Consultation

ED3 Sector Specific Methodology Consultation - Cost assessment Annex

Publication date:	08 October 2025
Response deadline:	03 December 2025
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We are consulting on the cost assessment methodology we will apply for the electricity distribution sector in the ED3 price control which will run from 1 April 2028 to 31 March 2033. We would like views from stakeholders with an interest in the regulation of energy networks. We would particularly welcome responses from groups representing consumers of electricity. We would also welcome responses from other stakeholders and the public.

This document outlines the scope, purpose and questions of the consultation and how you can get involved. Once the consultation is closed, we will consider all responses. We want to be transparent in our consultations. We will publish the non-confidential responses we receive alongside a decision on next steps on our website at ofgem.gov.uk/consultations. If you want your response – in whole or in part – to be considered confidential, please tell us in your response and explain why. Please clearly mark the parts of your response that you consider to be confidential, and if possible, put the confidential material in separate appendices to your response.

Any enquiries related to the text of this publication should be sent to Ofgem at:

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1. Cost assessment overview

Introduction

1.1 A key outcome for ED3 is that DNOs are provided with cost allowances that enable them to deliver in line with customer requirements. Customers should not pay more than the efficient cost of the electricity distribution services they receive in their region. We seek to achieve this overarching regulatory objective through a process we refer to as cost assessment.

1.2 The cost assessment framework is essential to protect customers by benchmarking DNOs against each other to establish the efficient level of costs to deliver their activities. This ensures customers do not pay more than they need to. It has the overarching objective to mimic a competitive process that is not available to customers as DNOs have regional monopolies in different areas of Great Britain, creating the need for economic regulation.

1.3 The purpose of this document is to provide an overview of the different elements that make up our proposed ED3 cost assessment framework. This includes the detailed methodology that sits within each element that we could use. Where relevant, we provide some background on how the elements have been used in the past, either in energy network price controls (including RIIO-ED2) or in other sectors such as water.

1.4 We consider the potential advantages and disadvantages of different approaches. In some areas we set out our initial assessment which approaches might be more suitable for ED3.

1.5 The document is split into chapters covering the following:

- In this introduction we provide some background on our cost assessment approach in previous price controls and the drivers of change that might inform our approach in ED3. We also describe how we have engaged with industry to develop our proposals.
- Chapter 2-4 set out our proposed approach for different modelling approaches - totex, disaggregated and mid models.
- Chapter 5 sets out cross-cutting issues in relation to cost assessment relevant to all modelling approaches or our overall approach more widely.
- Chapter 6 sets out our proposed approach to considering regional and company-specific factors.
- Chapter 7 sets out our approach to considering real price effects (RPEs) and ongoing efficiency (OE).

- Chapter 8 sets out our proposed approach to engineering assessments.
- Chapter 9 sets out scope, principles and timelines for the development of ED3 business plan data tables (BPDTs).
- Chapter 10 sets out our emerging approach to cost benefit analysis (CBAs) that will support investment proposals in ED3 business plans.

1.6 We are at an early stage in the consultation process. At this stage, we have not made any final decisions on how we will assess costs. Indeed, we may not be able to do so until we have received ED3 business plans and can test which of the various methods are most effective for modelling efficient ED3 electricity distribution costs.

1.7 Through this consultation we want to hear your views on how we should approach cost assessment for ED3. This includes suggestions for alternative approaches that you consider may be more effective and merit our consideration.

Background

Approach to cost assessment in RIIO-ED2

1.8 In RIIO-ED2, we used a toolkit approach to cost assessment. That involved a combination of quantitative and qualitative methods to assess company expenditure including regression analysis, unit cost benchmarking and engineering reviews.

1.9 We combined bottom-up disaggregated and top-down totex benchmarking modelling suites, assigning a 50% weight to each and triangulating. We used a combination of historical RIIO-ED1 data (2016-2023) and forecast RIIO-ED2 data (2024-2028). We set a catch-up efficiency challenge for all DNOs, based on a glide path to the 85th percentile of modelled costs.

1.10 We also adapted our approach to address strategic concerns on load-related expenditure (LRE) associated with forecasts of Low Carbon Technologies (LCTs) including Heat Pumps (HPs) and Electric Vehicles (EVs). This was implemented via a post-modelling adjustment that set the level of LCTs at the 2022 System Transformation Future Energy Scenario (FES), effectively imposing a common pathway when determining efficient RIIO-ED2 cost allowances.

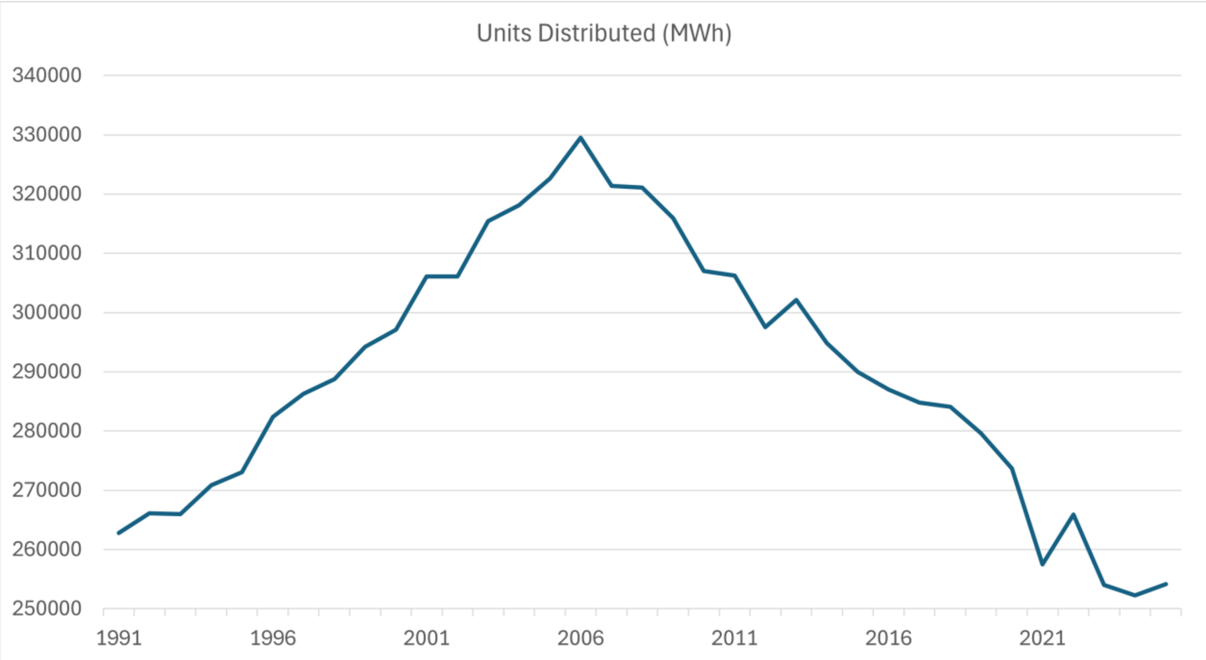
1.11 We also implemented a RPE mechanism to provide forward-looking allowances for discrepancies between our preferred measure of inflation Consumer Prices Index including owner occupiers' housing costs (CPIH) and selected input price indices for labour and materials. To help ensure the mechanism reflects outturn price pressures, we also implemented an indexation mechanism to annually true-up forecast index values.

1.12 Finally, we set an ongoing efficiency challenge (1% p.a. at totex level) using European Union (EU) KLEMS and other data to drive process optimisations and consumer value.[1]

Drivers of change

1.13 Since privatisation in 1990, the electricity distribution sector has operated in a 'steady state' environment in relation to electricity consumption growth. There have been relatively limited increases in electricity demand in the last 35 years driven by improvements in energy efficiency technologies used across the economy. Electricity distributed by the networks peaked in 2006 and has been on a decreasing trend since then (see Figure 1). As the figure shows, the amount of electricity distributed today is not too different from 1990.

Figure 1: Units distributed (MWh) in Great Britain since privatisation



1.14 This has meant the sector has mainly focused on operating and maintaining the network, responding to the evolving needs of the economy for electricity distribution services and innovating to deliver value for money. There have still been significant challenges including the increasingly distributed nature of green energy generation which has created the need to connect in different ways into the distribution network. The sector has also needed to address potentially more

[1] EU KLEMS: capital, labour, energy, materials and service - Economy and Finance

frequent and severe storm events requiring robust preparation and response to maintain service. However, investments to add new capacity to networks have been more limited and targeted at local areas experiencing electricity demand growth.

1.15 ED3 represents a significant shift on the path for Great Britain's (GB) economy to achieve net zero by 2050. That will lead to a fundamental change in the way the sector needs to plan for and deliver sufficient capacity to facilitate the economy's net zero transition. The electrification of transport via EVs and heat via HPs is an ongoing process associated with a level of uncertainty on the pace of take-up by consumers. However, it requires readiness by the sector to invest ahead of need to facilitate and promote rather than hinder the take-up of LCTs.

1.16 The unprecedented growth in the scope of DNO activities in the next 25 years creates important challenges for cost assessment. The ED3 price control period covers the early stages of the growth phase for the sector to facilitate net zero by 2050. Therefore, it is essential that the process delivers a robust framework that can become the new normal and set the scene for more business-as-usual (BAU) delivery of ambitious investment programmes in subsequent price control periods.

1.17 We consider that our RIIO-ED2 cost assessment framework is robust and delivers the right outcomes for customers for a steady state electricity distribution sector. However, the forthcoming 25-year growth phase brings about a need to carefully consider our toolkit approach to maintain the benefits of benchmarking while funding a significant step-up in the scope of DNO activities. We are cognisant a simple roll-over of the RIIO-ED2 cost assessment framework may not be sufficient to meet this challenge. Therefore, we are actively considering how to approach the ED3 cost assessment framework, examining every aspect of our toolkit in detail.

1.18 One key driver for change we are considering is the potential for a more strategic, multi-driver approach to company investments in ED3. The net zero transition and associated capacity increases provide a generational opportunity for DNOs to leverage multiple benefits of their investments, optimising across asset health, load and climate resilience drivers. To the extent possible, our ED3 cost assessment framework needs to recognise this potential change and consider available modelling options to facilitate a DNO approach that fully utilises any synergies available by driving the right incentives. This can help to promote cost efficiency in ED3 and beyond.

ED cost assessment - a toolkit approach

1.19 Our starting point in ED3 is that our cost assessment framework will continue to rely on a toolkit approach similar to RIIO-ED2. We propose to maintain the use of different modelling approaches to ensure efficient ED3 totex allowances are determined by a wide range of models. That helps to reduce the potential for error or bias in any one model.

1.20 In addition, using different modelling approaches captures DNO electricity distribution activities in different ways. That allows us to identify efficiency more accurately as an efficient operator is likely to be efficient on average across all modelling approaches. Therefore, triangulation between alternative approaches helps to implement balanced benchmarking adjustments that better capture the unique characteristics of all 14 DNO regions delivering electricity distribution services in Great Britain.

1.21 At the same time, we are also cognisant of the disadvantages of using multiple approaches. This introduces further complexity in the framework to collect the right data on a like-for-like basis, calibrate the various modelling approaches and combine them in a transparent and tractable cost modelling suite. Therefore, we propose not to use alternative models for the sake of having more models. Instead, we will actively assess the merits of every modelling approach in our toolkit before making a final decision on its use in ED3 Draft and Final determinations.

1.22 We propose to use three different modelling approaches:

- **Totex** - using aggregated cost data to implement a top-down econometric modelling approach using different cost drivers of electricity distribution activities;
- **Disaggregated** - using granular cost data of every category of expenditure with combinations of categories where appropriate to implement a simpler unit cost / ratio or regression benchmarking approach as appropriate; and
- **Mid model** - using aggregated cost data of the six large categories of expenditure in company reporting (Load, Non-load, Non-operational capex, network operating costs (NOCs), closely associated indirects (CAIs) and business support costs (BSCs)) to implement an econometric modelling approach.

1.23 In terms of the process we follow, we are currently at an early stage of the ED3 price review process. At this stage, it is difficult for us to be making decisions on the exact form of the modelling approaches we will use in the context of asymmetric information. Not having sight of the scope and efficiency of ED3 business plan proposals compared to historical delivery of electricity distribution services makes it challenging to make final decisions on some aspects of the cost assessment framework (eg on the type of models we use).

1.24 However, that does not prevent us from fully exploring our toolkit approach and expanding it in a close and collaborative consultation process with stakeholders via working groups and our methodology publications. That should help support the sector to submit high quality, ambitious ED3 business plans in December 2026 that facilitate the net zero transition. At that time, we can make our determinations having a complete set of information, having developed a sufficiently detailed ED3 cost assessment toolkit from which to draw on.

Stakeholder working groups

1.25 The complexity and fundamental importance of the cost assessment framework create a need for an extensive consultation process to develop our approach to benchmarking. Engaging with DNOs is essential because as operators of their networks, they have a good understanding what data they have that describes their activities and how this could be used in our framework. They are also well placed to inform our assessment of how different cost categories capture the electricity distribution activities that they undertake, how these may change over time and how they differ across the 14 distinct regional networks. We can use these insights to ensure that our cost assessment framework results in allowances that are sufficient for an efficient company to deliver its business plan.

1.26 This engagement helps us to refine the framework so that it can achieve the intended outcome of providing efficient cost allowances to the sector. It requires an extensive work programme to:

- collect the right data and actively assess its quality to facilitate comparability;
- develop an extensive cost assessment modelling suite of spreadsheet models and econometric cost models using best practice standards and drawing on regulatory precedent; and
- actively assess and horizon scan for ED3 policy developments, material shifts in company activities over time and key engineering insights to help inform model choice / design and the necessary supporting tools to help fund efficient expenditure.

