.
[31] From the business plans at PR19, the average share of labour for residential retail for WSH was 34%.

historical quality of these forecasts based on comparisons of recent forecasts to outturn values.

Below, we present an assessment of the RPEs in each input.

3.1 Wholesale labour

Labour is typically the largest single input (by share of TOTEX) in the wholesale and residential retail price controls. At PR19, labour was the only input for which Ofwat made an RPE allowance. The ex ante allowance was estimated using OBR forecasts for average real earnings. However, Ofwat acknowledged that the OBR forecasts had historically been inaccurate, and that it would be inappropriate to reward or penalise companies on the basis of inaccurate forecasts. Therefore, Ofwat also indexed labour costs to the ASHE manufacturing index.

The cost of labour has been volatile since the PR19 determination due to several factors not foreseen at the time of the determination. These include the impact of COVID-19 and associated government policies (e.g. lockdowns, the furlough scheme), and the easing and eventual end of the lockdowns that resulted in a resurgence of construction and business activity. This increased derived demand for workers contributed to a rise in labour costs.[32]

Nevertheless, the present context of high inflation and the cost of living crisis has meant that wages have been outstripped by inflation, causing the wedge between labour costs and CPIH to narrow. Indeed, in the first two years of AMP7, Ofwat's indexation mechanism for labour costs contributed to a reduction in companies' allowances, as real labour costs have increased less than anticipated at the PR19 determination.

3.1.1 Historical evolution of the RPE

When assessing the evolution of the RPE for labour in historical data, there are several labour indices that could be considered. In this report, we limit the analysis to four indices and consider the entire sample period for which the data exists. In particular, we examined the following indices as they provide a suitable breadth of the most relevant labour indices for the analysis.[33]

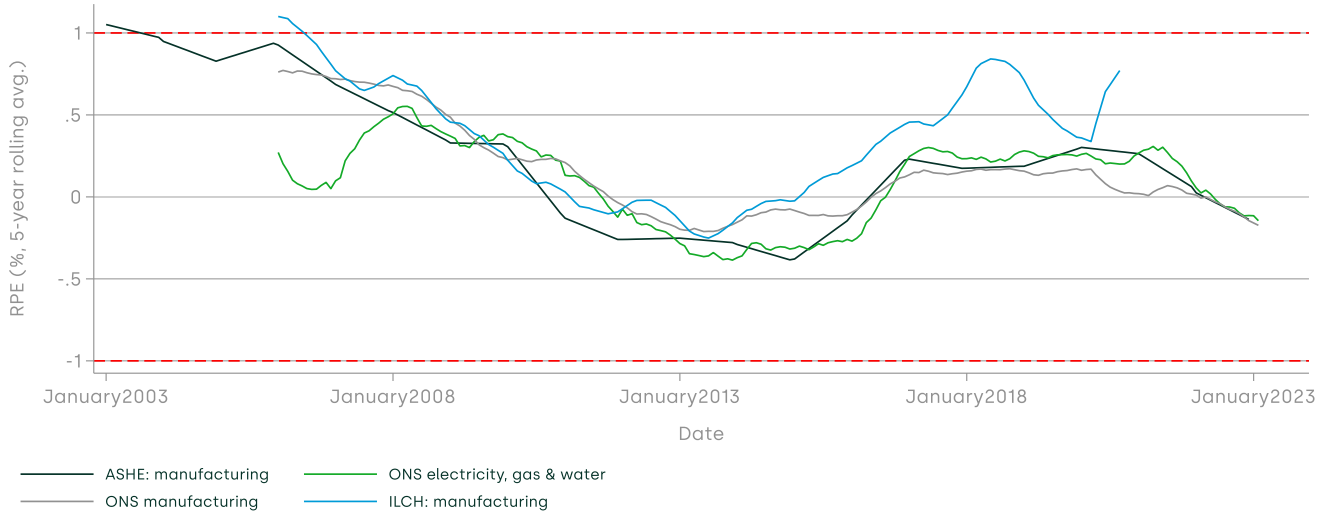
[32] See BCIS (2022), 'Construction site labour costs sees significant changes in 2021', https://bcis.co.uk/news/construction-site-labour-costs-bcis-hays/.

[33] The other indices that could have been considered include the hourly wage for, or labour costs of, workers for the entire economy or workers in the electricity, gas and water sectors, as published in the Index of Labour Costs per Hour (ILCH). We did not choose the index for all workers in the economy as it is too broad and would not precisely capture the price pressure of labour employed by water companies. We did not choose the index for workers in the electricity, gas and water

- Average weekly earnings for workers in the manufacturing sector, published by the Office for National Statistics (ONS). This is seasonally adjusted total pay excluding arrears.
- Average weekly earnings for workers in the electricity, gas & water supply sector, published by the ONS. This is non-seasonally adjusted total pay including arrears.
- The average hourly labour cost of all employees in the manufacturing sector. This is published as part of the ILCH.
- The mean hourly wage for workers in the manufacturing sector. This is calculated as part of the ASHE.[34]

The figure below shows how these indices have evolved (in real terms) in the historical data, weighted by the share of labour in wholesale TOTEX for the sample period 2005–22.

Figure 3.1 Labour RPE: historical data



Note: This figure illustrates the evolution of the five-year rolling average of the wedge between the aforementioned labour price indices and CPIH for the period 2005–22. The starting point of each line is determined by the start date of the index, where the earliest date in the figure is five years after the start date of the index. This is in order to allow the five-year rolling average to have an even effect on every year displayed. The figure is at the monthly level, but some indices are at a less granular level (i.e. quarterly or

sectors as, while this index most closely traces the costs faced by water companies, the RPE that would be measured on the basis of this index would be under the management control of water companies. This is because water companies (as well as other regulated utilities) are included in this index. Therefore, it would not be suitable to use this index for assessing and accommodating for price pressures that are outside of management control. Europe Economics made a similar argument for not using this index at PR19. We also did not consider the 'Water collection, treatment and supply' gross hourly pay index published in the ASHE for a similar reason.

[34] This was the index used by Ofwat for the true-up of the RPE for labour in PR19.

annually). For these less granular indices, we interpolate the data to the monthly level for illustrative purposes.
Source: Oxera analysis of the wedge between labour price indices and CPIH.

The figure shows that RPEs relating to labour have been somewhat volatile over the historical period, but fell in absolute value in the years after 2006. This provides marginal evidence of the stability of the RPE for labour during AMP8 if its current trajectory is to persist.

The ASHE manufacturing index is particularly relevant because it measures hourly rather than weekly wages, and can thus identify the labour costs borne by water companies more distinctly from the decisions made by workers regarding the amount of time spent working. Furthermore, Ofwat used this index to true up labour costs in AMP7. Focusing on the ASHE manufacturing index, the table below shows the expected increase in labour costs (in real and nominal terms) on the basis of the average real increase in the index over the full sample period (1998–2022).

