



RIO-GD2 cost assessment – frontier shift

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Ofgem

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I. INTRODUCTION

Ofgem's Gas Distribution (GD) cost assessment team commissioned Cambridge Economic Policy Associates (CEPA), in association with Economic Consulting Associates (ECA), to provide advice on the cost assessment process for RIIO-GD2/RIIO-2.

CEPA and ECA have prepared three briefing papers for publication alongside Ofgem's consultation paper on cost assessment. The topic of each paper is as follows:

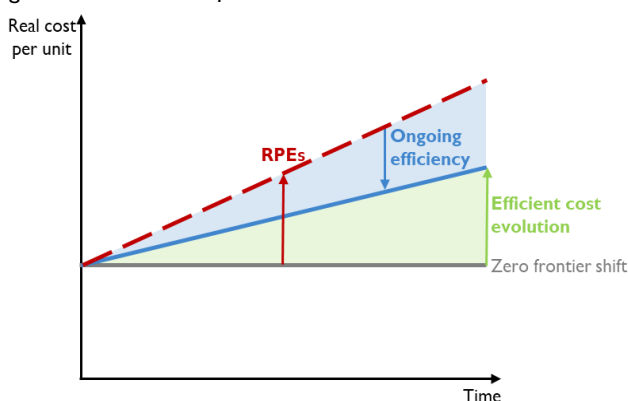
- econometrics and regional factors (prepared by CEPA).
- business support costs (prepared by ECA).
- frontier shift (prepared by CEPA).

This paper discusses a series of topics related to frontier shift.

Frontier shift is the rate at which the unit costs of an efficient company change over time. It captures both changes in the *volume* of inputs needed to produce a given level of output and in the *price* of inputs used. Ongoing efficiency is the change in the volume of inputs used. RPEs are the changes in prices of those inputs (net of inflation).

In other words, frontier shift is ongoing efficiency net of RPEs. If an efficient company were expected to make a 1% annual efficiency gain but its input prices were also rising at 1% a year, it would be expected to keep the cost of producing its outputs approximately constant over time—frontier shift would be zero.

Figure 1.1: Frontier shift illustration



Ofgem has already made decisions on some aspects of how frontier shift will be treated in RIIO-2; therefore, this note discusses how those decisions might be implemented, as framed by the questions set out at the start of each section of this briefing paper. Ofgem has indicated its intention to:

- set RPEs to zero if differences from general consumer price inflation are not material;
- use indexation in place of forecasts where it does allow RPEs;¹ and
- use growth accounting data to inform the level of ongoing efficiency challenge.

The decisions that Ofgem makes on frontier shift have implications for other aspects of cost assessment for RIIO-2. We make references to such linkages throughout the paper and recommend that this paper be read as part of the full set of briefing papers prepared by CEPA and ECA for Ofgem as part of this engagement.

This paper has three main sections: the first addresses a set of topics for the assessment of ongoing efficiency for RIIO-2; the second addresses topics related to RPEs; and the third section presents overall conclusions from this paper.

¹ We understand, however, that Ofgem may use RPE forecasts as part of an indexation mechanism that would subsequently be trued-up on an ex-post basis.





2. RIIO-2 ONGOING EFFICIENCY TOPICS

Setting a suitably stretching ongoing efficiency challenge is a key part of the regulator's role in ensuring value for money for consumers. This will be particularly important for Ofgem in the coming years as the energy sector faces a period of rapid change. Change brings uncertainty but also gives rise to opportunities for new business practices and innovations that will continue to allow all companies to become more efficient, even those at the frontier.

Ofgem asked us to develop proposals to address the following issues for ongoing efficiency in RIIO-2:

- How might Ofgem use growth accounting data to assess ongoing efficiency in RIIO-2?
- What other evidence might Ofgem consider alongside growth accounting data?

We address each area in turn in the sections that follow.

2.1. GROWTH ACCOUNTING APPROACH

In previous price controls, Ofgem has applied a 'traditional' approach of growth accounting analysis, drawing on historical data from the EU KLEMS dataset to set ongoing efficiency challenges.² For RIIO-T1 and GDI, for example, it applied the following annual ongoing efficiency assumptions:

- 1.0% for opex, informed by averages of EU KLEMS partial factor productivity measures (labour, and labour and intermediate outputs) for selected industries from 1970 to 2007; and
- 0.7% for capex and repex, informed by averages of EU KLEMS total factor productivity measures for the construction sector and other selected industries over the same period.³

Ofgem has proposed to apply growth accounting analysis, as it did in RIIO-1, to help inform the ongoing efficiency challenges applied in RIIO-2. In this section, we briefly consider the approach Ofgem could follow when using growth accounting data in terms of:

- choice of dataset;
- choice of comparators;
- time period; and
- productivity metric.

We find that EU KLEMS is likely to remain the preferred source of growth accounting data for Ofgem to use when assessing ongoing efficiency based on growth accounting data. Nevertheless, Ofgem may find value in exploring further with the industry the appropriate range of sensitivities on comparators, time periods and productivity metrics that would be used to test the robustness of the primary approach, addressing the lack of expert consensus on the 'correct' approach to take.

² Information on the EU KLEMS methodology and data is available on euklems.net.

³ p15, Ofgem (Dec 2012) "RIIO-T1/GDI: Real price effects and ongoing efficiency appendix" available on ofgem.gov.uk





2.1.1. Choice of dataset

Regulators and regulated companies often choose EU KLEMS as the primary growth accounting data source to inform their ongoing efficiency challenge proposals. However, it is not the only choice available.

The key source for the data used in EU KLEMS comes from Eurostat, which typically sources information from national statistical authorities, who in turn have access to information that is even more granular and up to date.