1.27 There are two main forums we have used for DNO engagement. The Cost Assessment Working Group (CAWG) and the Business Plan Data Tables Working Group (BPDTWG). The CAWG is the main forum to consider the cost assessment framework and facilitate informal consultation outside of our publications. It provides a forum for early thinking by the sector where both we and companies can present emerging ideas to help develop the ED3 cost assessment framework. We held seven CAWGs between May and August 2025 and these have informed our proposals.

1.28 The BPDTWG is a dedicated working group to consider all issues related to the BPDTs. As such, this is a more specialised forum to consider the format of the tables and ensure we collect the right data to facilitate the ED3 price review. That includes data to facilitate cost assessment but also to ensure other parts of the team including policy, regulatory finance and the engineering hub can have the data they need to undertake an assessment of ED3 business plans. We held the first two working groups in August / September 2025 that sought initial feedback on the development of ED3 BPDTs following an initial request for input issued to the sector. That has also helped refine our planning and informed our early BPDTs consultation. Please refer to Chapter 9 on BPDTs for more information.

Consultation questions

CAQ1. Do you have any comments on the format and use of the engagement forums we use to develop our cost assessment methodology so far including CAWG and BPDTWG?

2. Totex models

Introduction

2.1 Totex models use aggregated cost data to implement a top-down econometric modelling approach using different cost drivers of electricity distribution activities. We used this modelling approach to determine efficient electricity distribution costs in RIIO-ED2, assigning a triangulation weight of 50%.

2.2 Totex modelling is widely used in economic regulation of energy and water network industries. Indeed, we used totex models in RIIO-2 for both Gas Distribution (GD) and Electricity Distribution (ED) using a similar totex benchmarking framework. We also implemented totex models in RIIO-3 for GD in the RIIO-GD3 Draft Determinations published in July 2025.[2] Totex benchmarking is also the main approach to cost assessment that Ofwat uses to benchmark water company base cost activities[3] in England and Wales, most recently in the PR24 Final Determinations published in December 2024.[4]

2.3 The rest of this chapter sets out our ED3 totex models framework proposals. The chapter considers our proposals in detail beginning with the advantages and disadvantages of totex models and the principles we will be guided by in our ED3 totex model development. Then we provide an overview of RIIO-ED2 cost drivers and a proposed longlist of alternative cost drivers for ED3. Finally, we cover more technical aspects of our proposed ED3 approach including how we propose to specify our models, proposed econometric techniques to estimate them and the statistical diagnostics tests that can help us evaluate their robustness. We cover the following in turn:

- advantages and disadvantages of totex models;
- cost driver principles;
- model selection criteria;
- RIIO-ED2 cost drivers overview;
- longlist of alternative cost drivers for ED3;
- Composite Scale Variable (CSV) approach vs separate models;
- functional form, sample size and time trends; and
- estimation approach and statistical diagnostic tests.

[2] See RIIO-3 Draft Determinations for the Electricity Transmission, and Gas Transmission sectors | Ofgem
[3] Ofwat defines base costs as routine, year-on-year costs, which companies incur in the normal running of the business to provide a base level of service to customers and maintain the long-term capability of assets. This covers both wholesale and retail activities.
[4] See Final determinations - Ofwat

Advantages and disadvantages of totex models

2.4 There are two key advantages of the totex modelling approach that has made it the dominant model of benchmarking in sectors subject to economic regulation in GB where there is a sufficient number of operators.

2.5 First, totex models allow us to compare total resource use to a basket of fundamental explanatory factors (cost drivers) and outputs delivered. That allows us to derive an overall assessment of the relative value for money delivered by each operator. Since total expenditure ultimately drives the network bills paid by customers for electricity distribution services, this approach yields a robust and flexible benchmarking tool that results in one view of efficient modelled costs without the need to consider the underlying level of granularity.

2.6 Second, the totex framework is 'blind' to the more detailed input choices made by the operator that ultimately lead to the recorded total resource use. For example, it is irrelevant whether operators choose to replace or maintain assets, to contract out, keep work in-house or seek innovative options such as using flexibility to defer the need to invest in new capacity. That is important because in the context of asymmetric information, one of our overarching objectives is to implement a regulatory framework that leverages DNOs' superior information on how best to deliver electricity distribution services. The totex framework provides very pure incentives to facilitate this process. It does not aim to understand, model and steer every decision the company makes in delivering its services. Instead, it compares overall cost efficiency performance and in doing so, creates a strong competitive process between DNOs to demonstrate the most efficient way to deliver electricity distribution services.

2.7 On the other hand, the key disadvantage of the totex modelling framework is that it provides little narrative on exactly why operators are inefficient or efficient. Because the models aggregate all modelled cost lines together, the outputs of the model are also aggregated. Therefore, it is more difficult to understand what drives the underlying level of efficiency. This makes it harder for us and DNOs to evaluate and leverage those insights to promote better outcomes for customers.

2.8 Another disadvantage of totex models is their more limited ability to capture significant shifts in the level and scope of company activities over time. Totex models perform well in times of BAU delivery where operators need to maintain a good service to customers but do not necessarily need to significantly 'enhance' their activities (eg to deliver a service to more customers or to install new capacity). However, on their own, they are potentially less suited to capture a systematic change in the scope of company activities over time. That is due to two reasons:

- using historical data to forecast future efficient cost which drives strong efficiency incentives and limits information asymmetry but potentially cannot fully capture new scope of activities added (or removed); and
- the general implementation difficulty of incorporating well-specified aggregated 'activity-based' drivers into the modelling approach to capture changing scope of activities over time.

Consultation questions

CAQ2. Do you agree with the continued use of totex models in ED3?

CAQ3. Do you agree with the advantages and disadvantages of totex models we set out?

Cost driver principles

2.9 Totex models utilise high-level cost drivers as explanatory variables to model the efficient cost of delivering electricity distribution services. When choosing the appropriate set of cost drivers, we are led by a number of key principles. These principles ensure that our choice of cost drivers is well-evidenced and transparent.

2.10 We propose to retain the same high-level set of cost driver principles that we used in RIIO-ED2. ED3 totex model cost drivers should:

- make economic and engineering sense;
- be accurately and consistently measurable;
- have a relatively stable relationship with the costs over time; and
- be beyond the control of the network company.

2.11 The 'make economic and engineering sense' principle is fundamental to the process we will follow when developing our ED3 totex cost models. It ensures that when we evaluate the best available cost drivers, we take a step back to consider what drives efficient cost of electricity distribution services. That helps to avoid the potential risk of using spurious cost drivers in search of better performing models. Overall, it drives a discipline to look at fundamental cost factors which DNOs actively consider when delivering their activities.

2.12 The 'be accurately and consistently measurable' principle helps to ensure model drivers are accurate and measurable. The use of drivers with poor quality data can risk undermining the benchmarking process. This principle drives a discipline to the cost driver discovery process to actively assess the quality and comparability of cost drivers prior to including them in model testing. There might be a number of factors driving performance which are difficult and / or impractical to measure on a consistent basis which would not fit this criterion.

2.13 The 'have a relatively stable relationship with the costs over time' principle supports the robustness of totex models. Stability helps to establish consistent model performance over time. Cost drivers that vary significantly or have a volatile relationship with costs over time can introduce breaks in the data and make the modelling outcomes less reliable and predictable as additional (outturn) data is added and / or sample periods are varied.

2.14 The 'be beyond the control of the network company' principle is essential as it helps to mitigate the potential risk of companies influencing the level of a cost driver to attain a higher allowance. Cost drivers should ideally be outside of management control. This can avoid company behaviour directly affecting cost modelling outcomes. In practice, there is a limited set of drivers that are fully exogenous which can make specifying robust models difficult. Therefore, the degree of endogeneity over the short, medium and long-term and the potential risk of perverse incentives are important criteria to consider when deciding whether to use a cost driver in our totex models.

Consultation questions

CAQ4. Do you agree with the ED3 cost driver principles we propose to use to select cost drivers in our ED3 totex models?

Model selection criteria

2.15 When specifying our proposed ED3 totex models, we will be led by a set of model selection criteria. While these overlap with considerations on selecting appropriate cost drivers in the previous section, they go further to help evaluate the overall performance of the model and its ability to promote our regulatory objectives. We set out the criteria we will be actively considering when specifying models below:

- **Economic / technical rationale** - Do the model specifications and results have a clear economic / technical rationale?
  - Does the model specification have an economic rationale?
  - Are cost drivers in the model consistent with engineering rationale?
  - Is the sign and magnitude of estimated coefficients consistent with economic and engineering logic?

- **Consistency with wider ED3 policy framework**
  - Is the model consistent with policy in other parts of the ED3 regulatory framework?
  - Does the model facilitate wider regulatory framework objectives through creating the right incentives?
  - Does the model risk unintended consequences and / or perverse incentives?
- **Transparency** - on data used, results and ease of interpretation for stakeholders:
  - Can the model be clearly explained, interpreted and replicated by DNOs and other stakeholders?
  - Does the model strike a balance between complexity and transparency in achieving the intended outcomes?
  - Is the rationale for selecting the model compared to alternatives clear?
- **Robustness** - Does the model pass statistical tests? Is the model sensitive to the underlying assumptions?
  - How does the model perform against appropriate statistical tests?
  - Is the model stable when changing the data sample or precise model specification?
  - How well does the model explain existing data and forecast of future efficient expenditure?

  Econometric models may not pass all model robustness tests. Therefore, we will consider the relevant importance of each test when developing ED3 models but will not use performance against tests as a mechanistic rule for model selection.

Consultation questions

CAQ5. Do you agree with the ED3 model selection criteria we propose to use when specifying ED3 totex models?

RIIO-ED2 cost drivers overview

2.16 In RIIO-ED2, we used a combination of different cost drivers to model efficient cost in our totex models. To help conceptualise the type and nature of cost drivers we propose to consider in ED3, we can group them in three wide categories - scale, complexity and activity-based drivers. In the rest of this section, we set out the cost drivers we used in RIIO-ED2 and our initial assessment of their advantages and disadvantages when assessing against our ED3 cost driver principles.

Scale

2.17 The first category is scale. This category includes cost drivers that capture the overall scale of DNO activities. There are multiple ways in which we can capture the scale of these activities using ED reporting. Therefore, historically, we have used several scale cost drivers in our ED totex models.

2.18 The Modern Equivalent Asset Value (MEAV) reflects a homogeneous measure of asset base of each DNO using the replacement cost of assets. Advantages of the MEAV include:

- it reflects the overall complexity of the network over and above scale;
- reporting of asset classes is detailed and well understood; and
- it is a good driver of ongoing costs - since MEAV is a measure of the size of the asset base, everything else being equal, larger MEAVs should be associated with higher ongoing costs.

2.19 Some potential disadvantages of MEAV are that:

- MEAV reflects capex costs which are part of the dependent variable of our totex models. This might artificially increase model fit;
- it is calculated at the (modern equivalent) replacement cost but in practice, new assets replaced each price control period are a small fraction of the total asset base;
- it is endogenous in the long-term as it is affected by DNOs' asset management strategy in addition to exogenous regional characteristics; and
- it does not fully capture the network growth required to meet increasing demand and is therefore less applicable to periods of growing demand.

2.20 Customer numbers drive efficient cost of electricity distribution services as the network needs to serve them. Advantages of customer numbers are that:

- it is fully exogenous - DNOs do not control customer numbers in their region;
- it is measured reliably - DNOs know the number of customers they are serving; and
- it reflects incremental cost to serve each customer - this could be network costs associated with each customer and customer-facing costs (eg call centre, fault resolution, etc.).

2.21 Some potential disadvantages of customer numbers are that:

- it does not capture demand per customer;
- it does not capture type of customer – business versus residential; and
- it does not capture network configuration.

2.22 Network length is a measure of the size of the asset base consisting of the sum of the lengths of the 132kV, extra high-voltage (EHV), high-voltage (HV) and low-voltage (LV) networks. Advantages of network length are that:

- it captures size of network that drives ongoing cost (eg faults, replacement costs), similar to MEAV; and
- it better captures differences in population density - to the extent that the geographical distribution of the population served in each region impacts on the length of the network.

2.23 Some potential disadvantages of network length are that:

- it is endogenous as it partly reflects historical design choices and can be influenced by DNOs; and
- it does not capture type of network length that also drives costs (eg by voltage level).

2.24 Peak demand captures the level of peak demand on the network. That is a relevant cost driver as networks are reinforced to withstand peak demands in particular seasons and / or times during the day. Advantages of peak demand are that:

- it is relatively exogenous – limited ability of DNOs to manage peak demand via flexibility; and
- it is better able to capture load impacts – new LCTs impact on network costs via peak demand. Therefore, increases in the scope of load activities in ED3 and beyond is likely to make peak demand a more important driver of efficient costs compared to past price control periods. This is because it can partly account for the increasing demand on the networks in a way in which the other scale cost drivers in RIIO-ED2 might not be able to.

2.25 Some potential disadvantages of peak demand are that:

- it is less able to capture ongoing costs compared to MEAV and network length;
- it might discourage efficient flexibility to contain peak demand as reducing peak demand leads to lower efficient totex allowances;
- it involves more estimation than other scale cost drivers; and

- it has been on a decreasing trend for a number of years, meaning it has implicitly contributed to reducing efficient cost allowances for electricity distribution services in past price control periods.