Table 3.1 Labour: RPE and IPP for AMP8 using historical data

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real (RPP)	0.9%	0.9%	0.9%	0.9%	0.9%
Nominal (IPP)	0.9%	1.7%	2.6%	2.9%	2.9%

Note: This table summarises the average long-run real and nominal growth in labour prices implied by the ASHE index. The real growth rates are estimated from historical data for the period 1998–2022 and are extrapolated forward into all years of the AMP8 period. The nominal growth rates (i.e. IPPs) are calculated as the sum of the long-run RPE and the OBR forecasts of CPI in each financial year where the OBR forecasts are available. The forecasts produced by the OBR end in 2027 (calendar year). Therefore, we include the financial year 2027/28 as one of the forecast financial years because the final three quarters of 2027 fall in this financial year. For the remaining financial years beyond the forecast horizon of the OBR forecasts, the nominal IPP is the long-run RPE plus the long-run target inflation rate of 2%.
Source: Oxera analysis.

The analysis shows that real labour costs have risen by c. 0.9% p.a. according to the ASHE manufacturing index. This may provide a reasonable initial estimate of the labour cost pressures that companies will face in AMP8, on the assumption that the past is broadly representative of the future.

3.1.2 Incorporating forward-looking information

As far as we are aware, there are no forecasts of the ASHE manufacturing index from well-established statistical agencies. However, the OBR publishes forecasts for average earnings growth[35] on a biannual basis.[36] Specifically, this report provides projections of the growth in average earnings for the next five years, with the projections used in the latest edition (March 2023) running until 2027. The OBR forecasts also contain forecasts for CPI over the same forecasting horizon.

The table below shows the projected increase in labour prices (in real and nominal terms) for the five years of forecast data.

Table 3.2 Labour: RPE and IPP for AMP8 using external forecasts

IPP/RPE	2023/24	2024/25	2025/26	2026/27	2027/28
Real	0.0%	1.1%	1.7%	1.3%	0.8%
Nominal	4.1%	1.7%	1.7%	2.1%	2.5%

Note: This table summarises the real and nominal forecast growth in average earnings. The forecasts produced by the OBR end in 2027 (calendar year). Therefore, we include the financial year 2027/28 as one of the forecast financial years because the final three quarters of 2027 fall in this financial year.
Source: Oxera analysis of Office for Budget Responsibility (2023), 'Economic and fiscal outlook', March, Annex A.

The OBR forecasts differ from the RPEs estimated using historical data shown in section 3.1.1. In particular, for the financial years between 2024/25 and 2027/28, the OBR forecasts predict that the RPEs will be greater than or equal to the long-run RPE. If the OBR forecasts are correct, this implies that the inputs of water companies will face higher real price pressure in the first three years of AMP8 than what they have experienced historically.

However, the OBR forecasts have historically deviated from outturns. A comparison of the OBR's forecasts and annual outturns is presented below.

[35] Average earnings refer to the sum of all wages and salaries in the economy, divided by the total number of employees.
[36] For the latest version at the time of writing, see Office for Budget Responsibility (2023), 'Economic and fiscal outlook', March.

Table 3.3 OBR average earnings growth (%) forecasts versus outturns

Forecast date	Forecast year						
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
2015	2.6	3.4	3.7	3.6	3.7	3.9	
2016		2.2	2.4	2.8	3.3	3.6	3.7
2017			2.3	2.3	2.3	2.6	3
2018				3	3.1	3	3.1
2019					2.8	3.3	3.6
2020						1.2	2.1
2021							5
Outturn	**1.8**	**2.8**	**2.8**	**3.3**	**2.9**	**1.2**	**5.3**

Note: In a typical calendar year, OBR releases two Economic and Fiscal Outlook reports, typically in March and November. Annual outturn values for a given year are given in the second bi-annual report of the subsequent year. For example, the outturn value for 2021 is given in the November 2022 edition of the Economic and Fiscal Outlook report. However, there were no end-of-year releases in 2018 and 2019. Therefore, the outturn values for 2017 and 2018 were taken from the March releases in 2019 and 2020, respectively.
Source: Office of Budgetary Responsibility, Economic and Fiscal Outlook, various years.

The cause of these discrepancies partially stems from how the OBR undertakes its medium-term forecasts of average earnings growth.[37] In particular, these earnings forecasts rely upon forecasts of productivity, inflation, and the material impact of policies on earnings. The evolution of any of the aforementioned factors is subject to uncertainty, which is compounded when these uncertain forecasts are used to predict earnings growth. This resulting inability of the forecasts to accurately predict outturn earnings growth suggests that they should be treated with caution if RPEs are to be fixed ex ante.

3.1.3 Labour RPE for AMP8: final thoughts

We consider that the most appropriate method of forecasting the Labour RPE is as follows.

- For the years for which forecast data is available from the OBR (2026–28), this should form the basis of the ex ante RPE. While the OBR's forecasts have historically deviated from the outturn

[37] See OBR (2022), 'The economy forecast- average earnings', https://obr.uk/forecasts-in-depth/the-economy-forecast/labour-market/#averageearnings. accessed 05/09/2023.

values, the forecasts do incorporate some forward-looking information and can account for expected changes in the macroeconomy.

- For the remaining years (2028–30), the long-run RPE based on the ASHE manufacturing index should be used. This assumes that labour price inflation will return to the long-run growth rate.

The table below summarises our view of the appropriate Labour RPE assumption in AMP8.

Table 3.4 Labour: RPE and IPP for AMP8

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real	1.7%	1.3%	0.8%	0.9%	0.9%
Nominal	1.7%	2.1%	2.5%	2.9%	2.9%

Note: This table summarises the real and nominal forecast growth in average earnings for the financial years 2025/26, 2026/27 and 2027/28. For the remaining financial years, the RPE is the real growth for the ASHE manufacturing index and the IPP is the real growth for the ASHE manufacturing index plus the long-run target inflation rate of 2%.
Source: Oxera analysis.

The RPE for labour in real terms is expected to be positive for all years in AMP8. Labour RPEs are expected to fall in the first two years of AMP8, before settling to 0.9%, in line with the historical average.

3.2 Energy

At PR19, Ofwat did not make an allowance for energy RPEs. It examined the evolution of the energy price index published by the Department for Business, Energy & Industrial Strategy (BEIS) compared to CPIH, and concluded that there was insufficient evidence that energy price trends materially differed from CPIH. Moreover, Ofwat did not have faith in external energy price forecasts (again from BEIS). Therefore, Ofwat did not provide companies with an allowance for energy RPEs. In the first few years of AMP7, energy prices have increased materially in relation to CPIH, and companies have been required to largely absorb this IPP (e.g. through underperforming their cost allowances).

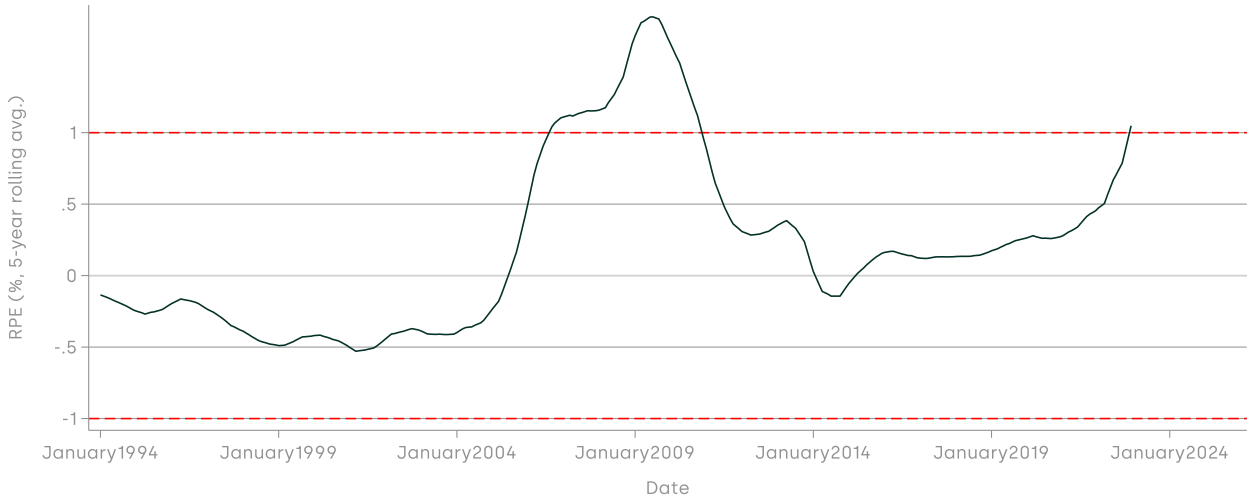
The UK was materially affected by the energy crisis in late 2022. This was driven by increasing post-COVID demand and Russia's invasion of Ukraine tightening gas supplies into Europe creating a significant rise in