The UK Office for National Statistics (ONS) produces growth accounting data based on its Annual Business Survey (ABS). The Bank of England and Office for Budget Responsibility also produce macroeconomic productivity forecasts, informed by ONS data. A recent paper prepared for Ofgem by the Energy Policy Research Group (EPRG) examined estimates based on both the ABS and EU KLEMS to inform analysis of historic productivity growth in electricity and gas networks.⁴

We consider EU KLEMS will remain the preferred primary source of growth accounting data for the upcoming RIIO-2 price controls:

- EU KLEMS is a well understood data source that has extensive precedent in UK regulation (including RIIO-1) - debates ahead of earlier determinations have explored its advantages and disadvantages in detail.
- EU KLEMS follows a consistent approach across most countries so allows for international comparisons, at the very least to sense check results for the UK. International comparisons based on the ABS may be more difficult.
- The ONS acknowledges that the EU KLEMS approach is “*conceptually preferable*” to the ABS given the ability to identify contributions to gross output from intermediate inputs as well as from capital and labour.⁵ In practice, the ONS has not adopted the EU KLEMS approach due to the more onerous data requirements.
- The more granular sector definitions available in the ABS have limited value if the focus is on sectors other than the ones being regulated (see Section 2.1.2).⁶
- The pro-cyclical nature of productivity means that unlike many other aspects of data used to inform cost assessment, the most recent data is not necessarily the most pertinent (see Section 2.2.2).
- Other economy-wide estimates of productivity (e.g. Bank of England and Office for Budget Responsibility forecasts informed by ONS data) lack enough granularity of sectors to ensure comparability to regulated networks’ activities.

As set out above, we find that EU KLEMS is likely to remain the preferred source of data for Ofgem’s assessments of ongoing efficiency based on growth accounting data. However, it need not be the only source that Ofgem considers. There may be cases, for example, where there is value in supplementing EU

⁴ Ajayi V. et al (Dec 2018) “Productivity growth in electricity and gas networks since 1990” available on [ofgem.gov.uk](https://www.ofgem.gov.uk)

⁵ Appendix I, “MFP Sources and Methods”, ONS webpage “Multi-factor productivity estimates: Experimental estimates to 2015” available on [ons.gov.uk](https://www.ons.gov.uk)

⁶ The EPRG notes that “in analysing TFP using ONS data, we found some difficulties due to the lack of key data for specific years” and some interpolation approximations had to be used for the gas sector. More generally the authors note that “data was surprisingly difficult to collect” and that “gas data was particularly poor”. p26, Ibid.





KLEMS with cross-checks from other credible sources, particularly in relation to issues regarding the selection of time period, as discussed in Section 2.1.3.

2.1.2. Comparator sectors

The EU KLEMS dataset offers the opportunity to estimate historical productivity trends for a variety of UK sectors. The principle that Ofgem applied in RIIO-T1 and GDI was that comparator sectors should be chosen based on the similarity of their business processes to the networks (i.e. their comparable use of labour, materials, and other inputs in the production process) for the type of cost activity considered (e.g. opex or capex).

General principles that Ofgem might use to help determine which sectors to use as comparators for RIIO-2 include the following:⁷

- **Comparability in nature to company activity.** As noted above, this is a key aspect, which Ofgem tested through sensitivity analysis for RIIO-T1 and GDI.⁸ In basic terms, regulated network activities are simply the construction and maintenance of an asset combined with some customer-/business-facing services. Sectors that undertake relatively similar activities in relation to the cost area being examined (e.g. opex or capex) are the most appropriate comparators. On this basis, we would expect, for example, that the construction sector will remain a relevant comparator for capex/replex activities.
- **Competitiveness.** Ongoing efficiency focuses on companies at the frontier, driven to innovate and cut out inefficiency by competitive forces. Sectors with limited competition may have more inefficient firms within them and so give less accurate estimates of what is achievable at the frontier. Similarly, sectors that are broadly public in nature or heavily regulated (and with limited innovation) are less likely to engender the competitive environment required for estimates to accurately reflect productivity improvements achievable at the frontier.⁹
- **Volatility and atypical changes.** Sectors that have seen (one-off) productivity changes caused by atypical/exogenous events may be poor comparators on a forward-looking basis for RIIO-2. Volatile productivity changes may also show a sector has experienced sector-specific changes and mean it is not stable enough to be a good comparator.

We consider that Ofgem should exercise caution in the use of growth accounting data from the regulated sectors themselves. The historical time periods typically considered as part of ongoing efficiency analysis mean their privatisation – an atypical event – may heavily influence the results. There may also be grounds for Ofgem to look further afield, lest historical performance become embedded in the target, dampening companies' incentives to become more efficient.

When choosing comparable sectors to use in growth accounting analysis, it is possible to consider including particularly relevant sectors (from a baseline of none) or *excluding* particularly irrelevant sectors (from a baseline of including all). The approach taken results in a different treatment of 'marginal' sectors and can

⁷ The current draft of the GD2 business data templates, for example, requests the GDNs to state ongoing efficiency growth across (at least) five cost categories.

⁸ p19, Ofgem (Jul 2012) "RIIO-T1/GDI: Initial Proposals – Real price effects and ongoing efficiency appendix" available on ofgem.gov.uk

⁹ Although not explicitly stated at GDI/T1, the competition principle is likely why public administration, education, health, and social services sectors were excluded from all growth accounting analysis.





lead to different productivity estimates. Given there is no obvious reason to prefer the inclusion or exclusion method over the other, a conservative approach would be to consider both. This then gives a wide range of sensitivities to inform a more holistic judgement of ongoing efficiency in the round.

2.1.3. Time period

The choice of time period can have a significant impact on the outcome of historic growth accounting analysis. There are two general approaches for dealing with this issue:

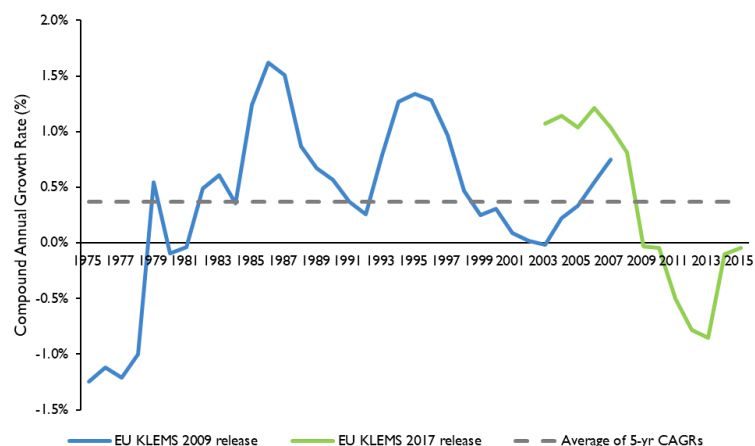
- **All available data.** One approach that Ofgem applied in RIIO-1 was to use the full range of EU KLEMS data available at the time: 1970 to 2007. That approach has the advantage of making use of as much data as possible, reducing the impact of outlying data points and so may result in an average productivity growth rate that may be more representative of long-run underlying factors. As a relatively simple approach, it may help reduce the need for (potentially arbitrary) judgements on what shorter samples should be selected, but it is vulnerable to methodological changes that reduce the comparability of data releases over time, as has occurred for EU KLEMS.¹⁰
- **Business cycles.** It is possible to separate the available data into one or more business cycles of boom and bust. This recognises that if the sample includes an incomplete business cycle it may result in a biased estimate. As such and given the potential for the macroeconomic picture to change, a focus on complete business cycles may better reflect the expected conditions for the upcoming price control. A disadvantage of this approach, however, is that it relies on the accuracy of judgements on when business cycles start and end. There are some standard time periods that regulators and companies have used, but this is not a simple decision, and so could lead to accusations of cherry-picking.¹¹