Complexity

2.26 The second cost driver category is complexity. Complexity drivers aim to capture DNO characteristics that make delivering services in their region more complex than in other regions. These could be drivers capturing key features of the network or geographical characteristics affecting the efficiency of day-to-day delivery.

2.27 Historically, we have not included many cost drivers controlling for complexity in our totex models. The scale drivers could potentially capture some complexity characteristics (eg MEAV and network length). However, having separate complexity drivers can help improve the performance of the totex models by targeting complexity factors that differ across the 14 DNO regions.

2.28 The main complexity driver we used in RIIO-ED2 is the number of faults. Faults on the network require asset replacement and incur response costs. Therefore, having a higher number of faults would suggest a more complex operation to maintain service, everything else being equal. Advantages of the number of faults driver are that:

- it captures reactive investments and fault response costs; and
- it can capture multiple cost impacts including on internal resources (eg customer services).

2.29 Some potential disadvantages of faults are that:

- it is not a standalone scale driver per se even though it is treated as such in the totex models (see CSV approach vs separate models section below for more detail);
- it is endogenous – faults can occur due to insufficient maintenance and ageing assets (factors within management control) or more exogenous factors (eg storms); and
- the overall complexity of faults which is partly within DNO control could also drive systematic differences between DNOs for a given number of faults.

Activity-based

2.30 The third cost driver category is activity-based drivers. These aim to capture the underlying scope / workload of DNO activity when delivering electricity distribution services. By construction, these activity drivers are more likely to be at least partly within management control because they inherently relate to the level of DNO activity.

2.31 We used three activity-based drivers in the RIIO-ED2 totex models. The first one is transformer capacity released on the primary and secondary network. This driver is a measure of capacity released in the network. Advantages of capacity released are that:

- it captures the key outcome of load investment – added capacity; and
- it does not consider how capacity is released, providing flexibility for DNOs to achieve outcomes using the most appropriate approach.

2.32 Some potential disadvantages of capacity released are that:

- it is endogenous - the company can attain a higher allowance by adding additional capacity;
- it only covers reinforcement of transformers - it does not consider other investments that release capacity; and
- it only serves as a proxy for wider load investments (eg connections).

2.33 The other two drivers we used in our RIIO-ED2 totex models are the cumulative number of heat pumps (HPs) and cumulative number of electric vehicles (EVs) as key LCTs at the heart of the transition of the GB economy to net zero by 2050. The key advantages of these metrics are:

- they are fully exogenous - they just reflect customer demand for LCTs which is beyond the control of DNOs;
- they reflect a key driver of the need for additional load capacity to achieve net zero by 2050;
- they promote consistency in demand metrics between NESO's FES and DNOs' Distribution Future Energy Scenarios (DFES) in RIIO-ED2. This allows us to sense-check DNO forecasts by comparing to independent third-party forecasts of LCT demand; and
- in the case of EVs, there is a statutory mandate of no sales of new petrol and diesel vehicles from 2035 that helps to mitigate demand uncertainty.[5]

2.34 Some potential disadvantages of cumulative number of LCTs are that:

- they do not differentiate between types of LCTs and their capacity;

[5] Phasing out sales of new petrol and diesel cars from 2030 and supporting the ZEV transition: summary of responses and joint government response - GOV.UK

- they do not capture DNO starting positions in terms of spare capacity on the network and the investment approach - the metrics are solely focused on demand for LCTs without considering whether it creates a need to invest in the context of each DNO's individual circumstances; and
- HP uptake is subject to more uncertainty due to a lack of statutory mandate to facilitate the transition from gas boilers in the short-term.

Consultation questions

CAQ6. Do you agree with the advantages and disadvantages of RIIO-ED2 totex model cost drivers we set out?

Longlist of alternative cost drivers for ED3

2.35 We have undertaken some initial work to consider a longlist of alternative cost drivers for consideration in the ED3 totex models. In the rest of this section, we set out the additional drivers we are considering using the three categories of scale, complexity and activity-based. Similar to the RIIO-ED2 cost drivers section, we undertake our initial assessment of their advantages and disadvantages when assessing against our cost driver principles.

Scale

2.36 For scale, we are considering the use of the units distributed scale driver. Units distributed reflects the amount of energy that is being distributed through a DNO’s network on an annual basis. This driver was used in the RIIO-ED1 totex models. The key advantages of units distributed are that:

- it is exogenous as it reflects demand for electricity; and
- it is better able to capture load impacts similar to peak demand to the extent that higher electricity consumption will be reflected in the driver as LCTs take-up increases over time.

2.37 Some potential disadvantages of units distributed are that:

- it is less able to capture ongoing costs compared to MEAV and network length; and
- it has been on a decreasing trend for a number of years, meaning it has implicitly contributed to reducing efficient cost allowances for electricity distribution services in past price control periods.

Complexity

2.38 We consider complexity is an important area where we need to evaluate alternative measures that can capture regional characteristics across the 14

DNO regions. Therefore, we welcome any proposals of alternative ED3 cost drivers that capture the complexity of delivering electricity distribution services.

2.39 We have developed three initial complexity drivers that we propose to consider in the ED3 totex models. They use existing data in RRP reporting or external data. Therefore, they do not require any additional data collection.

2.40 The first driver is the share of the network length that is overhead. We used reporting data on overhead and underground network length to derive this driver. The rationale behind using it is that the network length overhead is a proxy for network configuration. The key advantages of this metric are that:

- it is exogenous – there is a limited scope to change overhead network share in the medium term;
- overhead assets are systematically different from underground assets – they have shorter asset lives and lower capex. This is a characteristic that is likely to differentiate DNOs depending on their share;
- overhead networks are more susceptible to faults (eg in storms) - therefore, companies with a higher overhead network share should incur higher faults response costs and possibly higher tree cutting costs to mitigate the risk of disruption; and
- it is correlated with population density – there are more underground cables in urban areas so overhead share can partly account for density.

2.41 A potential disadvantage of the overhead network share is that there are multiple offsetting cost impacts which means the net impact on cost might be unclear. On the one hand, engineering rationale suggests the cost driver should have a positive impact as a higher overhead network share is associated with a more rural region on average and more disruption during storm events. On the other, overhead assets are generally cheaper and quicker to install than underground assets which could partly offset the positive cost impact.

2.42 The second complexity driver we are considering is the high voltage network share - ratio of the sum of 132kV, EHV and HV network length over total network length. This cost driver is a proxy for the higher complexity associated with higher voltages on the network. When designing their networks, DNOs trade off the advantages of high voltage (eg lower losses) with the costs (higher costs, safety considerations, etc.). The key advantages of the high voltage network share are that:

- it captures the higher costs of installation and ongoing maintenance of high voltage networks; and

- it could capture geographical / network characteristics of DNO areas that drive voltage choices.

2.43 A potential disadvantage of the high voltage network share is that it is endogenous. Network configuration and voltage choices are partly within company control although that is relatively limited.

2.44 The third cost driver we are considering for ED3 is population density. In the rest of this section, we first briefly set out the history of considering density in the RIIO-ED2 totex models. We then set out our initial work to derive a new weighted average density (WAD) metric. Finally, we consider the advantages and disadvantages of including density in our ED3 totex models as per all other cost drivers.

2.45 We considered controlling for population density in the early stages of the RIIO-ED2 process to capture the impact on efficient DNO network costs in totex modelling. We undertook some testing of different measures in totex models including:

- customers per network length;
- customers per service area; and
- GINI index – to capture variability of density within DNO areas.

2.46 However, these were ultimately not taken forward. Some of the reasons not to consider a modelling approach were around the potential for overfitting caused by outliers. While density varies across DNOs, most of them are grouped relatively close on the above density metrics. But London Power Networks (LPN - most dense) and Scottish Hydro Electric Power Distribution (SSEH - least dense) are two DNO regions that are clear outliers compared to the rest of the industry.

2.47 However, we think that there is merit in reevaluating available options to control for density within totex models in ED3 as a key exogenous regional characteristic impacting efficient costs. Therefore, we have undertaken some initial work on a new density metric that we set out below.

2.48 To evaluate the impact of density on efficient DNO costs in ED3, we have derived a new WAD metric. A similar metric for water companies in England and Wales was used in the PR24 price review to capture the impact of density on base costs expenditure.[6]

[6] MSOA_area_density_derivation_v2.0.xlsx

2.49 As a first step, we used the open-source free mapping software QGIS to overlay data on granular geographical regions of GB (Middle Layer Super Output Areas (MSOAs)) in England and Wales and Intermediate Areas (IAs) in Scotland from the 2011 Census) with DNO geographical boundaries (available on NESO's website). This process allowed us to allocate each geographical unit to the corresponding DNO, including cases where areas are split across multiple DNOs. The mapping reveals which proportion of each MSOA and IA is served by each DNO across GB. While most geographical areas are served by one DNO, some units at the border between DNO regions could be split between two or even three DNOs.

2.50 The MSOAs and IAs are relatively small geographical units, consisting of several thousand people. They map to more aggregate geographical units, such as the Local Authority District (LAD) level. Therefore, we can sum up populations and geographical areas of MSOAs and IAs to translate into LADs totals. This allows us to calculate a WAD using the LAD geographical units using the same underlying data. We use both levels of granularity to calculate two different WADs referred to as 'MSOA / IA WAD' and 'LAD from MSOA / IA WAD'. We collected the annual population estimates data from the Office of National Statistics (ONS)[7] and the Scottish Government Statistics.[8]

2.51 The WAD is calculated using the sum of population density of each area (persons / sq.km) weighted by population served for each area over total population served by the DNO (see equation below). Therefore, geographical areas with larger populations are weighted more heavily. This gives an accurate aggregate representation of the WAD across all geographical units that each DNO serves.

$$WAD_j = \sum_{i=1}^{N} \frac{Population_{ij}}{Population_j} * \frac{Population_{ij}}{Geographical\ area_{ij}} \quad where\ i\ is\ the\ unit\ (MSOA/IA\ or\ LAD)\ and\ j\ is\ the\ DNO$$

2.52 The methodology of the WAD to weight by population helps to capture the distribution of different levels of density within the DNO areas (ie the intra-regional variation). The metric explores the density of every region within the DNO area, not just the overall level of density like the simpler metrics we considered in RIIO-ED2. To give a stylised example how, consider two companies with the same overall 'simple' density (persons / sq.km for the whole DNO region) of 1000 persons / sq.km and the same two geographical areas.

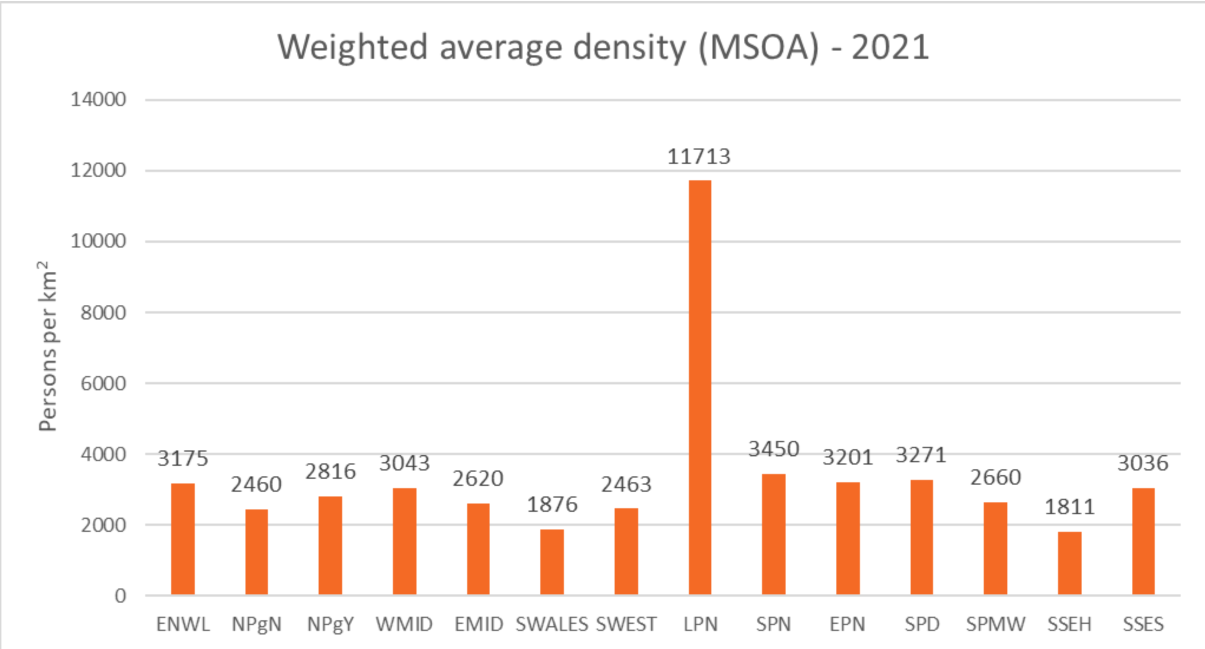
[7] Middle layer Super Output Area population estimates (supporting information) - Office for National Statistics
[8] statistics.gov.scot : Population Estimates Detailed (Current Geographic Boundaries)

Under the simple density measures we have considered in the past, these two DNOs will be considered as equally dense.

2.53 However, if one company has the same population in both areas and the other one has 20% in one and 80% in the other, the latter DNO will have a higher WAD. That is due to the higher weight being assigned to the denser region (80% of the population but 50% of the area) by construction. This highlights an important advantage of the WAD metric compared to simpler density measures that are unable to capture this additional level of complexity of DNO activities. That is, serving regions at both ends of the spectrum (dense and sparse). The more spread out the distribution of population across the geographical areas within a DNO region, the higher the WAD. This complexity impact is incremental over and above a simple assessment of the overall density of the DNO region.