wholesale gas prices.[38] Therefore, Ofwat's assumption that energy prices would be broadly stable in AMP7 has transpired to be incorrect.

3.2.1 Historical evolution of the RPE

To assess the historical materiality of the energy RPE, we examined the baseload price per kilowatt hour (p/kWh) for industrial electricity consumers published by BEIS over the full sample period (1994–2022).[39] This is shown in the figure below.

Figure 3.2 Energy RPE: historical data



Note: This figure illustrates the evolution of the five-year rolling average of the wedge between the BEIS industrial energy price index and CPIH for the period 1994–2022.
Source: Oxera analysis.

The RPE for energy displayed particularly high volatility between 2007 and 2010, and the current upward trajectory of energy prices is visible at the right-hand side of the figure. However, the most recent data points in the figure understate the material increase in energy prices in the last year because of the smoothing procedure. Therefore, the wedge between energy prices and CPIH may grow in the coming years if the current high energy prices persist.

[38] See Valero, A. (2022), 'Why have energy bills in the UK been rising?', *LSE British Politics and Policy*, https://blogs.lse.ac.uk/politicsandpolicy/why-have-energy-bills-in-the-uk-been-rising-net-zero/ accessed 28/09/2023.
[39] The entire historical sample includes data from 1989 to 2022. The first five years of the data are excluded from the figure as we are estimating a five-year rolling average.

The table below shows the expected energy RPE in AMP8 on the basis of the average historical increase in real energy prices in the sample period (1989–2022).

Table 3.5 Energy: RPE and IPP for AMP8 using historical data

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real	2.8%	2.8%	2.8%	2.8%	2.8%
Nominal	2.8%	3.6%	4.5%	4.8%	4.8%

Note: This table summarises the real and nominal growth in energy prices implied by the BEIS industrial energy price index. The real growth rates are estimated from historical data for the period 1989–2022 and are extrapolated forward into all years of the AMP8 period. The nominal growth rates (i.e. IPPs) are calculated as the sum of the long-run RPE and the OBR forecasts of CPI in each financial year where the OBR forecasts are available. For the remaining financial years beyond the forecast horizon of the OBR forecasts, the nominal IPP is the long-run RPE plus the long-run target inflation rate of 2%.
Source: Oxera analysis.

The analysis shows that real energy prices have increased by c. 2.8% p.a. in the sample period, and energy prices may increase at a similar rate in AMP8 if the trends persist.

3.2.2 Incorporating forward-looking information

BEIS has also published energy price projections until 2040, which Europe Economics explored at PR19.[40] We consider that these projections can be used to incorporate a forward-looking element into the prediction of energy RPEs.

These projections are made for various scenarios that make different assumptions regarding fossil-fuel prices, economic growth and the policies that are pursued. For the scope of this report, we consider energy forecasts under three scenarios: (i) a reference scenario with baseline assumptions regarding fossil-fuel prices; (ii) a scenario with high fossil-fuel prices and (iii) a scenario with low fossil-fuel prices.

[40] Ultimately, Ofwat did not apply an energy RPE.

The table below shows the projected RPE and IPP for energy on the basis of the reference scenario.[41]

Table 3.6 Energy: RPE and IPP for AMP8 assuming reference scenario

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real	-11.4%	-10.3%	-6.8%	-11.6%	-7.6%
Nominal	-11.4%	-9.5%	-5.1%	-9.6%	-5.6%

Note: This table summarises the forecast real and nominal growth in energy prices implied by the BEIS industrial energy price forecasts. The real growth rates were estimated as the wedge between the forecast energy price and the forecast growth in CPI for the financial years 2025/26, 2026/27 and 2027/28. For the remaining financial years, real growth in energy prices is estimated as the difference between forecast energy prices and the long-run target inflation rate of 2%.
Source: Oxera.

The real and nominal RPE for energy over the AMP8 period is negative for each year. This is because the forecasts anticipate that the exogenous factors responsible for driving energy prices to historical highs in the last few years will reduce over time, resulting in a gradual and consistent decline in energy prices over the coming decade.

Energy price forecasts have historically been inaccurate, as the previous forecasts for a given year: (i) never line up with outturns; and (ii) vary materially depending on which year the forecast was made. This is illustrated in the table below.

[41] We do not consider scenarios outside of the reference scenario when discussing the energy forecasts as it relates to the energy RPE. However, we do discuss the remaining two scenarios when assessing the chemicals RPE in subsequent sections of the note.

Table 3.7 BEIS energy price growth (%) forecasts versus outturns

Forecast date	Forecast year				
	2015	**2016**	**2017**	**2018**	**2021**
2015	0.33	9.55	6.94	-7.82	11.84
2016		-11.11	2.35	-0.46	8.63
2017			16.98	-3.08	1.59
2018				13.9	-2.82
2019					1.94
Outturn	**-5.85**	**-4.09**	**25.39**	**-0.21**	**242.6**

Note: In a typical calendar year, BEIS releases historical energy prices for a set of previous years and forecasts of energy prices for up to the next 20 years. Where available, annual outturn values for a given year are calculated from the data release in the next subsequent year. For example, the outturn value for 2015 is given by the historical energy prices in the 2016 release. However, as there were no end-of-year releases in 2020 and 2021, the outturn value for 2021 was taken from the 2022 release.
Source: Oxera analysis of Department for Business, Energy & Industrial Strategy, EEP - Annex M - Growth assumptions and prices.

The forecasts performed particularly poorly when estimating growth in 2021, as they failed to predict the pronounced post-COVID upsurge in energy prices. This suggests that the RPEs implied by these forecasts may be poor predictors of the energy prices that will prevail in AMP8, especially as there are many unforeseeable events that may arise in the coming years (e.g. developments in Russia's invasion of Ukraine).

We understand that WSH has undertaken internal analysis to forecast real energy prices in AMP8. The estimated RPE and IPP for energy on the basis of this analysis are shown in the table below.

Table 3.8 Energy: RPE and IPP for AMP8 assuming reference scenario

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real	-4.00%	1.40%	-4.60%	-1.60%	-0.90%

Note: This table summarises the forecast real growth in energy prices implied by WSH's energy price modelling.
Source: Oxera.