The choice of appropriate time period is likely to be particularly important for RIIO-2 (as compared to RIIO-1), particularly as there is not yet any data on a more recent full business cycle.

Figure 2.1 helps illustrate the cyclicity of productivity over time, as well as how it has fallen since the time of the global financial crisis and has failed to return to its long-term average since then.

This recent pattern of relatively low productivity growth could be the

Figure 2.1: Five-year compound annual growth rate of TFP (VA), all industries



Source: Ofgem, EU KLEMS

¹⁰ Methodological changes between the 2009 and 2017 EU KLEMS releases reduced the comparability of the UK data over time. See Figure 2.1 below and p11, The Conference Board (Jul 2018) "EU KLEMS Growth and Productivity Accounts 2017 Release, Statistical Module" available on euklems.net

¹¹ The choice to use the full available time period would not necessarily prevent Ofgem being accused of cherry-picking, particularly in light of evidence of low recent productivity discussed below.





result of a fundamental structural break. This would mean that historical data may no longer approximate to expectations for productivity growth in the (near- to mid-term) future; however, that is difficult to determine with any confidence given uncertainty about the overall business cycle.

Showing that a structural break has occurred is particularly difficult when considering a cyclical variable like productivity and is made more difficult still by the disconnect between the compound annual growth rates for years covered in both the 2009 and 2017 EU KLEMS releases, as can be seen in Figure 2.1.¹² It might not be unreasonable to expect that productivity could rise back to its pre-recession levels during RIIO-2.

The issues set out above mean that, similar to our findings on the choice of comparative sectors, we find that Ofgem may find it appropriate to consider estimates across a number of sensitivities on time periods and business cycle definitions to generate a range of estimates based on historic growth accounting data.

Not all these questions, however, are the reserve of regulators setting ongoing efficiency challenges. Recent low productivity growth has been a point of intense debate among a range of UK policymakers, including the Office for Budget Responsibility and the Bank of England, which both consider productivity forecasts as part of their macroeconomic modelling.¹³ Given the ultimate forward-looking nature of how Ofgem will apply its ongoing efficiency estimates, we expect there may be value in comparing the range of estimates produced from historic growth accounting data with OBR and BoE productivity growth forecasts. That process may help control for the cyclical nature of productivity and produce a narrower confidence range.

2.1.4. Productivity metric

Regulators face a choice between different measures of productivity, such as:

- total factor productivity (labour, capital and intermediate inputs);
- labour productivity; and
- labour and intermediate inputs productivity.

Partial factor productivity measures (e.g. labour productivity, and labour and intermediate inputs productivity) may be more relevant to activities with a large labour share, such as network companies' opex, while total factor productivity can be more relevant to capex.

Partial factor productivity growth may include the effect of capital substitution (i.e. where growth of capital exceeds the growth of variable factor inputs such as labour and intermediate inputs, thereby increasing partial factor productivity compared to total factor productivity), which is sometimes distortionary.

Regulators may, therefore, choose to hold capital constant to strip out the impact of capital substitution.

There are also two common measures of output used to measure productivity:

- **Gross output (GO)** is the simple aggregate of one or more companies. The inputs used to make gross output are capital, labour and intermediate inputs (energy, materials, services).

¹² We understand that an updated and revised EU KLEMS dataset will be released in the autumn of 2019.

¹³ See, for example, Bank of England (Jan 2018) "*The fall in productivity growth: causes and implications*" available on bankofengland.co.uk and pp44-49, Office for Budget Responsibility (Nov 2017) "*Economic and fiscal outlook*" available on obr.uk





- **Value added (VA)** is gross output minus the value of intermediate inputs required to produce the final output. Value added inputs are therefore labour and capital only.

There is no consistent expert view on which definition of output is more relevant for measuring ongoing efficiency—each has its own range of advantages and disadvantages.¹⁴ In such cases, it is typically good practice to construct a range using multiple methods.

2.2. ADDITIONAL EFFICIENCY CHALLENGE EVIDENCE

This section briefly discusses three potential sources of additional evidence on ongoing efficiency that Ofgem may consider for RIIO-2 alongside growth accounting data: (i) company proposals; (ii) econometric time trends; and (iii) adjustments towards a notional efficiency frontier.

2.2.1. Company proposals

In the RIIO-ED1 determination for electricity distribution operators (DNOs), Ofgem did not apply a separate ongoing efficiency assumption. All DNOs included assumptions within their submitted costs (these ranged between 0.8% to 1.1% per year).¹⁵ Ofgem assessed them as being in line with its own view of ongoing efficiency at the time and so proposed no adjustment to what the companies had suggested.¹⁶

For RIIO-2, Ofgem may wish to consider rolling out a similar approach to the other network sectors. However, in doing so, it would be important to recognise the interlinkages between the different aspects of the price control. For example, if Ofgem considered that the right levels of ongoing efficiency improvements were already accounted for within companies' proposed costs, it might not be appropriate to impose an additional independent efficiency challenge.

It will be important for Ofgem, therefore, to have a clear understanding of the nature of any ongoing efficiency assumptions already built into companies' expenditure forecasts. Asking companies to report on the RPE and efficiency challenge assumptions used within their business plans may be a useful way to identify how companies have built their expenditure forecasts and ensure business plans can be compared on a like-for-like basis. We understand that RPE and ongoing efficiency assumptions have already been requested in the Draft Business Plan Templates.

Ofgem may also find it helpful to consider how it might challenge the companies on why a more stretching target would not be appropriate and to explore whether it is helpful for companies to identify the extent to which their ongoing efficiency proposals can be attributed to consumer-funded innovation projects.