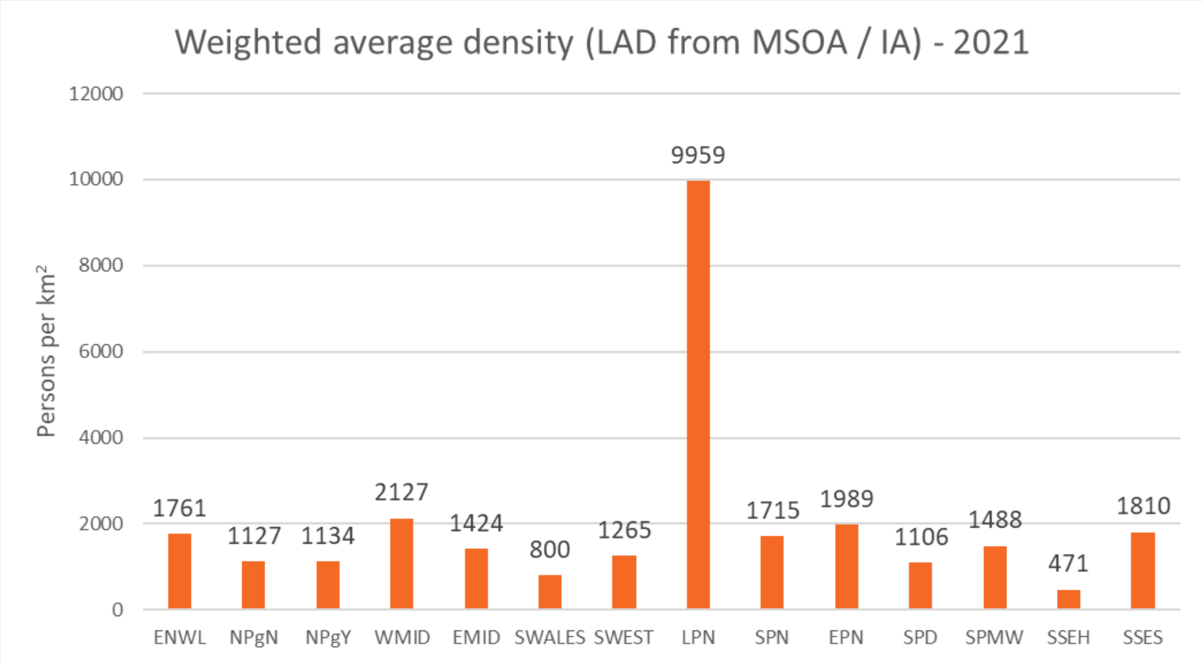
2.54 Figure 2 and Figure 3 set out the value of the WAD for all 14 DNO regions as of 2021 for the MSOA / IA WAD and the LAD from MSOA / IA WAD. We have shared the derivation of the metric with interested stakeholders on the RIIO Engagement Portal.[9]

Figure 2: Weighted average density MSOA / IA 2021



[9] See RIIO Engagement Portal - Documents - CAWG02 - All Documents. Please note the large size of the Excel file of 325MB which might require using a desktop version of Excel.

Figure 3: Weighted average density LAD from MSOA / IA 2021



2.55 The key advantages of the WAD are that:

- it directly captures economies of density – prior expectation that dense DNOs incur lower costs on average;
- it is correlated with other characteristics of dense areas (eg undergrounding of assets);
- it has a strong regulatory precedent of using the same metric to model water sector base costs in PR19 and PR24; and
- it is fully exogenous as it reflects the unique distribution of population across the 14 DNO regions which the DNOs cannot influence.

2.56 Some potential disadvantages of the WAD are that:

- extreme outliers can potentially lead to a risk of overfitting the models meaning modelling outcomes are primarily driven by characteristics of outliers rather than the overall impact of population density on efficient electricity distribution costs across all 14 DNO regions; and
- there is a lack of a strong rationale to choose either level of granularity (MSOA / IA or LAD).

2.57 We welcome views on other cost drivers that can capture the complexity of delivering electricity distribution services. For example, we were unable to develop a suitable economies of scale metric based on DNO networks data in existing RRP reporting. We welcome views whether any asset data or the number and size of substations data can help us to derive a suitable aggregate metric. This can help to better capture the overall economies of scale achieved across DNO regions in our ED3 totex models. This is different than the opportunities for economies of scale which we consider could be captured in our proposed WAD metrics.

Activity-based

2.58 Activity-based drivers are an increasingly important cost driver category for ED3. As DNOs mobilise to deliver an electricity distribution network facilitating net zero by 2050, they are likely to face different challenges across the 14 DNO regions. The starting point of available spare capacity, the age of their networks and localised LCTs demand are all likely to differ across the sector. Activity-based drivers help to capture potential differences in the scope of DNO activities required to maintain and improve their networks.

2.59 As such, activity-based drivers have a risk of being within management control, potentially inconsistent with our cost driver principles. Totex models without activity-based drivers tend to place the responsibility of managing the network on DNOs with stable totex allowances over time. This is appropriate in the context of a BAU environment where networks are not growing due to decreasing demand for electricity. It helps to encourage efficiency and innovation in maintaining the electricity distribution networks.

2.60 However, a lack of a good set of activity-based drivers might be detrimental to model quality and potentially lead to underinvestment if some DNOs face a systematically larger programme to reach net zero going forward. We consider this is a key consideration that should inform our assessment of activity-based cost drivers against our cost driver principles. Therefore, we will consider the degree of endogeneity over the short, medium and long-term and the potential risk of perverse incentives. We will trade these against the risks of worsening totex modelling outcomes and insufficient progress towards net zero for DNOs with the largest programmes to reach net zero.

2.61 The key activity-based driver we are considering for ED3 is the asset additions MEAV. This cost driver captures the total value of annual asset additions across all asset categories evaluated at replacement cost. Therefore, it is a driver that captures the DNOs' capex investment programmes.

2.62 The key advantages of the asset additions MEAV cost driver are that:

- it captures a comprehensive view of company investments as outputs;
- it should lead to a more robust relationship with cost as it directly captures DNO investment strategy;

- it uses the established MEAV framework but looking at incremental investment only; and
- it incorporates a workload volume driver in the totex models which can promote a more consistent approach to workload adjustments across different modelling approaches (see the Cost and workload adjustments section in Chapter 6 for a wider discussion on ED3 workload adjustments and Chapter 8 on engineering assessment for our overall approach).

2.63 Some potential disadvantages of the asset additions MEAV are that:

- it is strongly endogenous – DNOs are directly remunerated for additional asset investment if we include this metric in the models; and
- it does not consider efficiency of the scope / optioneering and the needs case of investments – metric just funds activity. However, this can be partly mitigated by the option to implement workload adjustments where scope is not justified under our engineering assessments.

2.64 We note that two DNO stakeholders presented some initial work to develop totex models using this new cost driver in CAWG3.[10] This preliminary work suggested the cost driver could help improve the robustness of the ED3 totex models. Particularly in the context of rising LRE in ED3 business plans, economic intuition would suggest this cost driver should be more statistically significant over time due to its ability to pick up the heterogeneity of DNO investment programmes. This is due to the ED3 investment programmes potentially diverging over time depending on DNO strategies to facilitate a net zero economy by 2050.

2.65 The second activity-based driver we are considering is the number of properties reactively or proactively unlooped. Unlooping refers to activities DNOs need to undertake to unloop the connections of some properties in GB which share the same service cable from the LV mains with one or more adjacent properties. This limits the available capacity for these customers to install LCTs including EVs and HPs.

2.66 There are estimated four million properties in GB that are on a looped connection. As explained in Chapter 3 of the ED3 Sector Specific Methodology Consultation (SSMC) core document, we want DNOs to adopt a proactive, programmatic approach to unlooping activities in ED3 and beyond. This can help deliver on the National Infrastructure Commission (NIC) recommendations (see

[10] RIIO Engagement Portal - Documents - CAWG03 - All Documents

Chapter 9 of the ED3 SSMC) and promote achieving efficiencies in delivery. Including an unlooping activity-based driver can help our ED3 totex models account for the increase in the scope of this programme going forward.

2.67 The key advantages of the unlooping cost driver are that:

- it is a key 'no regrets' LV investment pre-requisite to LCT uptake at relevant properties;
- it captures outcome (unlooping) providing flexibility to DNOs on how to achieve it;
- it is consistent with the NIC report recommendations; and
- it can help promote a more long-term, programmatic approach to unlooping by providing confidence to the sector via a transparent ex ante allowance for unlooped property volumes in ED3 business plans.

2.68 Some potential disadvantages of unlooped properties are that:

- the materiality of unlooping programmes across DNOs is not fully clear. If programmes are not material, the ED3 totex models might not be able to pick up a statistically significant impact; and
- there is no historical data in RRPs for RIIO-ED1 – this might not be a material data quality issue if unlooping was insignificant historically. However, it further highlights the issue around statistical significance - limited or no variation in RIIO-ED1 will likely reduce the scope for picking up the impact in our ED3 totex models;
- there is a potential for a variable job complexity for each property – companies might approach unlooping proactively which should be cheaper than reactive works. In addition, there are potentially different ways to deliver the works (partial vs full unlooping) and companies may have diverging strategies on 3 phase upgrading; and
- it may incentivise unlooping in areas where it is not needed - for example where there are low LCT forecasts in the short-term.

2.69 Finally, we consider that accounting for the level of connections activity can also be a suitable ED3 activity-based driver. The proposed cost driver is the number of new connections to the DNO network within the scope of price controls.

2.70 The key advantages of the number of connections cost driver are that:

- it captures outcome of connections to the network which is largely outside of DNO management control; and

- it can capture level of connections activity as a key growth indicator of the network which might not be fully captured by other cost drivers. This is appropriate in the context of reforms to the approach to connections as set out in Chapter 4 in the ED3 SSMC.

2.71 Some potential disadvantages of number of new connections are that:

- there are different types of connections which might drive different costs on average; and
- the size and load or export profiles of connections could differ on average.

2.72 We welcome DNO proposals on how we can leverage existing connections RRP reporting to develop an appropriate ED3 cost driver that best captures the unique connections challenges faced across the 14 DNO regions.

Consultation questions

CAQ7. Do you agree with the longlist of alternative cost drivers we propose to consider when developing ED3 totex models and the advantages and disadvantages we have set out?

CAQ8. Do you recommend adding other alternative ED3 cost drivers to our longlist? In your answer, please clarify if these rely on existing reporting or might require data collection and back-casting and submit them alongside your response where possible.

CSV approach vs separate models

2.73 In RIIO-ED2, we combined our scale cost drivers and the Faults complexity cost driver into a CSV. We also developed a composite variable (CV) to combine two LCT activity-based drivers of cumulative number of HPs added and cumulative number of EVs added. We have used different specifications of a CSV in our RIIO-1, RIIO-2 and the most recent RIIO-GD3 Draft Determinations. Therefore, it is a well-established methodology supported by regulatory precedent in energy price controls.

2.74 In general, our rationale for using composite variables is to help us include multiple variables into a single aggregate metric. This helps to specify our totex models for two reasons.

2.75 First, it allows us to include multiple cost drivers in the same totex model that are otherwise very highly correlated, leading to multicollinearity. Multicollinearity makes it difficult to ascertain the individual impact of each cost driver on electricity distribution costs. Since composite variables combine the drivers pre-modelling, we avoid this issue altogether.

2.76 Second, it gives us more 'degrees of freedom' in our totex models which generally use small samples (see sample size section). Even if cost drivers are not highly correlated, including too many cost drivers in the same totex model could lead to lower robustness and reduced statistical significance of some cost drivers. Or as a minimum, it could result in a lower stability of the model to adding outturn data over time. Composite variables can help to mitigate this potential modelling issue.

2.77 We used two types of CSVs in RIIO-ED2:

- a bottom-up CSV; and
- a top-down CSV.

2.78 In the rest of this section, we first set out the composite variables we used in RIIO-ED2. We then highlight the potential disadvantages of using composite variables. Finally, we propose an alternative approach to modelling using separate models.

Bottom-up CSV

2.79 The bottom-up CSV in RIIO-ED2 combined different cost drivers using an iterative process consisting of the following steps:

- First, we mapped each cost category in ED regulatory reporting to a cost driver. This mapping used engineering and economic insights on the most appropriate cost driver of cost in each category. For example, capacity released was considered the most appropriate cost driver for total reinforcement expenditure. Appendix 2 sets out the full cost and cost driver mapping we used in RIIO-ED2 over a total of 29 categories of expenditure.
- Second, we calculated a unit cost for each category using the cost and cost driver mapping. The unit cost used data over the entire sample period we used to estimate our RIIO-ED2 totex models (2016-2028).
- Third, we calculated the median unit cost out of the 14 unit costs for each DNO region. That resulted in a set of 29 median unit costs, one for each cost category.
- Fourth, we multiplied each median unit cost per category with the annual values of the cost drivers to get a notionally efficient spend in £m per category, per DNO, per year.
- Finally, we summed up the notionally efficient spend across all categories to calculate the bottom-up CSV and took the natural logarithm.