The analysis suggests that energy prices will be more stable than the BEIS forecasts suggests—WSH's forecasts show that energy prices in

real terms will fluctuate above and below 0% throughout AMP8, compared to a persistent decline in energy prices implied by the BEIS forecasting.

3.2.3 Energy RPE for AMP8: final thoughts

In light of the aforementioned evidence, we consider at this stage that the forecasts from WSH may provide a more appropriate estimate for the RPEs that companies may face in AMP8. As shown in the previous subsection, the historical analysis of RPEs is heavily influenced by recent macroeconomic and geopolitical events which may not recur in AMP8, while the BEIS forecasts are subject to material uncertainty and prone to error—more so than the labour RPEs discussed in section 3.1.

While WSH's forecasts may represent a 'better' estimate of what energy prices will be in AMP8, the reality is that energy prices are particularly difficult to forecast in this turbulent economic and geopolitical climate.

Note that these RPE estimates (as with all of the RPE estimates presented in this report) show the evolution of real input prices from 2025/26. If these RPE estimates are used to adjust the efficient cost predictions derived from the econometric model, Ofwat needs to ensure that the models fund companies on the basis of the price level observed in 2025/26. Given that real energy prices in particular have increased materially during the modelling period such that the price level observed in 2025/26 may be higher than that implicitly funded through the modelling, an uplift to allowances to reflect the outturn energy prices may be required. Further details of this adjustment can be found in section 5.

3.3 Chemicals

Chemicals are a key input in the water and wastewater treatment processes. While 'chemicals' is a somewhat broad category—and there may be different price pressures for different types of chemicals—we consider that the use of the ONS's 'chemicals and chemical products' price indices is a proportionate method for modelling the RPEs for chemicals.

Ofwat used the same index to assess RPEs in chemicals expenditure at PR19, but deemed that the share of chemicals within TOTEX was immaterial such that no RPE was required. However, in recent years the prices of chemicals have increased materially, in part driven by the

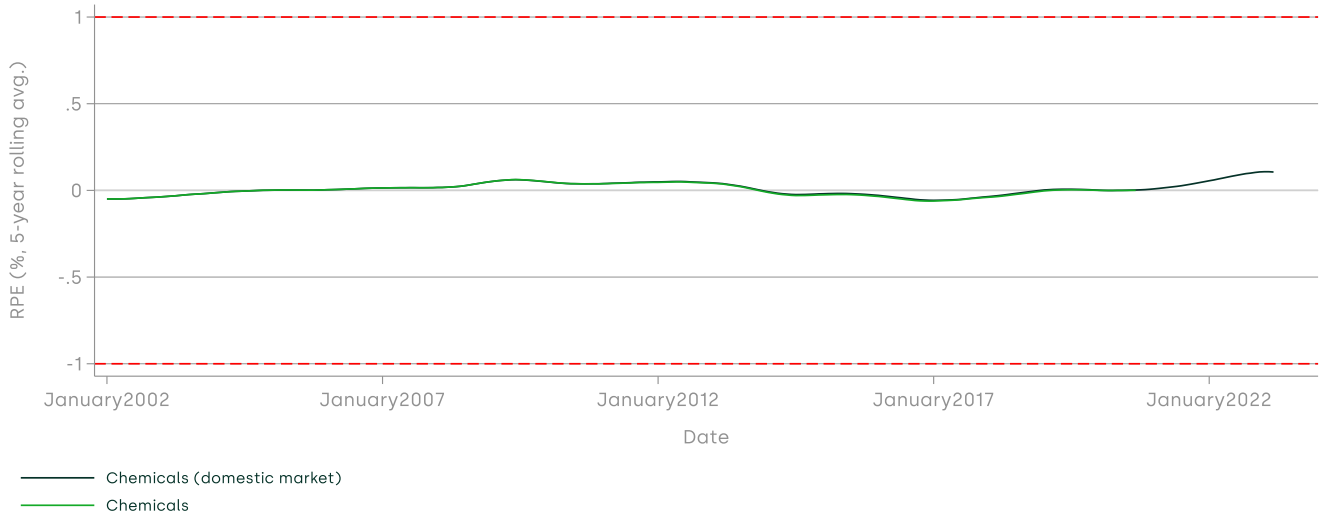
increase in real energy prices.[42] As such, as with increased energy prices, companies are required to absorb this cost pressure.

3.3.1 Historical evolution of the RPE

To assess the historical materiality of the chemicals RPE, we examined the price of 'Chemicals and chemical products' and of 'Chemicals and chemical products for domestic market' published by the ONS. For the remainder of the analysis we look solely at the 'Chemicals and chemical products for domestic market' index, as it is more up to date than the 'Chemicals and chemical products' index.

The figure below shows the evolution of the RPE over the sample period (2002–23).[43]

Figure 3.3 Chemicals RPE: historical data



Note: This figure illustrates the evolution of the five-year rolling average of the wedge between the aforementioned chemicals price indices and CPIH for the period 2002–23. The RPE is weighted by the share of chemicals costs in TOTEX.
Source: Oxera analysis.

Real chemicals prices were relatively stable prior to 2020, but grew materially in the years following. However, due to the relatively small

[42] The chemicals sector is one of the most energy-intensive sectors in the economy, and the cost of chemicals is therefore likely to be driven by the cost of energy. See ING (2022), 'The sectors most affected by soaring energy prices', Economic and Financial Analysis, 3rd June.
[43] The entire historical sample period was 1997–2022, so we exclude the first five years of the sample period because we are looking at the five-year rolling average.

proportion of chemicals in TOTEX and due to the upsurge in chemicals prices being limited to the post-pandemic years, the recent volatility in chemicals prices is not fully reflected in the figure. Therefore, we consider that an RPE for chemicals requires further consideration, despite the fact that it does not pass the PR19 materiality criterion.

The table below shows the expected increase in real and nominal chemicals prices in AMP8, based on the average growth in real chemicals prices observed over the full sample period.

Table 3.9 Chemicals: RPE and IPP for AMP8 using historical data

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real	0.7%	0.7%	0.7%	0.7%	0.7%
Nominal	0.7%	1.5%	2.4%	2.7%	2.7%

Note: This table summarises the real and nominal growth in chemicals prices implied by the 'chemicals and chemical products for domestic market' index. The real growth rates (i.e. RPEs) were estimated from historical data for the period 1997–2023 and are extrapolated forward into all years of the AMP8 period. The nominal growth rates (i.e. IPPs) are calculated as the sum of the long-run RPE and the OBR forecasts of CPI in each financial year where the OBR forecasts are available. For the remaining financial years beyond the forecast horizon of the OBR forecasts, the nominal IPP is the long-run RPE plus the long-run target inflation rate of 2%.

Source: Oxera analysis.

The analysis shows that real chemicals prices have increased at a rate of c. 0.7% p.a.

3.3.2 Incorporating forward-looking information

Unlike for energy and labour costs, we consider that there are few well-established forecasts of chemicals prices. However, we note that there is a strong relationship between the price of chemicals and the price of energy, given that energy is an essential component in the manufacture of chemical goods. Indeed, the ING Group has stated that the chemicals sector is the third most energy-intensive sector, behind aviation and shipping.[44]

[44] See ING (2022), 'The sectors most affected by soaring energy prices', Economic and Financial Analysis, 3rd June.