2.2.2. Time trends

We consider that the results obtained from the decomposition of historical company cost performance to estimate historical ongoing efficiency (as distinct, for example, from catch-up efficiency and input price

¹⁴ See, for example, discussion in pp42-44 CEPA (Nov 2012) "Ongoing efficiency in new method decisions for Dutch electricity and gas network operators" available on cepa.co.uk

¹⁵ Ofgem (2014) "RIIO-ED1: Final determinations for the slow-track electricity distribution companies – Business plan expenditure assessment" available on ofgem.gov.uk

¹⁶ This does not include the efficiency savings that were considered possible due to the introduction of smart grid technology. We do not consider this here.





pressures) should be interpreted with caution as it is likely to be difficult to isolate such effects with confidence.

We note, however, that Ofgem may already be producing some similar analysis if it uses a time trend variable within its RIIO-2 econometric analyses rather than year dummies. Ofgem included a time trend in the top-down and bottom-up totex models for ED1.¹⁷ Ofwat also used this approach at PR14 and has tested it within econometric cost models for PR19 too.

It can be difficult to interpret time trend variables as they capture a combination of frontier shift and changes in quality not explained by other explanatory variables. However, they offer a potential crosscheck of the frontier shift estimates developed by Ofgem for RIIO-2, and also of ongoing efficiency if RPEs are stripped out.

As with the use of ongoing efficiency assumptions embedded in company cost proposals, caution must be exercised to ensure double counting of ongoing efficiency does not occur. If the time trend coefficient is used to produce forecast costs, an estimate of frontier shift will therefore already be in part or fully included in the allowances produced by the model. This issue is discussed further in the separate CEPA paper on econometrics and regional factors.

2.2.3. Adjustments towards a notional efficiency frontier

A key assumption underlying the approaches detailed above is that benchmarking network companies using historical data from their sectors results in accurate forecasts of their achievable production frontiers.

In practice, however, it is possible that existing industry structures or regulatory arrangements may create barriers for network companies to reach the frontier, and so an efficiency challenge based on historical performance (i.e. the *observable* frontier) may not reflect what is currently achievable (i.e. the *notional* frontier). Such constraints might be alleviated by:

- **Structural changes.** There may be events that change the environment for network companies and result in trend or step changes in their ability to improve productivity. One example is the privatisation of the gas and electricity networks, which may have enabled companies to push towards a more challenging frontier that was not previously considered to be attainable.
- **Regulatory arrangements.** The concept of ongoing efficiency is the movement in the achievable frontier over time (assuming a given set of input prices). In the economy as a whole, or highly competitive industries, the most efficient existing companies may be close to this notional frontier. However, conditions may exist in the regulated sectors (e.g. unequal incentives across capex and opex that existed before the introduction of the totex framework) that make it more difficult for the regulated companies to be at the notional frontier.

As such, it may be appropriate for Ofgem to consider an additional efficiency challenge beyond that suggested by ongoing efficiency estimates based on growth accounting data (i.e. an estimate of frontier shift from competitive sectors)—this can be seen as a general ‘catch-up’ for the regulated companies to the notional frontier. Doing this would be consistent with the view that all the regulated companies may be able to make further efficiency gains within the boundaries of current technology and approaches and so may justify applying a form of additional catch-up efficiency challenge.

¹⁷ pp28-29, Ofgem (Nov 2014) “RIIO-ED1: Final determinations for the slow-track electricity distribution companies - Business plan expenditure assessment” available on ofgem.gov.uk





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While such an additional efficiency challenge may be conceptually valid, there are challenges to be addressed in implementation, including:

- identifying a specific source of efficiency improvement that is not either already captured in companies' forecasts or captured in a more generic efficiency challenge based on growth accounting data;
- finding a sound approach to isolate and quantify the size of any such effects; and
- establishing why any existing cases of such benefits would be expected to recur over time.

As a result, Ofgem may benefit from consulting on this matter to build an evidence base to identify where a workable approach might be possible.

Ofgem may also benefit from consulting on how any efficiency improvements arising from innovation projects funded by consumers should be taken into account in any such adjustment of ongoing efficiencies, allowing consumers to benefit from that innovation through lower charges.





3. RIIO-2 RPE TOPICS

Ofgem asked CEPA to consider the following questions for RPEs in RIIO-2:

- How might Ofgem consider whether to set RPEs to zero if differences from general consumer price inflation are not material?
- How might Ofgem approach the selection of price indices for use in an RPE indexation mechanism?

We address these two issues in the sections that follow.

3.1. RPE MATERIALITY

In the July 2018 RIIO-2 Framework Decision, Ofgem confirmed it would index real price effects (RPEs) “to the extent evidence suggests this is different from general consumer price inflation”¹⁸ and that it would explore whether to set RPEs “to zero if the evidence suggests that deviations in wage and construction-linked inflation from general consumer price inflation are not material.”¹⁹

Ofgem has not yet determined how it will approach judgements of materiality when developing any RPE indexation mechanism. Therefore, Ofgem has asked CEPA to consider how it might approach setting RPEs to zero if differences from general consumer inflation are not material. In this section, we break that question into two parts:

- the default approach for non-indexed costs; and
- the approach to judgements of materiality in deciding whether or not to index costs.

In the first section, we explore the circumstances under which setting RPEs to zero is appropriate as the default approach for categories of costs without RPE indexation. We address this question first as the default approach forms the benchmark against which Ofgem would base its judgements of materiality.

In the second section, we set out proposals for two key aspects of how Ofgem might approach judgements of whether RPEs are sufficiently material (compared to the default approach) to warrant indexation.

3.1.1. Default approach for non-indexed costs

We consider that further work is needed to determine if setting RPEs to zero is appropriate as the default position for cost categories that are not subject to indexation. The need for further work in this area is driven by two main considerations: (i) the need to ensure the approach to RPEs is consistent with the treatment of ongoing efficiency; and (ii) Ofgem’s intention to move from RPI to a CPI-based measure (CPIH or CPI) as the general measure of inflation in the price control.²⁰

¹⁸ Para 5.29, p41 Ofgem (Jul 2018) “RIIO-2 Framework Decision” available on [ofgem.gov.uk](https://www.ofgem.gov.uk)

¹⁹ Para 5.36, p42, Ibid.