2.80 Overall, we consider that the bottom-up CSV cost driver has a strong theoretical rationale. It is a single composite metric that captures the cost driver activity of each individual DNO evaluated at the median unit cost per category. That helps to normalise each activity into a notional expenditure incurred. DNOs that undertake more activity (eg have larger MEAVs, customer numbers, peak demand, network length, etc.) will have higher bottom-up CSVs on average. The driver identifies relative efficiency by comparing the notional company (evaluated at the median unit cost) in the bottom-up CSV with the actual company expenditure as the dependent variable. DNOs that incur more expenditure than their notional counterparts are then flagged as inefficient by the totex model using the bottom-up CSV cost driver and vice versa.

Top-down CSV

2.81 The top-down CSV uses the same rationale as the bottom-up CSV but has a much simpler design. It uses the same first step to come up with a cost and cost driver mapping (see Appendix 3).

2.82 However, it does not go through the same normalisation process as the bottom-up CSV. Instead, it is calculated as a simple sum of the product of the weights of each cost driver based on the expenditure weights in the cost and cost driver mapping and the natural logarithm of the annual values of each cost driver. For example, peak demand was assigned to the load categories in RIIO-ED2 and the load categories accounted for 8% of expenditure over the modelling sample. Therefore, that is the weight we assigned to peak demand. This process resulted in the following weights in RIIO-ED2:

- MEAV - 49%;
- Network length - 24%;
- Customer numbers - 10%;
- Total faults - 9%; and
- Peak demand - 8%.

2.83 The top-down CSV then takes the following form:

$$Top-down\ CSV_{it} = 0.49 * \ln(MEAV)_{it} + 0.10 * \ln(Customer\ numbers)_{it} + 0.09 * \ln(Faults)_{it} + 0.08 * \ln(Peak\ demand)_{it} + 0.24 * \ln(Network\ length)_{it}$$

$$where\ i\ denotes\ the\ DNO\ and\ t\ denotes\ the\ financial\ year$$

2.84 The top-down CSV is potentially less accurate than the bottom-up CSV. The key reason for this is the lack of normalisation across the different cost drivers. MEAV is captured in £m, network length in km, peak demand in MW, etc. Therefore, the top-down CSV approach combines different cost drivers with different units into a single metric. This could result in a different implied overall weight of each driver from the one derived from the cost and cost driver mapping process. This is because scale drivers with higher absolute values will be overrepresented in the top-down CSV.

2.85 To see why, consider the following stylised example where the top-down CSV consists of two drivers: MEAV and customer numbers. If both have a 50% share of expenditure but the value of the natural log of MEAV is 20 on average and the value of the natural log of customer numbers is 10 on average, then the calculation takes the following form:

$$Top-down\ CSV_{it} = 0.5 * \ln(MEAV)_{it} + 0.5 * \ln(Customer\ numbers)_{it} =$$

$$= 0.5 * 20 + 0.5 * 10 = 10 + 5 = 15$$

2.86 This very simple example shows that the actual implicit weighting of MEAV is higher than the assumed 50%. It accounts for 10 units out of a total of 15 which is a 66% weight. The customer numbers account for the rest (5 out of 15 or a 33% weight).

2.87 Therefore, depending on the differences in the actual values of the cost drivers used for each DNO, the weights will be somewhat different than the ones derived from the cost and cost driver mapping. In addition, implicitly, each DNO will have its unique weights to the extent that the relative values of its cost drivers will differ. This highlights an important disadvantage of the top-down CSV compared to the bottom-up CSV.

LCT CV

2.88 We also used a top-down composite variable (CV) to combine the LCTs activity-based drivers we used in one of the RIIO-ED2 models. We assigned an equal weight to the cumulative number of EVs and the cumulative number of HPs in the CV. This was based on engineering insights on the marginal cost (based on contribution to peak demand) and forecast volumes for both types of LCTs.

Disadvantages of using composite variables

2.89 Composite variables have some potential disadvantages which we need to weight against the advantages set out above. First, the weights assigned to each scale driver during the cost and cost driver mapping step impose a pre-modelling assumption on the relative importance of each driver in explaining electricity distribution costs. That could be detrimental to model quality and alternative approaches for determining the weights could lead to different modelling outcomes. For example, while we assign a driver using our best view of engineering and economic rationale, there might be a secondary driver that is also important in explaining the cost variation in the relevant category. The CSV approach cannot account for this impact.

2.90 Second, composite variables make it more difficult to evaluate the individual impact of each scale driver. On the margin, it is difficult to interpret what the value of the coefficient means since the CSV consists of several cost drivers. This reduces the overall transparency and interpretability of the totex model which is potentially inconsistent with our model selection criteria.

2.91 We will continue to evaluate the appropriateness of composite variables when developing our ED3 totex models. For example, we will consider the cost and cost driver mapping as a key determinant of the weights assigned to each cost driver for the bottom-up and top-down CSVs. One priority for ED3 is to ensure bottom-up and top-down CSVs are internally consistent. That is, the cost and cost-driver mapping should be consistent across the two CSV approaches to the extent that engineering and economic rationale should not differ. We welcome stakeholder views on how we can improve our ED3 methodology for developing composite variables, both for the CSVs and the LCT CV.

Alternative approach - separate models

2.92 Given some of the potential disadvantages of the CSV approach, we propose to explore an alternative approach to developing our ED3 totex models. Instead of using CSVs, we can use multiple models with each scale driver and triangulate across them.

2.93 That can help us develop a wider set of models capturing different aspects of networks and have a more robust view of relative efficiency determined fully by the modelling outcomes. It avoids the need to impose pre-modelling assumptions on the scale drivers on their relative importance in explaining electricity distribution costs. Instead, it relies on letting the totex model decide how important each scale driver is.

2.94 In addition, separate models could help improve the transparency of our models. The coefficient could be more readily interpreted as an elasticity with respect to the relevant cost driver (eg a 1% increase in MEAV leading to X%

increase in electricity distribution costs). That mitigates the disadvantage of the CSV where a one-unit increase is more difficult to calculate and interpret given the CSV consists of a high number of cost drivers with different weights.

2.95 As we explained in previous sections, scale drivers capture slightly different scale and / or complexity characteristics of DNO networks. Therefore, an approach with a separate model for each scale driver is likely to result in a more rounded view of relative efficiency. It can better capture the unique characteristics of the 14 DNO regions and has the potential to improve modelling outcomes. This process will necessarily be iterative. Testing different cost drivers is likely to produce a different level of overall performance (eg in terms of R-squared). That will result in a refinement of the most appropriate scale cost drivers to use from the longlist we set out in the sections above.

2.96 The same goes for our ED3 longlist of complexity and activity-based drivers. Some of them could be assessed in our model development process to be close substitutes that are highly correlated. In these circumstances, we should also consider separate models with each driver. That can help capture company efficiency in different ways, improving the robustness of our modelling suite and avoiding the reliance on any one model.

2.97 However, the key disadvantage of this approach is the potential proliferation of models. The permutations of different scale, complexity and activity-based drivers can grow exponentially with each additional cost driver we are considering. In our presentation of RIIO-ED2 cost drivers and the ED3 longlist, we have set out:

- five scale cost drivers;
- four complexity drivers; and
- six activity-based drivers.

2.98 We will also likely receive further proposals for cost drivers in response to this consultation. That creates the need to undertake extensive model testing of different possible combinations of the drivers and an evaluation against our model selection criteria. We recognise that this might impose an additional administrative burden compared to the continued use of the established composite variables approach. However, we consider that the separate model approach is a credible alternative to the composite variables approach that we want to consider for ED3 totex model development. That can help expand our toolkit from which to draw on when we make final decisions on efficient electricity distribution totex allowances in ED3.

Consultation questions

CAQ9. Do you agree with our characterisation of bottom-up, top-down and LCT composite variables?

CAQ10. Do you have any preference between the use of a bottom-up and top-down CSVs?

CAQ11. Do you have any proposals for improvements of our composite variables methodology across the three composite variables we used in RIIO-ED2?

CAQ12. Do you agree with our proposal to consider an alternative approach of separate models in ED3?

Functional form, sample size and time trends

Functional form

2.99 The specification of the functional form is an important aspect of any econometric methodology. Different functional forms reflect different assumptions on the relationship between the dependent and explanatory variables.

2.100 Our RIIO-ED2 models used a Cobb-Douglas (or log-log) functional form. In this functional form, we take natural logarithms of both the dependent and independent variables. The log-log functional form has been established as the preferred functional form widely used in totex benchmarking in GB economic regulation. It is relatively simple and transparent. This aligns with our ED3 model selection criteria. It takes the following form:

$$\ln(Totex_{it}) = \beta_0 + \beta_1 * \ln(Cost\ driver_{it}) + \epsilon_{it}$$

2.101 In this generic specification, β0 is a constant term, β1 is the coefficient associated with the cost driver and ϵit is the error term that captures the share of costs not explained by the cost driver for DNO i at time t. The error term consists of different components including noise, measurement error and inefficiency.

2.102 When both cost and cost drivers are expressed in natural logarithms, β1 can be interpreted as the elasticity of costs with respect to the cost driver. If the cost driver increases by 1%, cost is expected to increase by β1%. This ease of interpretation of the impact of cost drivers on costs highlights the simplicity and transparency of the log-log functional form.

2.103 Our starting point for ED3 totex modelling is that we will continue with the use of a log-log functional form due to the advantages we set out above.

Sample size

2.104 The sample size we use when estimating our ED3 totex models is an important part of our toolkit approach. When considering the appropriate sample size, we trade off multiple considerations. Large sample sizes utilising historical and forecast data help us to develop more robust totex models. That is because they examine DNO performance over a longer time period, helping us to establish a baseline of relative efficiency. Therefore, everything else being equal, larger sample sizes are desirable when we develop our ED3 totex models.

2.105 However, larger sample sizes have some potential disadvantages:

- they might rely on us going further back in the historical period where costs might not be as representative for future costs; and
- they might rely on us using ED3 totex forecast data which is within DNO management control when submitting ED3 business plans.

2.106 Therefore, when deciding on the appropriate sample size, we need to weigh the benefits and potential risks of using both historical and forecast data.

2.107 Using outturn historical data is a fundamentally important tool in our toolkit. It helps us to challenge the efficiency of DNO business plans by addressing the inherent information asymmetry on the efficient cost of delivering electricity distribution services. Modelling using historical data only is completely independent from DNO totex forecasts. It reflects the level of efficiency that the sector was able to achieve in the historical period given the cost drivers used in our totex models. As such, it is the best available independent estimate of what efficiency could look like in future periods. This makes using historical data a powerful tool in our toolkit approach to challenge the efficiency of the sector and hold it to account.

2.108 On the other hand, using historical data only could potentially be restrictive. As explained above, going back further in time might not be appropriate given the different challenges DNOs face in the ED3 price control period. When considering the sample period for ED3 totex modelling, using data before RIIO-ED1 (ie before 2016) might not be sufficiently representative of efficient ED3 totex. Therefore, omitting forecast data can limit sample size and directly influence the robustness of our benchmarking approach.

2.109 In addition, considering forecast data helps to leverage DNOs' superior information on the expected challenges to deliver electricity distribution services in ED3. As the operators of their networks, DNOs are well placed to forecast efficient ED3 totex. However, this does not mean DNOs have an incentive to reveal efficient cost in their ED3 business plans. That is because they are likely to consider a range of competing factors when forecasting ED3 totex, including:

- the level of risk they are willing to take in forecasting;
- different views of potential input price and supply chain pressures;
- long-term considerations of how ED3 fits in with the overall company strategy to facilitate net zero by 2050; and
- potential reputational and / or financial incentives to show ambition (eg via the Business Plan Incentive (BPI) or other incentives).

2.110 All of these factors and many others contribute to DNO decisions on how to approach their ED3 business plans. Therefore, while forecast data is a relevant tool in our toolkit approach, we need to fully consider its potential disadvantages around efficient ED3 cost revelation.

2.111 Our RIIO-ED2 totex models pooled historical and forecast data from RIIO-ED1 and RIIO-ED2 to estimate the totex models using a panel data sample of 13 years (2016-2028). RIIO-ED2 totex model 3 used forecast-only data (2024-2028) given the limited data on LCTs in the historical sample. RIIO-GD3 models used the entire sample available of 18 years from RIIO-GD1 to RIIO-GD3 (2014-2031).

2.112 Our starting point for ED3 totex modelling is that we will use a sample of 18 years from RIIO-ED1 to ED3 (2016-2033). This longer sample period consisting of 252 observations (18 years over 14 DNO regions) can help us to develop more robust ED3 totex models. Indeed, that is a larger sample than the ones used in past price control periods or in other sectors.

2.113 However, we propose to also consider using historical-only data models where forecast totex is significantly higher than historical totex and changes in the scope of DNO activity cannot sufficiently explain the increase. Therefore, historical-only modelling can act as a sensitivity check. This can help provide additional information on the degree to which forecast data in ED3 business plans is influencing efficient ED3 totex allowances.

Time effects

2.114 We used a dummy variable time trend in our RIIO-ED2 totex models. This variable is not directly or transparently supported by engineering and economic rationale the way the cost drivers we set out in the sections above are. On the other hand, time effects can capture time-varying unobservable effects that the main cost drivers fail to capture. These could be:

- exogenous factors we are not capturing in the model;
- increasing efficiency over time; and
- increases in the quality of electricity distribution services over time.

2.115 In RIIO-ED2, we used a different time trend variable compared to regulatory precedent at the time. We implemented a dummy variable approach with the dummy taking a value of 1 in the RIIO-ED2 period and 0 otherwise. That was a change in approach compared to the more traditional time trends included in other ED and GD price controls.

2.116 The more conventional approach to using time trends before RIIO-ED2 was to use a linear time trend variable. That does not model a step change at the start of the price control period. Instead, it models a gradual continuous annual change in overall efficiency to capture unobservable impacts over time as set out above. This time trend covered the entire sample period used (historical and forecast data).