Therefore, we can use the estimated relationship between the energy prices and chemicals prices from historical data, and the external energy forecasts from WSH, to predict the inflation of chemicals over AMP8. The table below shows the output of the regression of chemicals prices on energy prices (both in logs and in first differences), and there is evidence of a strong and statistically significant positive association.

Table 3.10 Statistical relationship between chemicals and energy

Variable	Coefficient Estimates
Log(Energy prices)	0.3156***
Constant	0.0094
Observations	26

Note: The dependent variable in the regression is the first difference of the price index of chemicals in logs, and the independent variable is the first difference of the price index of energy in logs. *** p<0.01, ** p<0.05, * p<0.1
Source: Oxera analysis.

The analysis shows that a 1% increase in nominal energy prices is associated with a c. 0.32% increase in nominal chemicals prices. We incorporated the regression output above with the energy price forecasts produced by WSH to generate forecasts of chemicals prices over the AMP8 period.

The resulting forecasts of chemicals prices are shown below.

Table 3.11 Chemicals: RPE and IPP for AMP8 using internal forecasts

IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
Real	-3.28%	-1.31%	-2.92%	-1.87%	-1.65%

Note: This table summarises the forecasted real and nominal growth in chemicals prices implied by the statistical relationship between chemicals prices and industrial energy price forecasts. The real growth rates are estimated as the wedge between the forecasted energy price and the forecasted growth in CPI for the financial years 2025/26, 2026/27 and 2027/28. For the remaining financial years, real growth in chemicals prices is estimated as the difference between the forecast chemicals prices and the long-run target inflation rate of 2%.
Source: Oxera.

In line with the forecast reduction in energy prices and on the basis of this analysis, real chemicals prices are expected to fall in AMP8. However, we note that the chemicals forecasts are estimated from energy forecasts which we have shown to be uncertain. Furthermore, the robustness of the energy forecasts aside, the chemicals forecasts are generated from a statistical model and will thus be subject to forecast error. Therefore, these forecasts may not be sufficiently robust to provide accurate ex ante allowances for companies.

3.3.3 Chemicals RPE for AMP8: final thoughts

We consider that the forecast of chemicals prices based on the forecast energy prices is more appropriate than that based solely on backward-looking information. However, as noted above, these forecasts are subject to significant uncertainty. Indeed, it would be inappropriate to provide a fixed ex ante RPE on the basis of this information, given the considerable uncertainty.

Note that the 'chemicals and chemicals products for domestic market' is a broad measure of chemicals prices, and thus may not perfectly capture the chemicals prices that are most applicable to those used by water companies. It may be appropriate to validate the cost trends from this aggregated index with trends in alternative, more granular indices. Such an index is the Federal Reserve Economic Data published by the Research Department at the Federal Reserve Bank of St. Louis. This publicly available information contains separate indices for specific categories of chemicals,[45] although it relates to chemicals purchased/produced in the USA and may therefore not directly capture the national prices faced by the water companies in England and Wales.

3.4 Materials, plant and equipment

MPE is the second most material input in wholesale TOTEX. As with chemicals (or even more so), MPE covers several distinct inputs that may be subject to different price pressures. Nevertheless, the price of construction materials can be somewhat indicative of MPE costs. Prices for construction materials rose by 25% between 2021 and 2022, largely due to high demand for buildings working in tandem with construction material shortages despite the reopening of supply chains post-COVID.[46]

[45] See https://fred.stlouisfed.org/series/WPU061.
[46] See Federation of Master Builders (2023), 'State of Trade Survey Q4 2022', https://www.fmb.org.uk/resource/state-of-trade-survey-q4-2022.html.

At PR19, Ofwat examined a series of indices representing different types of materials.[47] While some were found to materially deviate from CPIH, Ofwat concluded that there was insufficient evidence that a material wedge existed between materials prices and CPIH, and therefore did not provide an RPE allowance at PR19.

3.4.1 Volatility

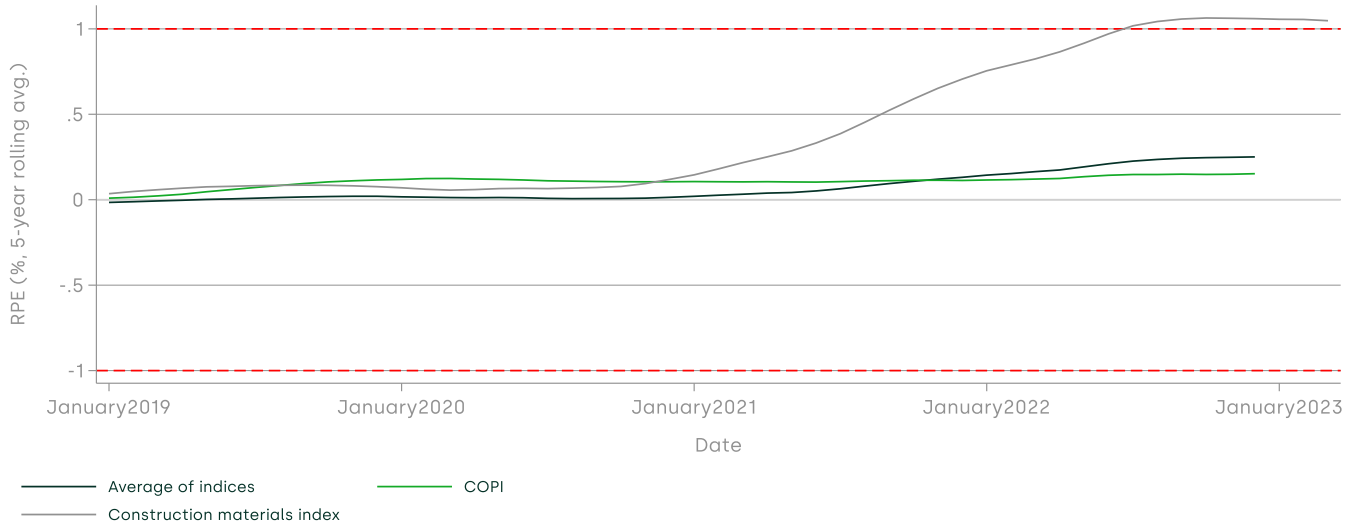
As noted, there are several indices that could be considered when assessing the evolution of the RPE for MPE in historical data, given the diversity of inputs that are included within MPE. To get a holistic understanding of the key aspects of MPE costs, we considered three publicly available indices, building on the PR19 approach.

- The Construction Output Prices Indices (COPIs) provide an estimate of inflation within the UK construction industry.
- The Construction Material Price Indices (CMPIs) give a measure of the notional trend of input costs to a contractor in terms of changes in the cost of building materials, i.e. factory gate prices charged by materials manufacturers.
- An average index comprising the following indices: the 'All Work' COPI, the 'All Construction' CMPI, the 'Other pumps and compressors for domestic market' index and the 'Machinery and equipment n.e.c for domestic market' index.

We considered a sample period of 2019–2022. The entire historical sample period varies by index, with the shortest being 2014–22 and the longest being 2000–22. As the maximum time period that is eligible for analysis using a five-year rolling average varies materially across the indices, we confined all indices to the shortest possible time period for which the analysis could be carried out (2019–22) in order to keep the graphs to a comparable scale.

[47] These include two Building Cost Information Service (BCIS) indices and several ONS indices. As BCIS indices are not in the public domain, we do not consider them in this report.