²⁰ The Framework Decision says Ofgem will consider again whether to use CPIH or CPI and provide an updated position at Draft Determinations. See Para 12.87, p133 Ibid.





Consistency with treatment of ongoing efficiency

As a form of economy-wide output price inflation measure, CPI-based measures capture both movements in input prices and an element of ongoing efficiency improvements across the economy as a whole (and internationally to the extent that it is affected by imported goods). This may risk some element of double counting of ongoing efficiency if a separate adjustment capturing that effect is also used as part of incorporating frontier shift into companies' cost allowances. Ofgem, for example, set out in the RIIO-2 Sector Specific Methodology Decision that it intends to consider the extent that output price indices may already reflect ongoing efficiency improvements.²¹

An alternative to having zero RPEs (based on CPI-based measures) as the default approach to RPEs is to set both RPEs and ongoing efficiency to zero. Table 3.1 sets out some initial views on the strengths and weaknesses of these two approaches. Further work by Ofgem is needed to establish the circumstances in which either of these two approaches might be appropriate.

Table 3.1: Pros and cons of potential default approaches

| Option | Pros | Cons |
|--|---|---|
| 1. Zero RPEs and non-zero ongoing efficiency | <ul style="list-style-type: none">• Relatively simple to conduct RPE materiality assessments vs. CPI-based measure• Consistent with RIIO-1 approach to 'other' costs | <ul style="list-style-type: none">• Risks introducing some double counting of ongoing efficiency if an RPE is not approximate to CPI-based measure (e.g. for 'other' input costs)• Double counting becomes a greater issue for RIIO-2 if much larger shares of totex are subject to the default approach than in RIIO-1 (e.g. if large shares of totex are found to not be suitable for RPE indexation)• If CPI-based measures of inflation differ materially from input price movements in general, this approach may have a bias towards flagging RPEs as being material. |
| 2. Zero RPEs and zero ongoing efficiency | <ul style="list-style-type: none">• Reduces risk of double counting ongoing efficiency | <ul style="list-style-type: none">• Materiality assessments may be problematic as they may require assumptions on the level of ongoing efficiency• Unpicking ongoing efficiency from certain cost categories may be difficult (e.g. identifying what portions of capex relate to 'other')• Setting RPEs to zero may be simpler conceptually than setting ongoing efficiency to zero for certain input cost categories—ongoing efficiency may be better thought of at the firm or activity level (e.g. opex/capex) than by input cost categories (e.g. labour/materials)• Potential to understate scope for ongoing efficiency improvement. Unclear how generous this may be to companies |

Change in the general measure of inflation

In RIIO-GD1 and T1, Ofgem applied zero RPEs for two cost categories: 'transport' and 'other'.²² In doing so, it assumed that (before application of ongoing efficiency) these costs would rise in line with RPI, the general measure of inflation used in the price control at the time. It adopted a similar approach for ED1 where RPEs for 'other' costs were set to zero before subtracting 0.4 percent for a "step-change" in RPI.²³

²¹ Para 9.42, p70, Ofgem (May 2019) "RIIO-2 Sector Specific Methodology – Core document" available on [ofgem.gov.uk](https://www.ofgem.gov.uk)

²² p13, Ofgem (Dec 2012) "RIIO-T1/GD1: Real price effects and ongoing efficiency appendix" available on [ofgem.gov.uk](https://www.ofgem.gov.uk)

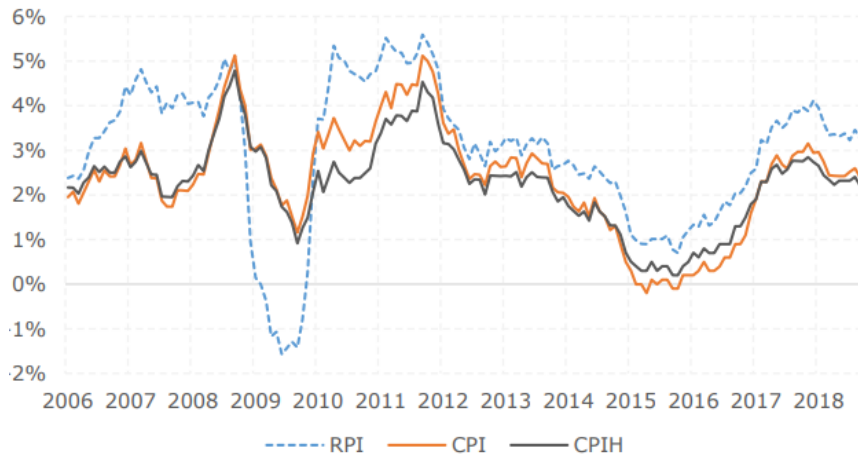
²³ pp151-152, Ofgem "RIIO-ED1 Draft determinations - business plan expenditure assessment" available on [ofgem.gov.uk](https://www.ofgem.gov.uk)





Ofgem intends to use CPI-based measures of inflation for RIIO-2. Figure 3.1 illustrates that CPIH and CPI have tended to be lower than RPI over the last 10 years; indeed, Ofgem assumed an RPI-CPIH wedge of 1.049% in the RIIO-2 Sector Specific Methodology Decision.²⁴

Figure 3.1: Comparing rates of inflation, monthly (% change over 12 months)



Source: Ofgem and ONS data²⁵

Therefore, the default approach for RIIO-2 should be considered in the context of the indexation of cost allowances using a CPI-based measure of consumer price inflation, which has historically been lower than RPI, alongside a higher share of costs potentially being subject to the default approach than in RIIO-1 (as discussed in the next section).

3.1.2. Approach to judgements of materiality

The level of RPE allowances will be of paramount importance for the network companies. However, the imperfect nature of the data available to build an RPE indexation mechanism means there is value in Ofgem considering options to reduce any indexation mechanism's complexity. This is because of the risk of unintended consequences, and the level of resources needed to design and maintain it.

Companies will need to convince Ofgem of the need for RPEs and indexation for any cost category if it is to be incorporated into the price control. We consider it proportionate to expect that stronger evidence of materiality would be needed to persuade Ofgem to include smaller cost categories. It is not clear that there is a set numeric threshold that Ofgem should set to consider evidence put forward by companies (as Europe Economics did in analysis for Ofwat for PR19)²⁶. The share of totex covered by capex/repex materials may be an appropriate threshold for Ofgem to consider.