2.117 In RIIO-ED2 Draft Determinations, we developed the approach further to add an additional time trend to cover the forecast period only. The rationale behind this second time trend was to capture potential differences in the definition of the dependent variable in our RIIO-ED2 totex models between historical and forecast data. We considered a single time trend covering the entire sample period was not suitable as OE and RPEs impacts are embedded in the historical data but not in the forecast data (submitted excluding OE and RPEs impacts). Therefore, the second forecast time trend can help capture this additional impact over and above a more general change in efficiency over time.

2.118 Our rationale for using the RIIO-ED2 dummy variable was to capture the anticipated change in the nature and scale of DNO activities during the RIIO-ED2 period compared to RIIO-ED1. However, we expressed concerns that including the dummy effectively resulted in an upward step-change in modelled totex in RIIO-ED2 relative to RIIO-ED1. This essentially accepted the premise that RIIO-ED2 is different and a change for the electricity distribution sector from business-as-usual, when ideally this conclusion should be derived as an outcome from our modelling.

2.119 However, we accepted that premise in RIIO-ED2 Final Determinations on the basis that:

- the outcome is similar to the approach of using two time trends;
- we expect a step change in the scope of company activities in RIIO-ED2 to facilitate the transition to net zero by 2050; and

- it improved the statistical robustness of the RIIO-ED2 totex models.

2.120 RIIO-GD3 Draft Determinations also used the two time trends approach as per RIIO-ED2 Draft Determinations. However, we highlighted the risk that the forecast time trend could allow the model to reflect inefficiencies in forecast data. Therefore, we set out our intention to further consider this issue for RIIO-GD3 Final Determinations.

2.121 We propose to fully consider the nature and purpose of time trends in our ED3 totex models. The lack of transparency of this driver means that it is potentially not fully consistent with our cost driver principles. Time trends risk controlling for factors that are within DNO management control. Where the sign of any time trend (and in particular the forecast time trend and dummy variables both tested in RIIO-ED2) is positive, that risks extrapolating inefficiency into the ED3 price control period. It can also potentially drive perverse incentives for DNOs to increase their forecast costs in ED3 business plans. This can increase the magnitude of the coefficient on forecast period time trends and result in unjustified increases in ED3 efficient modelled costs. Therefore, the use of a time trend could potentially be inconsistent with our model selection criteria.

2.122 In addition, it is not clear whether a step change in the scope of sector activity and associated impact on efficiency can be captured well by a time trend. The time trend is uniform across the sector, capturing an average sector impact. In practice, every DNO will have a unique investment programme to reach net zero by 2050. Therefore, using a time trend to capture this impact is inappropriate.

2.123 Instead, we consider that the development of a better set of activity-based drivers can help capture significant shifts in the scope of DNO activities over time. This can help improve ED3 model performance on a more transparent basis that is more consistent with our regulatory objectives. For example, the MEAV additions driver capturing the DNO investment programmes can capture volume impacts (see Longlist of alternative cost drivers for ED3 section).

2.124 In conclusion, we propose to fully explore the statistical performance and impact of different time trends on efficient ED3 totex. As part of that, we will examine how they interact with the longlist of ED3 cost drivers we are considering. That process will result in one of the following outcomes:

- using an ED3 dummy variable similar to the RIIO-ED2 dummy variable;
- using a full sample time trend (historical and forecast period);
- using a full sample time trend (historical and forecast period) and a forecast period time trend; and

- not using a time trend or an ED3 dummy variable.

Consultation questions

CAQ13. Do you agree with our proposal to use the log-log functional form when developing ED3 totex cost models?

CAQ14. Do you agree with our proposal to use the sample period RIIO-ED1 - ED3 (2016 - 2033) to estimate our ED3 totex models?

CAQ15. Do you agree with our proposal to undertake a full assessment of the scope and purpose of including time trends in our ED3 totex models?

Estimation approach and statistical diagnostic tests

Estimation approach

2.125 We can implement different estimation methods to estimate our ED3 totex models. We have a panel dataset to estimate the models. It includes multiple observations over three price controls (RIIO-ED1, RIIO-ED2 and ED3) of each of the 14 DNOs over time. There are several different econometric modelling techniques we can use to model efficient ED3 totex:

- **Pooled Ordinary Least Squares (OLS)** - this regression approach treats each data point as a unique observation. This approach does not consider the panel data dimension of the dataset and treats all observations as independent. This is the only estimation method used by Ofgem since RIIO-1.
- **Random effects** - this regression approach exploits the panel structure of the dataset. It explicitly considers that we have 14 separate DNO panels in our modelling sample. It assumes each company has an unobserved unique time invariant factor that affects costs which is not correlated with other cost drivers. This is the preferred estimation approach for Ofwat to model base expenditure in PR19 and PR24.[11]
- **Fixed effects** - this estimation approach also exploits the panel structure of the dataset. However, it assumes each company has an unobserved unique time invariant factor that affects costs (ie a fixed effect), which is correlated with other cost drivers. It also only exploits the 'within' variation of the data. That is, how costs are evolving over time within each of the 14 DNO panels rather than comparing how costs differ between regions (ie the 'between' variation).

[11] See PR24 final determinations: Expenditure allowances - base cost modelling decision appendix - Ofwat

- **Stochastic frontier analysis (SFA)** - a modelling technique that explicitly accounts for the existence of inefficiency. It allows the residual term to split between inefficiency and error. However, it requires a significant amount of data for the estimation process to run successfully.

2.126 Our starting point for ED3 is that we will continue with the well-established OLS estimation approach. The fixed effects and SFA approaches have some significant disadvantages in a regulatory cost assessment context which means they have not been used in GB economic regulation.

2.127 The fixed effects regression is unlikely to improve modelling outcomes as it depends on the within variation of the dataset. It is also very data intensive due to the need to include DNO dummies in the regression. That could potentially result in a lower robustness of our models that are estimated using relatively small samples. The scale drivers we use such as MEAV, customer numbers and network length have relatively small changes over time. Therefore, there is a limited within variation to exploit in a fixed effects regression approach. That can also make the fixed effects model less robust than OLS. We note that the Competition and Markets Authority (CMA) concluded fixed effects are not an improvement to random effects for PR19 base totex models in the PR19 redeterminations.[12] Therefore, we do not expect to use the fixed effects estimation approach in ED3 totex model development.

2.128 We recognise that the SFA estimation approach has the potential advantage of being able to distinguish between inefficiency and error within the residual. However, we are concerned that the SFA inefficiency estimates are very sensitive to the pre-modelling assumptions made on the distribution of the model error term. This creates additional uncertainty on the appropriate way of modelling inefficiency. We note that the CMA identified these disadvantages in PR19 redeterminations and did not consider SFA base cost models on that basis.[13]

2.129 The only alternative estimation approach we propose to consider in ED3 is the use of random effects. This approach more fully considers the panel dimension of our modelling sample. Therefore, it has the potential to improve the modelling outcomes compared to OLS. Similar to Ofwat in PR19 and PR24, we

[12] Competition and Markets Authority, 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, final report', March 2021, p. 123, paragraph 4.22.
[13] Competition and Markets Authority, 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, final report', March 2021, p. 123, paragraph 4.26.

propose to consider appropriate statistical tests to evaluate whether random effects models result in an improvement compared to OLS models. That might ultimately result in adopting the random effects estimation. However, we will need sufficient evidence of a material improvement in modelling outcomes to warrant a change from our well-established OLS estimation approach.

Statistical diagnostic tests

2.130 We will use a set of statistical diagnostic tests to evaluate the statistical performance and robustness of ED3 totex models. This is a well-established approach with a set of statistical diagnostic tests used in all recent price reviews in the energy and water sectors. It is an essential part of the process to ensure the final set of models we choose are the ones that best predict efficient ED3 totex while being consistent with our model selection criteria (see Model selection criteria section).

2.131 However, we reiterate that econometric models may not pass all model robustness tests. Therefore, we will consider the relevant importance of each test when developing ED3 models but will not use performance against tests as a mechanistic rule for model selection.

2.132 In addition, we propose to assign a different level of importance to the set of statistical diagnostic tests we use. In the rest of the section, we set out our proposed statistical tests split into three categories capturing the level of importance we propose to assign on each when specifying ED3 totex models (High, Medium and Low). All statistical tests we are proposing are consistent with ED and GD approaches in past price control periods. The only additional test we are proposing is the Breusch Pagan LM test. This test can help evaluate whether we should consider random effects over OLS models as explained in the previous section. In addition, we set out the range of efficiency scores as a statistical diagnostic test explicitly.

<u>High importance</u>

2.133 **Adjusted R- squared** - the adjusted R-squared measures the proportion of variation in the dependent variable that can be explained by the model. Models with higher R-squared explain the variation in DNO costs better. The range of the metric is from 0 to 1.

2.134 **Statistical significance of parameters (t-test)** - this test is evaluating whether we can be confident that there is a statistical relationship between the explanatory variable (cost driver) and the dependent variable (cost). It tests whether we can statistically reject the hypothesis that there is no relationship (ie that the coefficient is zero). The p-value of the t-test indicates the confidence in the estimated coefficient with lower p-values increasing how confident we are in the value of the estimated coefficient.

Medium importance

2.135 **Efficiency score distribution** - efficiency scores can be calculated for any model as the ratio between a DNO's requested costs and predicted efficient modelled costs. Efficiency score values below (above) 1 suggest the DNO is more (less) efficient than the modelled outcome. The range of efficiency scores is an important supplementary indicator of model quality. A large range of efficiency scores could indicate the presence of issues in the underlying model, such as the presence of omitted variables. It suggests our model is not fully able to capture some characteristics of the 14 DNO regions that have material impacts on costs, leading to a higher distribution of efficiency scores.

2.136 **The RESET test** - this test considers whether there is some non-linear relationship in the model that has not been captured. In the cost modelling literature this is normally dealt with by considering a translog specification which captures these non-linearities directly. Failure of this test suggests that it is appropriate to consider alternative options. However, if alternative specifications using non-linear terms do not lead to model improvement, then failure of the RESET test on its own may not be a valid justification to dismiss a model. The higher the p-value, the more confident we are that the functional form is adequate.

2.137 **Testing for panel effects (Pooling test)** - given that our dataset comprises observations on multiple DNOs over several years, we need to evaluate whether models that explicitly recognise the panel structure of the data might be valid alternatives to OLS (which pools the data and treats all observations as independent). The null hypothesis of the Pooling test is that the slope of the estimated relationship is stable over time. If the null hypothesis is rejected, it would imply that each individual cross-section has its own slope. Therefore, panel data analysis may not be appropriate. The higher the p-value, the more confident we are that panel data analysis is appropriate.

Low importance

2.138 **Normality of errors** - violations of this assumption does not affect the properties of OLS estimators themselves. They remain the best linear unbiased estimators. The impact of non-normality only has implications for the ability to use finite sample inference – that is, making judgements about the statistical significance of the parameters in small samples. This test is failed for lower p-values.

2.139 **Heteroskedasticity** - if the heteroskedasticity test fails, it means that the variance of the model residuals is not constant across observations. The standard response to this potential issue is therefore to use robust standard errors when assessing the level of statistical significance. This test is failed for lower p-values.

2.140 **Breusch-Pagan LM test** - this is a test for pooled OLS versus random effects. This test is failed for lower p-values. Failure of this test would indicate that the random effects estimation method is preferred over the pooled OLS estimation.

Consultation questions

CAQ16. Do you agree with our proposal to retain the OLS estimation approach and to evaluate a random effects estimation approach when developing ED3 totex models?

CAQ17. Do you agree with our proposed set of statistical diagnostic tests we intend to use to evaluate the robustness of ED3 totex models?

3. Disaggregated models

Introduction

3.1 Disaggregated models use granular cost data of every category of expenditure with combinations of categories where appropriate to implement a simpler unit cost / ratio or regression benchmarking. We used this modelling approach to determine efficient electricity distribution costs in RIIO-ED2, assigning a triangulation weight of 50%.

3.2 Disaggregated modelling is used in different contexts in GB economic regulation. We used disaggregated modelling to help set efficient gas distribution cost allowances in RIIO-GD1. However, we did not use this modelling approach for RIIO-GD2 and the recent RIIO-GD3 Draft Determinations.

3.3 Ofwat used disaggregated models to model enhancement expenditure in PR19 and PR24.[14] PR19 enhancement models generally modelled a specific scope of company activities to improve the level of service (eg storm overflows, phosphorus removal, etc.) using a cross-sectional company approach (referred to as company level enhancement models). These models generally used forecast aggregated company data for the entire price control period to estimate efficient allowances for each area of enhancement expenditure. They were based on relatively simple econometric cost models using a single cost driver or unit cost models with a sample size of 17 (for water activities) or 10 (for wastewater activities) to align with the number of regulated companies for each service.[15]

3.4 PR24 enhancement models continued with the PR19 approach but went further to estimate efficient enhancement expenditure on a site level basis (referred to as scheme level enhancement models). Ofwat implemented this approach for areas of significant water company enhancement activity where there was a sufficient sample size to support a scheme level approach.[16] This followed suggestions by the CMA in the PR19 redeterminations that scheme level enhancement models can be an alternative to company level enhancement models.[17]

[14] Ofwat defines enhancement expenditure to be generally where there is a permanent increase or step change in the current level of service to a new 'base' level and/or the provision to new customers of the current service level. It may be driven by new statutory obligations, by improving service quality and resilience, or by providing new solutions for water provision in drought conditions.
[15] See PR19-final-determinations-Securing-cost-efficiency-technical-appendix.pdf (section 4)
[16] See PR24-final-determinations-Expenditure-allowances-Enhancement-cost-modelling-appendix.pdf
[17] Competition and Markets Authority, 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, final report', March 2021, p. 413.