Figure 3.4 MPE RPE: historical data



Note: This figure illustrates the evolution of the five-year rolling average of the wedge between the aforementioned MPE price indices and CPIH for the period 2017–22.
Source: Oxera analysis.

The RPE for MPE was flat and homogeneous across indices in the period 2019–21, but the post-2021 increase in costs was particularly strong for the construction materials index, such that the volatility in MPE prices would be deemed material according to Ofwat's criterion.[48]

The table below shows the estimated real and nominal increase in MPE prices on the basis of the indices outlined above over the full sample period.[49]

[48] This is not to say that we consider this criterion to be correct. We find it to be arbitrary and neither Ofwat nor Europe Economics provided a well-reasoned justification it in either of the reports issued in PR19.
[49] Statistical tests show that each index contains at least one structural break. Structural breaks are notable and persistent changes in the evolution of an index, and therefore indicate a permanent change in its trajectory.

Table 3.12 MPE: RPE and IPP for AMP8 using historical data

Index	IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
COPI	Real	0.3%	0.3%	0.3%	0.3%	0.3%
	Nominal	0.3%	1.1%	2.0%	2.3%	2.3%
CMPI	Real	2.3%	2.3%	2.3%	2.3%	2.3%
	Nominal	2.3%	3.1%	4.0%	4.3%	4.3%
Avg. of indices	Real	0.7%	0.7%	0.7%	0.7%	0.7%
	Nominal	0.7%	1.5%	2.4%	2.7%	2.7%

Note: This table summarises the real and nominal growth in MPE prices implied by the aforementioned MPE price indices. The period considered for the calculation of the real growth of the COPI is January 2014 to December 2022. The period considered for the calculation of the real growth of the CMPI is January 2000 to September 2022. The period considered for the calculation of the real growth of the average of the indices is January 2014 to September 2022. The nominal growth rates (i.e. IPPs) are calculated as the sum of the long-run RPE and the OBR forecasts of CPI in each financial year where the OBR forecasts are available. For the remaining financial years beyond the forecast horizon of the OBR forecasts, the nominal IPP is the long-run RPE plus the long-run target inflation rate of 2%.
Source: Oxera.

As seen above the RPE varies from 0.3% p.a. to 2.3% p.a. depending on which index is used.

Note that, as far as we are aware, there are no robust publicly available forecasts of MPE prices that could be used to incorporate forward-looking information in the RPE analysis.

3.4.2 MPE RPE for AMP8: final thoughts

We note that CMPI may be influenced by the increase in real energy prices in recent years, and that energy prices are expected to decline in future. Therefore, the historical analysis of this index might overestimate the extent to which real materials prices are expected to evolve over AMP8.

Nonetheless, all of the analysis presented above is entirely backward-looking, and does not explicitly account for expected changes in macroeconomic conditions. As such, it may be insufficiently accurate to set a fixed ex ante allowance. Therefore, some form of indexation mechanism may be required to mitigate the risk of windfall gains and losses arising from inaccurate forecasts.

It may be appropriate for Ofwat to explore more granular indices that could capture the actual inputs included in the MPE category, rather than the aggregated indices outlined in this report. Indeed, this is how Ofgem assessed RPEs in the electricity distribution sector in the latest price control.[50]

Given (i) the uncertainty regarding the exact choice of MPE price index and (ii) the limitations with relying on historical analysis in the current context, we consider that an appropriate ex ante RPE for MPE should be 0%. However, as noted above, some form of indexation may be required to account for these uncertainties.

3.5 Retail labour

Labour costs represent a material proportion of WSH's residential retail TOTEX. While we have already explored IPP and RPE for labour as it relates to retail, we consider that a separate assessment of the labour costs related to the residential retail price control is necessary. This is because the nature of the activities carried out in the retail price sector are materially different to those undertaken in the wholesale sector. For instance, wholesale activities largely involve the treatment and distribution of water, and therefore require workers who are skilled in sewerage and water treatment. However, retail activities are more office-based, and therefore require workers who are proficient in administration and business support. There is no reason to suspect that that these different kinds of labour are subject to the same cost pressures, without empirical evidence. Therefore, we assess the IPPs associated with retail labour by considering labour price indices that are more related to retail activities.

3.5.1 Historical evolution of the IPP

We consider the following labour indices from the ASHE for retail labour:

- average hourly wages for workers in a retail trade, with the exception of motor vehicles and motorcycles;
- average hourly wages for workers involved in office administrative, office support and other business support activities;
- average hourly wages for workers involved in administrative and support service activities;
- average hourly wages for workers involved in business support service activities n.e.c;

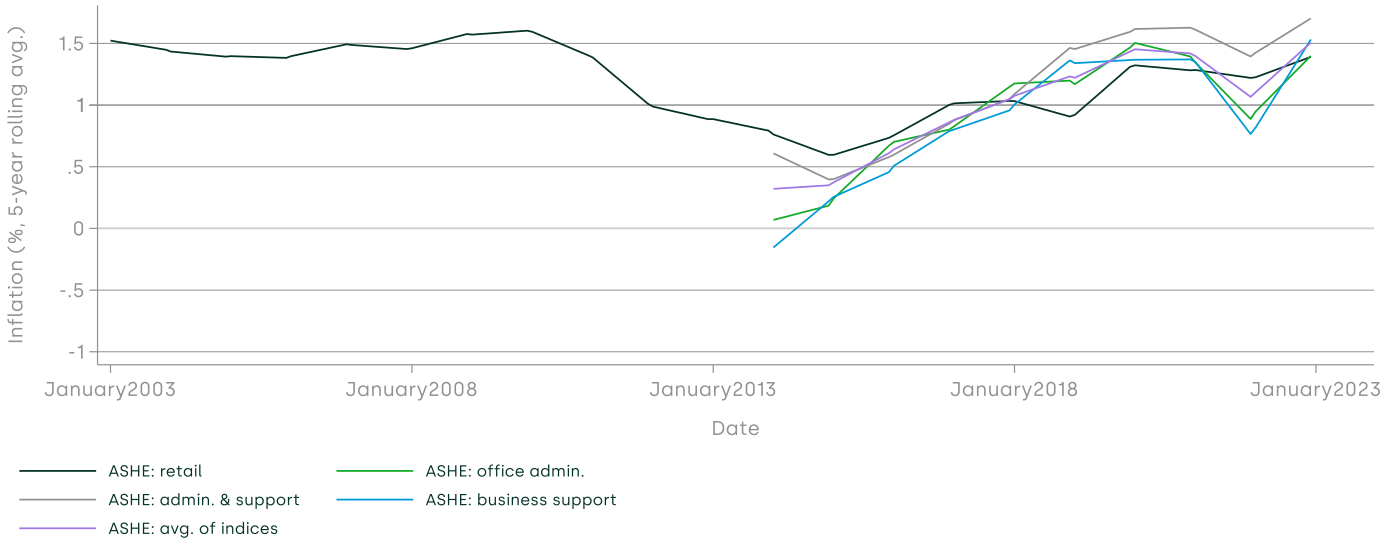
[50] Ofgem (2022), 'RIIO-ED2 Draft Determinations – Core Methodology Document', June, Table 67.

- the average of all four of the above indices.

Note that all the analysis presented in this section is based on nominal price pressure (i.e. it does not account for CPIH), given that residential retail is a nominal price control.