It is important to recognise that there is no hard-and-fast rule for how to assess materiality in this regard and that large categories could all arguably be sub-divided into smaller categories that would individually be classed as immaterial but together may represent a material RPE for the businesses. As such, Ofgem may need to exercise some oversight and challenge on how companies split out their costs to avoid companies

²⁴ p7, Ofgem (May 2019) "RIIO-2 Sector Specific Methodology Decision – Finance" available on [ofgem.gov.uk](https://www.ofgem.gov.uk)

²⁵ Ibid.

²⁶ Europe Economics analysis for Ofwat for PR19 used a cut-off of 10 percent. See p18, Europe Economics (Jan 2018) "Real Price Effects and Frontier Shift" available on [ofwat.gov.uk](https://www.ofwat.gov.uk).





either presenting a fine disaggregation of costs where the default approach is seen as more generous or allocating a greater portion of costs to an index that is expected to rise.

In addition, considering more than one aspect to materiality is also helpful. For example, given the historic volatility of materials costs, it does not seem appropriate to rule out indexation of gas materials (capex/repex) based on the relatively small share of totex (<10% in the case of gas distribution) alone.

When considering judgements of materiality in whether or not to index RPEs, it may be appropriate for Ofgem to take a risk-based approach focusing on cost categories that represent a relatively large share of totex and/or that would likely face relatively large movements over time. On that basis, Ofgem could consider two elements to the judgement of materiality: (i) excluding cost categories covering small shares of totex; and (ii) incorporating judgements of the expected materiality of price movements into the process of selecting suitable cost indices.

Exclude cost categories covering small shares of totex

Excluding relatively small cost categories is one option that Ofgem could consider to simplify and streamline the indexation mechanism.

In RIIO-GDI, Ofgem included RPEs for categories covering as little as 1% (equipment / plant) or 2% (gas materials (opex)) of totex, as shown in Table 3.2 below.²⁷

Table 3.2: Indices used for GDI

| Input categories | Weight in totex | Indices used to set ex ante RPE allowances |
|-----------------------------|-----------------|--|
| Labour | 64% | Average weekly earnings (AWE) private sector AWE construction AWE transport and storage PAFI civil engineering |
| Gas materials (opex) | 2% | FOCOS Resource Cost Index of Infrastructure |
| Gas materials (capex/repex) | 9% | PAFI Plastic Pipes and Fittings PAFI Pipes and Accessories: Copper PAFI Structural Steelwork - Materials: Civil Engineering Work |
| Equipment / plant | 1% | PAFI Plant and road vehicles Machinery & equipment (Output PPI) Manufacture of machinery & equipment (Input PPI) |
| Other (including transport) | 24% | No RPE |

Source: Ofgem²⁸

For RIIO-2, Ofgem may wish to consider setting an explicit minimum threshold for materiality because designing and maintaining an indexation mechanism requires greater resources than for setting an ex-ante allowance. Even when the mechanism is set up, there are additional risks from each additional index included as it is possible it might need to be replaced during the course of the price control (e.g. if

²⁷ It may have been the case that some larger categories were identified but were categorised as 'other' given the lack of a suitable comparator index.

²⁸ Ofgem (Dec 2012) "RIIO-T1/GDI: Real price effects and ongoing efficiency appendix", available on [ofgem.gov.uk](https://www.ofgem.gov.uk)





discontinued)—a consideration that was not relevant for RIIO-I when ex-ante allowances were set based on forecasts

For example, considering the indices used by Ofgem for GDI as an example, excluding the two smallest categories with an RPE (gas materials (opex) and equipment / plant) would have reduced the number of indices used from 11 to 7, while only reducing the share of totex covered from 76 percent to 73 percent and reducing the overall allowed RPE by 0.02% of totex a year.²⁹

Consider materiality of price movements as part of the index selection process

For smaller cost categories, Ofgem may benefit from considering a materiality threshold based on the expected percentage impact on totex relative to the default approach—smaller cost categories would need to demonstrate a larger percentage change relative to the default to justify their inclusion in the index.

An illustrative example of such an approach would be to introduce a rule of thumb that historical differences between the price index and CPI-based measure should be sufficiently large to change totex by 0.1 percent per year relative to the default approach (and therefore an aggregate 0.5% of annual totex over the five-year price control period). That would mean a cost category covering 5% of totex would need to demonstrate an average historical RPE difference of 2% a year; a category covering 1% would need to exceed 10%.

Judging the materiality of a price movement in isolation can be misleading. For example, a metric may be volatile, making it difficult to make a robust prediction while being both accurate and relevant; or have materially large movements but have poor comparability to companies' costs due to measurement error.³⁰

A deterministic approach to materiality may increase the risk of rejecting cases that accurately capture small but uncertain movements and/or accepting volatile series that may not reflect companies' costs or that are subject to measurement error. As such, judgements of the materiality of price movements of an index may be improved by linking them to the level of confidence in the underlying series. If an index is highly accurate and relevant, the expectation of deviations greater than 0.1% per year may be sufficient to justify its use. For series that are less relevant or accurate, and so which might be considered appropriate only when used alongside other indices, the appropriate materiality threshold may be higher, potentially over 1% per year.

Therefore, judgements of materiality would ideally be informed by: (i) assessments of the indices' relevance to the costs they are mapped to; and (ii) the degree of measurement error that indices are likely to be subject to. Section 3.2 describes how considering the materiality of price movements as part of the assessment of indices is helpful in this regard.

Assessments of materiality will ideally be forward-looking and so focus on price index forecasts, where possible. However, much analysis will need to be backward looking because of the limited availability and wide confidence bands for forecasts—both of which are consistent with the use of ongoing indexation rather forecasts in setting RPEs. Such backward-looking analysis would involve reconstructing the behaviour of the index in previous years relative to the default and may consider annual deviations between the approaches and their standard deviations.

²⁹ Gas materials (opex) had an RPE of +1.6%; Equipment / plant had an RPE of -0.9%.

³⁰ Measurement error refers to the case where an index does not accurately represent an estimate of the cost it seeks to represent. A small sample size is a common cause of measurement error.





3.2. PROCESS TO IDENTIFY SUITABLE PRICE INDICES

Selecting good indices is essential for the appropriate treatment of RPEs. Unfortunately, perfect indices do not exist so it is important to have a well-considered approach for how they would be selected.