3.5 The rest of this section sets out our proposed ED3 disaggregated modelling framework. We cover the following in turn:

- advantages and disadvantages of disaggregated models;
- summary of RIIO-ED2 disaggregated models; and
- principles for ED3 disaggregated model development.

3.6 We recognise that our disaggregated model development process is at an early stage. Therefore, we look forward to stakeholder feedback on how we can most effectively and collaboratively progress ED3 disaggregated model development through our CAWG and BPDTWG.

Advantages and disadvantages of disaggregated models

3.7 There are three key advantages of disaggregated models which make this modelling approach an essential part of our ED3 cost assessment toolkit.

3.8 First, each cost category forms a different cost assessment model in disaggregated modelling. That leverages the richness of regulatory reporting on electricity distribution services. It allows us to use different cost drivers with solid engineering and economic rationale at the granular cost category level. This potentially better reflects the decisions DNOs face day-to-day to deliver high quality and efficient electricity distribution services. The disaggregation could be by voltage, by asset type, type of service delivered, etc. The approach also uses a mix of very different techniques including unit cost analysis, ratio benchmarking, regression analysis, trend analysis, etc. This additional flexibility can help to better reflect the bespoke nature of the activities in each cost category.

3.9 Second, the level of granularity of disaggregated modelling helps us and the sector to better understand sources of efficiency and best practice. We can examine and analyse which DNOs excel in which areas (eg connections, asset replacement, faults, etc.). This can be used to follow up on the sources of efficiency to inform regulatory policy and DNO engagement (eg in BAU regulatory reporting work). For example, we can assess whether differences are driven by variations in the contracting and procurement approach, approach to planning, supply chain management practices, etc. That makes the disaggregated modelling suite a very important source of evidence to help drive better outcomes for customers.

3.10 It gives us a cost assessment tool to understand best practice and engage closely with the sector to help leverage insights and shift frontier performance over time. That helps to mimic competitive market outcomes where companies continuously assess the price and quality of their products to maintain relevance with their customers. More broadly, it also allows us to provide a more coherent narrative when communicating with internal and external stakeholders that want to understand the sources of efficiency of DNOs.

3.11 Third, the disaggregated modelling suite can potentially be more responsive to step changes in the scope of DNO activity over time. This is essential in the context of a growing electricity distribution sector that is central in the effort to reach net zero by 2050. As explained in the previous section, it is more difficult to account for this in aggregate totex models which focus on cost drivers outside of management control as per our cost driver principles. The disaggregated modelling suite arguably takes the opposite perspective in relation to DNO management control of cost drivers. It directly depends on granular DNO activity across all cost categories with most cost drivers being firmly within management control in the short-term. In doing so, we can better account for changes in the scope of DNO activity over time and potential step changes in activity when setting efficient allowances. In that context, the engineering assessment of the need for investment is an important safeguard to ensure efficient scope of DNO activity. Where these find that DNOs have inefficient scope in the proposed level of investment, we implement workload adjustments.

3.12 On the other hand, disaggregated modelling can also have some potential disadvantages. First, these models are subject to increased risk of differences in business model to deliver electricity distribution services leading to differences in apparent efficiency. Because our regulatory framework does not prescribe to DNOs how to run their networks, they have a flexibility to take the approach they consider is best and most efficient given the unique characteristics of their regions. This has an influence on our disaggregated modelling suite given the granularity of the benchmarking models which could be picking up differences in business models rather than differences in efficiency.

3.13 The second potential disadvantage is the risk of 'cherry picking'. Differences in business models across DNOs lead to a potential risk of creating an efficient operator that has an efficiency level which is unattainable from an economic and engineering perspective. That is, creating a DNO that is forecast to be the most efficient across all disaggregated activities. Therefore, there is an important need to fully consider and calibrate the efficiency challenges we will assign when modelling each disaggregated cost category in ED3. We consider efficiency challenges further in Chapter 5.

3.14 Third, disaggregated models could potentially result in confusing, unintended and perverse incentives being created. Due to the high number of disaggregated cost models in our suite (36 in RIIO-ED2), it is difficult to evaluate what kind of incentives this modelling approach creates for DNOs. It potentially creates a risk that DNOs do not fully exploit synergies available across different cost categories. Where there are known interactions and / or trade-offs between categories, we want the sector to fully explore and proceed with options that minimise total cost. In addition, we want DNOs to be incentivised to reveal efficient costs in each cost category in ED3 business plans and to demonstrate ambition to deliver improved customer outcomes. In practice, the complexity of the disaggregated modelling suite can potentially obfuscate DNO incentives and therefore increase the risk of gaming and / or worsening the robustness of the disaggregated modelling suite.

3.15 Finally, the disaggregated modelling approach is very resource intensive. Since the disaggregated models have a high level of granularity, they require a significant programme of work from us and DNOs to examine and develop the suite. That is not to say the models are complex. On the contrary, most of the models utilise simpler modelling techniques such as unit cost and ratio benchmarking. However, the split into multiple sub-categories within each cost category in reporting means they are much more data intensive. The larger disaggregated datasets need to be fully considered and analysed to ensure each disaggregated model delivers its intended outcome of capturing DNO relative efficiency within the category.

Summary of RIIO-ED2 disaggregated models

3.16 We include a summary of our RIIO-ED2 disaggregated models in Appendix 4. Overall, we implemented 36 disaggregated models in RIIO-ED2. The models use a combination of forecast and historical data to set efficient cost allowances within each of the cost categories.

3.17 In general, our RIIO-ED2 disaggregated models were simpler than the totex models. They included a granular assessment of the volumes DNOs are delivering across their business which are used in a unit cost or a ratio benchmarking approach. However, we went further to use a top-down benchmarking approach in some areas including:

- faults and ONIs;
- closely associated indirects (CAIs); and
- core business support costs (BSCs).

3.18 The models also implemented workload adjustments based on the engineering team's assessment of efficient workloads across the different cost categories. That part of the process ensured that the scope of activities funded in RIIO-ED2 is efficient. It is also distinct from the RIIO-ED2 totex modelling approach that did not apply workload adjustments in the same way (see Chapter 6 for our proposed approach to workload adjustments in ED3).

Principles for ED3 disaggregated model development

3.19 At this early stage of the process, we are setting some high-level principles we are going to consider as our programme to develop the ED3 disaggregated modelling suite takes shape.

3.20 The first overarching principle is that we propose to use the RIIO-ED2 disaggregated models as a starting point for further development. We consider RIIO-ED2 to be an appropriate starting point given the extensive model development undertaken in RIIO-ED2. RIIO-ED2 disaggregated models had a strong utilisation of data in ED regulatory reporting and are therefore grounded in strong engineering insights on the key bottom-up cost drivers of DNO activity. Since many of these insights will remain valid in ED3, we do not see a strong case to start from a different initial base as we develop our ED3 disaggregated modelling approach.

3.21 Second, we will consider the underlying level of granularity appropriate to model DNO activities at a disaggregated level. As per our first principle, granular models can better capture engineering insights of how DNOs deliver electricity distribution services. However, they may not fully capture important interactions within a cost category or with an adjacent cost category. Therefore, our model development will actively consider the level of granularity and whether it should change to improve disaggregated modelling outcomes. This was considered in CAWG6 where DNO stakeholders presented on disaggregated models.[18]

3.22 Third, we will consider the balance between the use of historical and forecast data when developing our ED3 disaggregated modelling suite. This is consistent with our approach to ED3 totex modelling (see Sample size section in Chapter 2). Our assessment of unit cost over time in a disaggregated setting might inform a different approach across categories, just as it did in RIIO-ED2. However, leveraging historical cost efficiency insights to set ED3 disaggregated allowances will remain an essential part of our ED3 toolkit approach.

[18] See RIIO Engagement Portal - Documents - CAWG06 - All Documents

Consultation questions

CAQ18. Do you agree with the continued use of disaggregated models in ED3?

CAQ19. Do you agree with the advantages and disadvantages of disaggregated models we set out?

CAQ20. Do you agree with our proposed principles for disaggregated model development in ED3?

4. Mid models

Introduction

4.1 The last two chapters set out our proposal to use the RIIO-ED2 totex and disaggregated modelling approaches as the backbone of our emerging ED3 cost assessment toolkit. However, at this early stage of the model development process, we want to fully consider alternative modelling approaches. In particular, we are interested in developing a modelling approach that bridges the gap between our two traditional ED cost assessment approaches.

4.2 To that end, we have explored whether we can develop alternative mid-level models (referred to as mid models). Our main objective for this modelling approach is that it should add value to our ED3 cost assessment toolkit. To achieve this, we consider that mid models need to be sufficiently different from either of our two modelling approaches:

- they should not be too aggregated as then they risk adding little value compared to our ED3 totex modelling approach; and
- they should not be too granular as then there is a risk that they veer into our ED3 disaggregated modelling suite development as part of which we propose to consider the appropriate level of aggregation anyhow (see Chapter 3).

Criteria for level of aggregation

4.3 The following criteria capture factors we propose to consider when deciding on the appropriate level of aggregation of ED3 cost models:

- **Complementarity** - Is there a strong technical / economic reason to believe that activities or groups of expenditure are complementary and should be benchmarked together and a consistent set of cost drivers can be identified?
- **Cost trade-offs** - Can DNOs make trade-offs in expenditure between the different activities / areas included in the cost pool, and so benchmarking those activities / costs together will help avoid biased relative efficiency results or unintended managerial incentives for the DNOs?
- **Cost boundary complexity** - How complex is the boundary of cost reporting data that needs to be defined to benchmark the identified cost pool / activity (eg how well defined is the group of costs within regulatory reporting templates)?
- **Risk of inaccurate / biased models** - Is there too much 'noise' in the data to be confident that including certain types of expenditure within

aggregated regressions could lead to inaccurate model results, or coefficient estimates that are difficult to interpret using engineering / economic logic?

4.4 The criteria provide a useful framework for considering and evaluating how we can aggregate models. Not only in the context of mid models but also to inform our disaggregated model development. Indeed, one DNO presented some initial ideas of an alternative framework for disaggregation in CAWG6.[19] We welcome further feedback on this issue in response to our consultation and subsequent engagement.

Scope

4.5 We consider that the high-level grouping of ED cost reporting categories is an appropriate starting point for considering the development of ED3 mid models. This splits DNO expenditure into six main categories:[20]

- load-related capex;
- non-load related capex;
- non-operational capex;
- network operating costs (NOCs);
- closely associated indirects (CAIs); and
- business support costs (BSCs).

4.6 This level of granularity helps to achieve our objectives of creating models that are sufficiently close to the 'centre' on the spectrum from disaggregated to totex models. The additional level of aggregation can generate important additional insights on DNO efficiency and adds value to our ED3 cost assessment modelling suite.

4.7 We also consider that our approach is appropriate from an engineering and economic perspective. DNOs are likely to approach planning for how to deliver electricity distribution services in terms of the above categories.

4.8 Load-related activities have complementarities, interactions and synergies that DNOs actively consider when delivering their programmes. For example, reinforcement works associated with connections could result in a preferred strategy to invest further to reinforce the network to avoid future interventions.

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[19] See RIIO Engagement Portal - Documents - CAWG06 - All Documents

[20] See Appendix 4 for a full list of reporting categories under each high-level grouping. We use the terms pools and categories in the rest of this chapter to capture the level of aggregation in mid models. Categories mainly reflect the boundaries of existing regulatory reporting. Pools can go further as they may combine different categories for cost assessment purposes based on an assessment against our criteria for level of aggregation

4.9 Similarly, non-load activities also have important interactions. The non-load category includes expenditure to maintain the electricity distribution network. As part of that, DNOs face trade-offs between the different cost categories in the non-load pool. For example, they can replace assets under the asset replacement cost categories or alternatively decide to refurbish the assets to incrementally extend their asset lives.

4.10 Overall, we consider that the only category that could potentially benefit from subsuming into others when assessing against our criteria for level of aggregation is the non-operational capex category. Non-operational capex consists of the following categories:

- IT and telecoms (Non-op);
- property (Non-op);
- vehicles and transport (Non-op); and
- small tools and equipment.

4.11 As such, this category closely interacts with opex incurred under other pools. For example, there are IT and telecoms and property management opex categories under BSCs. In addition, there is a vehicle and transport opex category under CAIs. The interactions between these categories were indeed explicitly recognised by our RIIO-ED2 disaggregated modelling that pooled some of these categories (see Appendix 4). Therefore, we propose the following allocation of non-operational capex categories into pools for ED3 mid model purposes:

- IT and telecoms (Non-op) - assigned to BSCs pool;
- property (Non-op) - assigned to BSCs pool;
- vehicles and transport (Non-op) - assigned to CAIs pool; and
- small tools and equipment - assigned to CAIs pool.

4.12 A key characteristic of our proposed ED3 mid model approach is that relevant insights on appropriate volume drivers from RIIO-ED2 disaggregated modelling are readily available. Mid models bring disaggregated models up to a multi-driver econometric model setting. They can retain key insights of the underlying cost drivers within the cost pool as appropriate, alongside other scale and / or complexity drivers supported by engineering and economic rationale. That can add value to our ED3 cost assessment toolkit approach with mid models retaining a narrative on reasons for efficiency but avoiding the potential disadvantages of disaggregated models. The rest of this chapter sets out this approach in more detail and presents some initial illustrative examples of ED3 mid models.