The evolution of the inflation rates implied by each of the indices, weighted by the average share of labour in WSH's residential retail costs, is shown in the figure below. All indices follow the same trend, and suggest a weighted IPP of c. 1–1.5% p.a.

Figure 3.5 Labour IPP: historical data



Note: This figure illustrates the evolution of the five-year rolling average of the growth in nominal retail labour prices. The sample period considered is 1998–2022 for the retail index, and 2009–22 for all other indices. The start of the time period for each displayed in the figure is five years after the first year of the sample period due to the use of a five-year rolling average.
Source: Oxera analysis of the growth in retail labour prices.

The analysis shows that retail labour price inflation has been increasing since c. 2015. On the basis of the long-run growth in the retail labour price indices estimated over the full sample period, the table below shows the anticipated increase in nominal labour price index in AMP8.

Table 3.13 MPE: RPE and IPP for AMP8 using historical data

Index	IPP/RPE	2025/26	2026/27	2027/28	2028/29	2029/30
ASHE retail	Nominal	3.3%	3.3%	3.3%	3.3%	3.3%
ASHE office admin	Nominal	1.8%	1.8%	1.8%	1.8%	1.8%
ASHE administration and support	Nominal	2.9%	2.9%	2.9%	2.9%	2.9%
ASHE business support	Nominal	1.7%	1.7%	1.7%	1.7%	1.7%
ASHE avg. of retail indices	Nominal	2.3%	2.3%	2.3%	2.3%	2.3%

Source: Oxera analysis.

The forecast IPP for retail labour ranges between 1.7% and 3.3% p.a. depending on which index is used.

3.5.2 Incorporating forward-looking information

The OBR forecasts of average earnings relate to expected economy-wide increases in wages and can therefore be used to set an ex ante allowance for labour IPPs in the residential retail price control. The OBR's forecasts of nominal earnings growth are re-stated in the table below.

Table 3.14 Labour: IPP for AMP8 using external forecasts

IPP	2025/26	2026/27	2027/28	2028/29	2029/30
Nominal	1.7%	2.1%	2.5%	2.1%	2.5%

Source: Oxera analysis.

As discussed in section 3.1.2, the OBR's previous forecasts have deviated from the outturn over successive periods, such that caution needs to be exercised when setting fixed ex ante IPP allowances.

3.5.3 Labour IPP for AMP8: final thoughts

Following our approach for wholesale labour costs, we consider that the OBR forecasts should be used for assessing residential retail costs in the first three years of AMP8, while the remaining two years should be based on the long-run historical trend in retail labour cost indices. For the purpose of this analysis, we consider a simple average of the four indices outlined in section 3.5.1. The expected IPP on the basis of this analysis is shown in the table below.

Table 3.15 Labour: IPP for AMP8 using external forecasts

IPP	2025/26	2026/27	2027/28	2028/29	2029/30
Nominal	1.7%	2.1%	2.5%	2.3%	2.3%

Note: This table summarises the nominal forecast growth in average earnings for the financial years 2025/26, 2026/27 and 2027/28. For the remaining financial years, the IPP is the long-run IPP of the average of four retail-specific indices in the ASHE survey.
Source: Oxera.

Note that residential retail labour IPPs are subject to similar uncertainty to the wholesale labour RPEs. Therefore, setting a fixed ex ante allowance on the basis of these estimates is likely to result in windfall gains or losses for companies.

We understand that the data tables for PR24 do not allow companies to present nominal IPP, despite residential retail being a nominal price control. Therefore, we present the RPE for retail labour costs in the table below.

Table 3.16 Labour: RPE for AMP8 using external forecasts

IPP	2025/26	2026/27	2027/28	2028/29	2029/30
Real	1.70%	1.30%	0.80%	0.30%	0.30%

Note: This table summarises the nominal forecast growth in average earnings for the financial years 2025/26, 2026/27 and 2027/28. For the remaining financial years, the IPP is the long-run IPP of the average of four retail-specific indices in the ASHE survey.
Source: Oxera.

4 Accounting for forward-looking uncertainty

The independent forecasts used to predict input prices in AMP8 outlined in the previous section represent the best estimate of how RPEs are expected to evolve. However, the use of independent forecasts does not in itself mitigate the risk that WSH will be over- or underfunded in AMP8 on the basis of RPEs. The independent forecasts are themselves measured under some form of uncertainty, and it is clear that outturn input price indices often differ from forecasts, for example, due to unexpected macroeconomic developments. As such, an ex ante allowance for input prices can create windfall gains and losses for WSH and its consumers.

As noted, at PR19 Ofwat used OBR forecasts to set an ex ante RPE for labour costs in the wholesale price controls, and revenues were adjusted within the regulatory period if outturn labour prices differed to what was forecast. For the first two years of AMP7, Ofwat had forecast that real hourly wage growth would increase at a rate of 1.1% for both years. However, outturn real labour costs in the first year grew by only 0.4% and fell by -0.61% in the second year, and companies' allowed revenues will be adjusted downwards to reflect this. The indexation of allowed revenues to relevant labour cost indices has protected consumers against errors and uncertainty in forecasting labour costs in AMP7.

We note that other price indices are similarly (or more) prone to forecasting errors. For example, the figure below shows the BEIS forecasts for energy prices under different forecast scenarios.

Figure 4.1 Forecast energy prices during AMP8 under different scenarios

Note: This figure illustrates the year-on-year growth of the BEIS industrial energy price forecasts for the years in AMP8. The scenarios plotted comprise: (i) a reference scenario with baseline assumptions regarding fossil-fuel prices; (ii) a scenario with high fossil-fuel prices and a scenario with low fossil-fuel prices.
Source: Department for Business, Energy & Industrial Strategy, EEP - Annex M - Growth assumptions and prices.

While the reference scenario might be BEIS's 'best estimate' of how energy prices will evolve in AMP8, there are clearly realistic scenarios where energy prices will be materially different to this reference scenario. Indeed, the difference between the energy price forecast in 2030 between the high and low prices scenarios is c.31%.[51] Setting a fixed RPE for energy prices ex ante is likely to over- or undercompensate companies for the evolution of energy prices. Note that the same arguments can be made with respect to chemicals and MPE costs.

We note that, at RIIO-ED2, Ofgem indexed 87.9% of electricity distribution network operators' (DNOs) TOTEX to price indices other than CPIH.[52] In its methodology document, Ofgem noted the following:

[51] The energy price forecasts in the different scenarios converge from c. 2024 onwards, although there remains a material difference in prices between the scenarios into AMP8. The figure is somewhat distorted by the large differences in price forecasts for 2022 and 2023.
[52] Ofgem (2022), 'RIIO-ED2 Final Determinations Core Methodology Document', December, para. 7.610.

> We [Ofgem] believe it [indexing revenues to RPEs] will better reflect actual costs faced by DNOs and protect consumers against the risk of inaccurate forecasting associated with setting an ex ante allowance for RPEs. This is because indexing RPEs reduces the potential for out-performance or underperformance of RPEs due to forecasting errors. Ex ante allowances for RPEs may also cause windfall gains or losses for DNOs due to factors outside of their control, for example due to the cost of labour or materials.
>
> **Ofgem (2020) , 'RIIO-ED2 Sector Methodology Decision: Annex 2 Keeping bills low for consumers', December, para. 4.11.**

Therefore, it would be prudent for Ofwat to index wholesale revenues to a selection of input price indices that also cover non-labour inputs.