The proposed move to RPE indexation means that the process for selecting price indices used in the RIIO-1 price controls may need to be reviewed for RIIO-2 because:

- indexation reduces or removes scope for regulatory judgement when considering imperfect data;
- year-by-year movements in indices and potential for measurement error have a financial impact;
- it creates incentives for companies to try to influence the series' values; and
- potential for future restatements or methodological changes generate governance requirements.

We think a two-stage process could be useful for selecting price indices for use in RIIO-2.

In the first stage, Ofgem would determine a longlist of options. That longlist could be constructed based on a search of regulatory precedent, series proposed by stakeholders and research on series available from reputable data providers previously used by Ofgem for this purpose.

In the second stage, the focus of this section, Ofgem would assess those indices against a set of assessment criteria to identify a shortlist of indices suitable for use in an RPE indexation mechanism. Table 3.3 and Table 3.4 below set an indicative list of 14 potential assessment criteria for use in the second stage of the process.

We developed the criteria based on: Ofgem RIIO-1 precedent for selecting RPE indices to produce RPE forecasts; CEPA analysis for Ofgem of RPE indexation for DPCR5;³¹ Ofgem's consultation proposals for RPE indexation for EDI³² and CEPA analysis for British Gas in response to that consultation;³³ and criteria considered as part of the design of the RIIO-1 cost of debt indexation mechanism.³⁴

The assessment criteria are grouped into six desirable features of an RPE index:

- (i) simplicity;
- (ii) credibility;
- (iii) accuracy;
- (iv) independence;
- (v) transparency; and
- (vi) timeliness.

The five criteria in Table 3.3, covering elements of the first four desirable features, would be graded on a pass / fail basis as part of an initial screening process to filter out indices that are unlikely to be suitable for inclusion in any RPE indexation following detailed analysis. A fail on just one criterion would be sufficient to exclude it from further analysis.

³¹ CEPA (Apr 2009) "Research Into Volume and Input Price Uncertainty for Electricity Distribution Price Control Review 5" available on ofgem.gov.uk

³² Ofgem (Nov 2014) "Reasons for our decision on the treatment of real price effects for RIIO-EDI slow-track electricity distribution network operators" ofgem.gov.uk

³³ CEPA (Sep 2014) "Response to the Ofgem consultation on Real Price Effects for RIIO EDI" available on ofgem.gov.uk

³⁴ p30, Europe Economics (Dec 2010) "The Weighted Average Cost of Capital for Ofgem's Future Price Control - Final Phase I Report" available on ofgem.gov.uk





Table 3.3: Threshold assessment criteria for selection of input price indices

| Criterion | Rationale for criterion | Substantiation | Grading |
|---|---|---|---|
| A. Simplicity | | | |
| The index represents a material cost or identifiable portion thereof | Proportionality of overall indexation mechanism (see Section 3.1.2) | Share of sector totex and mapping to cost categories | Share of sector totex Pass / fail (subject to a threshold being set) |
| Movements in the index are likely to have a material impact on totex | Proportionality of overall indexation mechanism | As above or evidence from company submissions clearly demonstrating a material impact on totex (e.g. >0.1%) | Pass / fail |
| B. Credibility | | | |
| Data provider is credible | Credibility of the data provider will be important for the legitimacy of the mechanism and provides confidence that the series will be maintained appropriately | Data provided by the organisation has been used or considered by a regulatory authority for the analysis of RPEs in the UK within the last ten years (or comparable recent reliance by a public body in a similar area) | Pass / fail |
| C. Accuracy | | | |
| Reflects movements in the respective input cost category (or a distinct portion thereof) for a notional efficient company in the sector | The index must reflect movements for a notional efficient company | Comparison of drivers of changes in the index and changes in input costs for companies in the sector | Pass / fail |
| D. Independence | | | |
| The index has a low or no chance of being manipulated by actions of companies in the sector ³⁵ | Companies in the sector should not be able to manipulate the data series for financial gain | Verification from data provider that companies in the sector neither represent a material portion of the sample nor have the ability to influence if incentivised to do so | Pass / fail |

The nine remaining criteria shown below in Table 3.4, spanning five of the six categories of desirable features, would then be used to assess the remaining indices shortlisted through the pass / fail process. These criteria could be applied to price indices individually, when multiple indices are combined for a given cost category, and even when all costs are aggregated together to form the overall indexation mechanism.

³⁵ This would also need to be monitored over time.





Table 3.4: Detailed assessment criteria for selection of input price indices

| Criterion | Rationale for criterion | Substantiation | Grading |
|--|--|--|------------------------|
| A. Simplicity | | | |
| Series does not capture ongoing efficiency | Avoidance of the need to adjust ongoing efficiency | Series represents the cost of an input for companies in the sector | True / false / unclear |
| B. Credibility | | | |
| Series has no known statistical or methodological flaws | Measurement error risk should be minimised | Analysis of index methodology, if available | True / false / unclear |
| Number of years available | Mature indices are less likely to be discontinued or have methodological changes and assist with producing up-front forecasts | Verification of availability | Years |
| C. Accuracy | | | |
| Level of confidence that use of the index will provide a more accurate reflection of the above than the default approach to RPEs | The index must be at least as good as the default approach to RPEs (see Section 3.1.1) | As above plus comparison with drivers of the value of the default approach to RPEs (e.g. economy-wide factors affecting CPI-based measures), and analysis of forecast deviations from CPI-based measures and relative volatility (see Section 3.1.1) | Red / amber / green |
| Historic movements can be explained | For a good index that is not affected by measurement error, it will be possible to understand the drivers of the magnitude and volatility of movements over time | Analysis of historic values and press search | Red / amber / green |
| E. Transparency | | | |
| Series is publicly available | Allows stakeholders to replicate the calculations, improving understandability | Verification of steps required to access data | Free / paid / false |
| A forecast comparable to the index is available from the same data provider | Simpler for stakeholders to understand the future behaviour of the mechanism | Verification of availability | True / false |
| F. Timeliness | | | |
| Time lag for provisional values to be published | A longer lag may lead to delays in adjustments for RPEs | Verification of data provider methodology | Months |
| Time lag for final values to be provided | As above | As above | Months |





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For indices that are not rejected at the pass / fail stage, the outcomes of the assessment of indices against the criteria in the table would be a judgement from Ofgem in the round of whether:

- the index is suitable for use alone for a distinct share of totex;
- the index is suitable for use for a distinct share of totex but only in combination with another index; and/or
- the default approach to RPEs might be preferred.