Regarding residential retail, Ofwat has stated in its PR24 methodology document that it does not intend to index revenues to inflation. Specifically, it argues that 'any expected input price pressure can be reflected in the revenue limit we set for companies at the outset of the price control.'[53] As in wholesale, we note that the ex ante forecasts for key inputs (e.g. labour) are uncertain and depend on exogenous factors (e.g. macroeconomic developments). Therefore, a pure ex ante assessment of residential retail input prices is likely to result in windfall gains or losses for companies.

[53] Ofwat (2022), 'Creating tomorrow, together: Our final methodology for PR24', December, section 3.6.3.

5 Reflecting current price levels

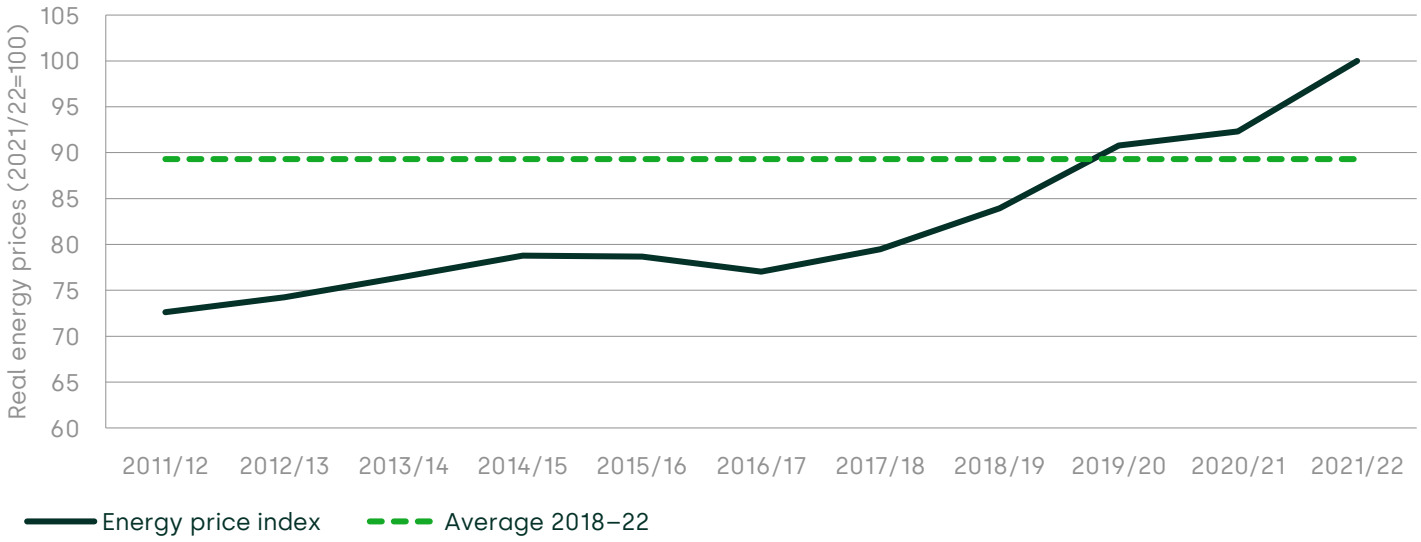
The analysis and arguments outlined in the previous sections relate to the estimation of RPEs and how the uncertainty around the estimated RPEs can be accommodated in the wider regulatory framework. Another important consideration relates to how RPE analysis overlaps with Ofwat's cost assessment modelling, particularly models that rely on historical data (such as the base cost modelling).

At PR19, Ofwat used econometric models that were based on historical data (at the time, 2012–19) to estimate the historical average relationship between costs and cost drivers. It benchmarked companies' costs using the last five years of outturn data (2015–19) to adjust the regression analysis to reflect its view of the relationship between cost drivers and efficient costs. These efficient cost models were then extrapolated into AMP7 using forecasts of companies' cost drivers, and Ofwat overlaid an RPE assumption from the first forecast year (2020). This implicitly assumes that the (real) input prices that companies faced in the benchmarking period (2015–19) were representative of the (real) input prices that they faced in 2020.

Although this assumption was not explicitly evidenced at PR19, it may have been broadly appropriate given the relative stability of real input prices in that time period. However, given the recent volatility (specifically, increase) in input prices, this assumption may now be less valid. In particular, we note that the recent high prices facing the industry might be 'averaged out' with outdated (and unrepresentative) data, such that the 'implicitly funded' input price is lower than the prices that companies actually face in the last year of outturn data.

As an example of how this is manifested, the figure below shows the evolution of electricity input prices in the modelling period.

Figure 5.1 Evolution of energy prices in the modelling period



Source: Oxera analysis.

The chart shows that real energy prices have been increasing over the modelling period. Moreover, the average energy price in the last five years of outturn data is c. 10% below the actual real energy price faced by companies in 2021/22. Therefore, if Ofwat were to apply an RPE from 2021/22, it would first have to uplift allowances to reflect the energy prices faced by companies in 2021/22.

A1 Details of Ofwat's approach at PR19

This appendix provides more details regarding the staged approach to assessing RPEs undertaken by Ofwat and its consultant, Europe Economics at PR19.

Stage 1A: Are there any material RPEs outside management control that are not captured by CPIH indexation?

Europe Economics examined the following questions as part of this stage.

- Is there a significant likelihood that the value of the wedge between the input price and CPIH will be substantially different from zero over the period of the price control? This is broken down into two further questions:
  - Is the expected value of the wedge between the input price and CPIH materially different from zero? To answer this, Europe Economics used historical data to measure the size of the average wedge over a specified time horizon, and tested whether this wedge was statistically different from 0. Where forecasts are available, it assessed the wedge between the input price and forecast CPI.
  - Does the wedge between the input price and CPIH exhibit high volatility over time? Europe Economics attempted to assess this for a five-year time horizon by looking at the five-year rolling average of the wedge as the share of TOTEX. If the wedge of a given input, as a share of TOTEX, exceeded a threshold of 1% then the wedge is said to be materially volatile and there may be case for an ex post adjustment mechanism.
- Are there sufficient and convincing reasons to think that CPIH does not adequately capture the input price? Europe Economics assessed this by comparing the share of the input in TOTEX to the share of the input in CPIH. Alongside this, it looked at the correlation between the input price and CPIH.
- Is the input price and exposure to that input price outside management control for the duration of the price control? Europe Economics assessed this on the company's ability to control three criteria:
  - the level of the price paid for the input through having a degree of market power, or the company being able to pay

lower and competitive rates for inputs due to remedying past mismanagement;
- the volatility of the price paid for the input through establishing long-term contracts with input suppliers;
- the volume of the input through improving efficiency or substituting to other inputs in order to re-optimise its input mix.

Inputs that passed these criteria were progressed to stage 1B.

Stage 1B: What, if anything, should be done about these RPEs?

Europe Economics examined the following questions as part of this stage.

- Is there a robust basis for forecasting the input price?
- Is there a robust and relevant index for the input price?
- Would an RPE mechanism for the cost area create any perverse incentives for companies?
- Should the risk be borne by customers rather than investors?

Inputs that passed these criteria were progressed to stage 2.

Stage 2: Check on the overall 'package' implied by stage 1 results

Europe Economics assessed RPEs for the following inputs:

- labour;
- energy;
- chemicals;
- MPE.

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