A stylised example of this process is provided in Appendix A.

Although we do not propose an explicit quantitative weighting of the criteria in Table 3.4, the items under 'accuracy' are particularly important. Therefore, it would seem proportionate to place a greater weighting on them when considering the overall performance against the criteria. Assessments of the indices used in RIIO-1 against these criteria may help Ofgem to calibrate how judgements on the different criteria are weighted.

We expect it is likely that Ofgem will be able to identify a set of candidate indices that would be suitable, at least when used in combination. If that is indeed the case, Ofgem may need to exercise a further round of judgements to select the final package of indices, most likely with regard to if suitable but less preferable indices should be excluded.





4. CONCLUSIONS

Frontier shift is the rate at which the unit costs of an efficient company change over time. Ensuring it sets an appropriate level of challenge for regulated companies is an important part of the cost assessment framework.

This paper has discussed a series of topics related to the treatment of RPEs and ongoing efficiency, two aspects of how Ofgem considers 'frontier shift' efficiency.

Our key findings regarding the ongoing efficiency topics covered in this paper are as follows:

- EU KLEMS remains a useful source of growth accounting data for Ofgem to use when assessing ongoing efficiency. Ofgem may find value in exploring further with the industry which sensitivities on comparator sectors, time periods and productivity metrics would be useful to include in the assessment of ongoing efficiency.
- Growth accounting data, however, may not be the only source of evidence that Ofgem could consider using to inform its determination of the appropriate level of ongoing efficiency challenge for RIIO-2. Three other potential sources of such evidence are: (i) company proposals; (ii) econometric time trends; and (iii) adjustments towards a notional efficiency frontier. The approach to the use of any such evidence should be robust and consistent with other aspects of the price control, especially within cost assessment.

Regarding RPEs, our main conclusions are as follows:

- Before determining which cost categories (if any) will be indexed for RPEs, it is important to confirm the default treatment of cost categories that will not be indexed, ensuring the approach adopted is consistent with other aspects of the price control.
- Ofgem will likely need to explore further the issues around applying ongoing efficiency assumptions to cost categories where RPEs have been set to zero.
- There may be value in Ofgem considering how best to exclude relatively small cost categories to help simplify and streamline any resulting indexation mechanism.
- We consider it proportionate to require a higher burden of proof for the indexation of cost categories that represent smaller shares of totex than capex/replex materials; for example, considering a range of measures including the materiality of price deviations from the benchmark measure of general inflation.
- A structured approach to index selection would consider multiple criteria to informing an assessment of whether an index is appropriate for use on its own or only in combination with others, if at all.





APPENDIX A ILLUSTRATION OF PRICE INDEX ASSESSMENT

The following tables presents a stylised illustration of the assessment proposed in Section 3.2 for four fictional indices.

Table A.1 presents the case of the initial filtering of price indices to identify which are taken forward for detailed assessment. In the example shown, Index 4 is rejected at an early stage due to only covering a small portion of totex. As such, no further assessment of the series is required, even on the threshold criteria.

Table A.1: Stylised illustration of price index threshold assessment

| Criterion | Index 1 | Index 2 | Index 3 | Index 4 |
|---|-------------|-------------|-------------|------------|
| A. Simplicity | | | | |
| The index represents a material cost or identifiable portion thereof | 15% Pass | 15% Pass | 40% Pass | 2% Fail |
| Movements in the index are likely to have a material impact on totex | Pass | Pass | Pass | Fail |
| D. Credibility | | | | |
| Data provider is credible | Pass | Pass | Pass | Pass |
| B. Accuracy | | | | |
| Reflects movements in the respective input cost category (or a distinct portion thereof) for a notional efficient company in the sector | Pass | Pass | Pass | - |
| C. Independence | | | | |
| The index has a low or no chance of being manipulated by actions of companies in the sector | Pass | Pass | Pass | - |

Table A.2 presents the case of the more detailed assessment that would take place for the shortlisted indices. As shown in the table:

- Index 1 is found to be suitable for use with a distinct share of totex as it is expected to capture movements in a material portion of totex better than with use of the default approach. The limitations with regards to transparency are not a priority but may help discriminate between it and another index that performs equally well on the other criteria.
- Index 2 is found to be suitable only in combination with other indices as there are some questions about its statistical robustness, but it is still expected to perform better than the default. Using the index in combination with others may help to reduce the impact of any volatility or measurement error affecting the index's values.
- Index 3 is similar to Index 2 but there is less confidence that it would provide a more accurate reflection of companies' costs than the default approach. As such, it might be appropriate to consider either using it in combination with another series or simply to use the default approach.





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Table A.2: Stylised illustration of price index detailed assessment

| Criterion | Index 1 | Index 2 | Index 3 | Index 4 |
|--|---------|---------|---------|-------------------------|
| A. Simplicity | | | | |
| Series does not capture ongoing efficiency | True | Unclear | True | - |
| B. Independence | | | | |
| The index has a low or no chance of being manipulated by actions of companies in the sector | Pass | Pass | Pass | - |
| C. Accuracy | | | | |
| Level of confidence that use of the index will provide a more accurate reflection of the above than the default approach to RPEs | Green | Green | Amber | - |
| Historic movements can be explained | Green | Amber | Amber | - |
| D. Credibility | | | | |
| Series has no known statistical or methodological flaws | True | Unclear | True | - |
| Number of years available | 15 | 4 | 30 | - |
| E. Transparency | | | | |
| Series is publicly available | Paid | Free | Free | - |
| A comparable forecast is available from the same data provider | False | False | True | - |
| F. Timeliness | | | | |
| Time lag for provisional values to be published | 6 | 6 | 3 | - |
| Time lag for final values to be provided | 12 | 12 | 6 | - |
| Summary judgement | | | | |
| Suitable alone for distinct share of totex | Yes | No | No | Fails threshold test(s) |
| Suitable only in combination with others | No | Yes | Yes | |
| Consider use of default approach for non-indexed costs | No | No | Yes | |





Queens House
55-56 Lincoln's Inn Fields
London WC2A 3LJ
United Kingdom

Level 20, Tower 2
Darling Park, 201 Sussex St
Sydney NSW 2000
Australia



CEPA Ltd
@CepaLtd