A hybrid approach

4.13 Our objective for ED3 model development is to fully explore alternative specifications of mid models to explore their performance and the extent to which they can enrich our ED3 cost assessment toolkit. We are currently at an early stage of the model development process for these models. Because the nature of these models is inherently related to disaggregated modelling insights, we expect that disaggregated and mid models will have some important interactions that we will need to consider on an ongoing basis. However, we set some indicative examples of how our ED3 mid models could look like.

4.14 Our initial proposal for developing ED3 mid models is that they should represent a hybrid approach between our totex models and our disaggregated models. First, as explained earlier in this chapter, we propose that mid models should be estimated using an econometric modelling approach. That can follow the framework as set out in Chapter 2 (eg in relation to sample size, estimation approach, statistical diagnostic tests, etc.).

4.15 However, we consider that the statistical robustness of mid models should not be assessed on a like-for-like basis with ED3 totex models. The level of granularity is likely to make ED3 mid models less statistically robust (eg in terms of overall R-squared). However, comparing such metrics across models of a different level of granularity is inappropriate. This is due to aggregated totex models being more immune to interactions between cost categories and trade-offs. Instead, using other diagnostic tests such as the range of efficiency scores to compare the mid modelling suite performance against the disaggregated modelling suite performance for the relevant mid model cost pool might be more appropriate. Overall, we propose to use a wide range of insights from totex and disaggregated modelling to evaluate the performance of our proposed ED3 mid models.

4.16 Second, ED3 mid models can also utilise the scale, complexity and activity-based cost driver framework for totex models to help us control for unique characteristics across the 14 DNO regions. For scale, we can use the same set of cost drivers that we use in our ED3 totex models. Since our approach considers the appropriate mapping of granular cost categories to cost drivers, engineering and economic insights on the appropriate cost drivers to use should be readily available. We propose to also consider the consistency with the approach to controlling for scale in the totex models in terms of using CSVs or separate models (see CSV approach vs separate models section in Chapter 2).

4.17 For complexity, we can utilise the cost drivers set out in Chapter 2 including:

- share of network overhead;
- high voltage network share; and
- weighted average density.

4.18 These complexity drivers could help capture exogenous cost drivers that impact the delivery of electricity distribution services across the relevant categories. We are cognisant that the impact of these complexity cost drivers might be different across mid model categories. That is, some of these cost drivers might not have a statistically significant impact in all cost categories. For example, engineering insight suggests that the share of the network overhead might help explain cost variation in load and non-load but is expected to be less relevant in explaining efficient BSCs.

4.19 We propose to use activity-based drivers to leverage disaggregated modelling insights into our proposed ED3 mid model approach. Across the different granular cost categories, we already have insights into the cost drivers that capture DNO levels of activity. The activity-based drivers provide a tool to control for these in our ED3 mid model pools.

4.20 One implementation difficulty associated with the activity-based drivers is that they are likely to be highly correlated. For example, for any DNO region the number of new connections could be highly correlated with asset replacement as they are both a function of the overall size of the DNOs. That could present multicollinearity issues like the ones associated with controlling for multiple scale drivers in our totex models. To address this, we propose to consider an approach to normalise by dividing by a scale driver. That can help identify the relative level of workload undertaken by DNOs for a given scale using the preferred cost driver within the mid model cost pool.

4.21 In addition, we recognise that each driver would drive a different proportion of costs within the underlying mid model cost pool. Therefore, cost drivers for material cost categories within the pool are more likely to lead to a statistically significant impact on costs. For example, asset management is a high materiality category within non-load and faults is a major category in NOCs. This is likely to directly influence the statistical performance of the longlist of cost drivers we propose to develop using the detailed disaggregated modelling insights. Therefore, it is a factor that we propose to consider in ED3 mid model development.

Initial examples

4.22 We are at an early stage of developing our ED3 mid models. However, to help illustrate our approach in relation to the hybrid approach we propose to consider, we set out three examples of mid models with some underlying activity-based cost drivers:

- **Load** – peak demand (scale), number of connections, unlooped properties, capacity released, LCTs (EVs and HPs).
- **Non-load** – MEAV / network length (scale), MEAV additions (non-load), number of diversions, volumes of civil works / refurbs, overhead line clearance sites resolved.
- **NOCs** – MEAV / network length (scale), number of faults, ONIs, spans cut / affected.

4.23 As we explained earlier in the chapter, these models can be supplemented by complexity drivers that can help to control for regional characteristics of the 14 DNO regions that could affect costs within the pool. Every activity-based driver can also be normalised by dividing by the preferred scale driver within the pool.

4.24 We welcome DNO ED3 mid model proposals in relation to these initial examples and wider suggestions on any of the five pools we are considering. However, we recognise the development of suitable ED3 mid models will represent an iterative process to be taken forward using our CAWG and BPDTWG as appropriate.

Consultation questions

CAQ21. Do you agree with our criteria for level of aggregation when developing ED3 mid models and disaggregated models?

CAQ22. Do you agree with our proposal to consider mid models in our ED3 cost assessment toolkit approach?

CAQ23. Do you agree with our proposed level of aggregation for the mid models? If not, please state your alternative proposal.

CAQ24. Do you agree with our hybrid specification of the ED3 mid models to combine approaches from ED3 totex and disaggregated modelling?

5. Cross-cutting issues

Introduction

5.1 This chapter sets out cross-cutting cost assessment issues. These can be issues that apply across all three ED3 cost modelling approaches and therefore benefit from a separate consideration. Alternatively, they can represent an additional step in our proposed ED3 cost modelling process or a key input that we need to consider when determining efficient ED3 totex allowances.

5.2 We cover the following in turn:

- post-modelling adjustments;
- disaggregation of allowances;
- triangulation; and
- efficiency challenges and the ratchet.

Post-modelling adjustments

RIIO-ED2 demand driven adjustment

5.3 In RIIO-ED2, we implemented a 'demand driven' post-modelling adjustment in our totex models. This was an intervention into RIIO-ED2 business plans forecasts to reflect our concerns that DNO forecasts of LCT uptake of EVs and HPs were excessively optimistic and potentially inconsistent across the sector. That represented a significant risk to customers that DNOs that submitted the most ambitious load plans and scenarios could receive inflated baseline allowances if the forecast level of LCT growth does not materialise.

5.4 To address this risk, our preferred option in RIIO-ED2 was to use a post-modelling adjustment approach to set a more conservative baseline allowance that flexes up using an uncertainty mechanisms (UMs) package for LRE. We calculated the adjustment separately for each of the three RIIO-ED2 totex models. It was based on the relative difference between DNO forecasts of LCT uptake in RIIO-ED2 business plans and the FES 2022 System Transformation forecast. It also used a benchmarking approach to normalise submitted volumes to derive an alternative forecast of the capacity released cost driver. We used the modelled relationship between RIIO-ED2 totex and the activity-based demand drivers. We applied this to an adjusted efficient view of the activity-based drivers consistent with the FES 2022 System Transformation scenario. That implemented a reduction to three relevant activity-based cost drivers:

- cumulative number of EVs;
- cumulative number of HPs; and

- capacity released.

5.5 Our initial assessment of early evidence of LCT take-up in RIIO-ED2 from the first two years in the price control period suggests that our intervention is broadly consistent with LCT take-up trends. Therefore, our current view is that our concerns regarding inflated forecasts of the pace of LCT take-up in RIIO-ED2 are partly materialising. Figure 4 and Figure 5 include the outturn number of EVs and HPs added for all DNOs in RIIO-ED2 compared to the FES 2022 System Transformation scenario and DNO forecasts submitted in response to RIIO-ED2 Draft Determinations up to 2025.

Figure 4: Cumulative number of EVs in RIIO-ED2 up to 2025

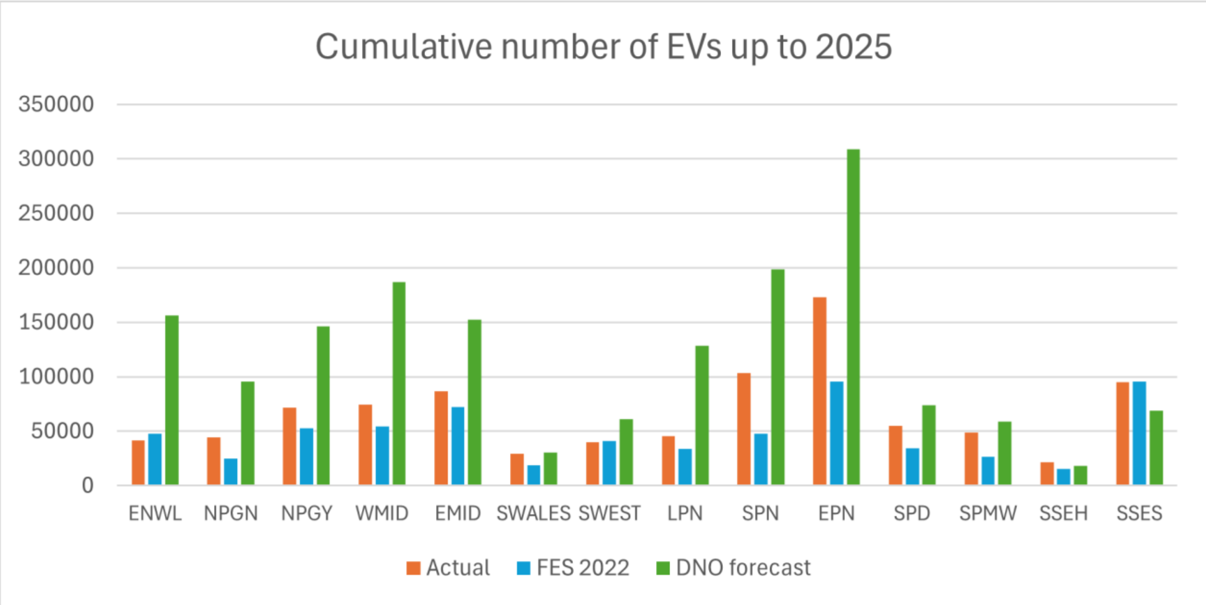
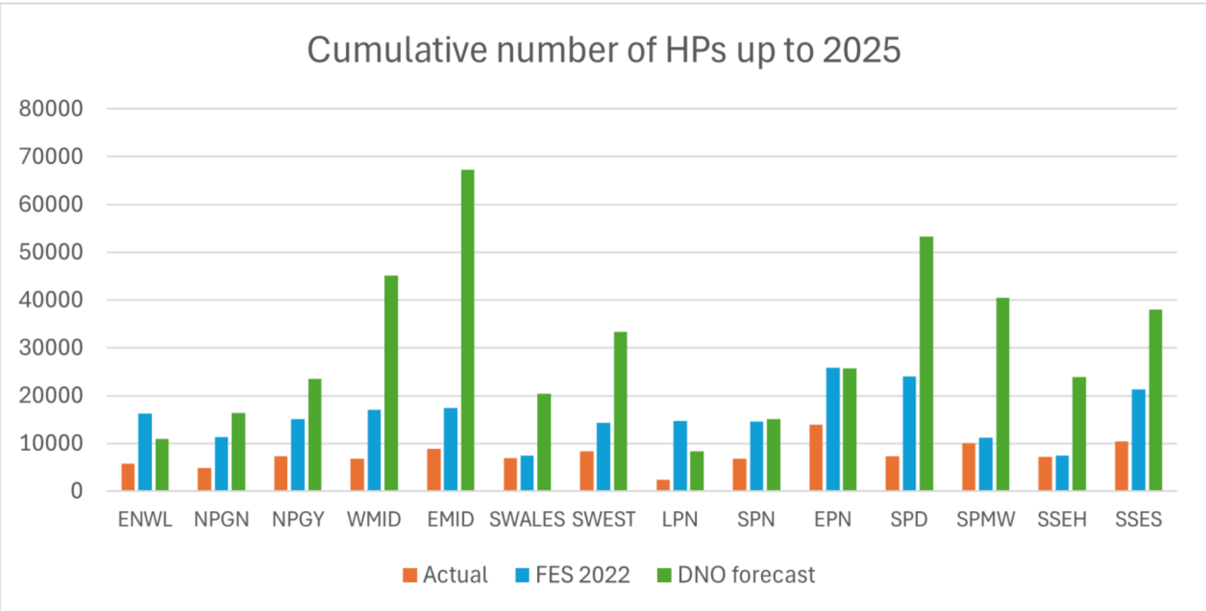


Figure 5: Cumulative number of HPs in RIIO-ED2 up to 2025



5.6 Particularly for HPs, there has been relatively limited uptake across the 14 DNO regions with even the 2022 System Transformation scenario representing an over forecast. This initial assessment reinforces the importance of our RIIO-ED2 intervention which protected customers while allowing DNO LRE allowances to vary with UMs as appropriate.

ED3 approach to scenarios

5.7 The ED3 price control period will be supported by a fundamentally different approach to scenario planning compared to RIIO-ED2. Future investment needs for the electricity distribution network will be informed by the NESO's transitional Regional Energy Strategic Plan (tRESP) to be published in early 2026 and a first RESP published in 2027. We consider that the tRESP will lead to a more planned approach to investment in ED3 and beyond which will also support comparability between ED3 business plans compared to RIIO-ED2. The tRESP will help achieve consistency in identifying investment needs by setting a common long-term pathway to reach net zero and common parameters to derive the capacity needs associated with LCTs.

5.8 In addition, NESO will support us in assessing the extent to which ED3 business plans are consistent with the tRESP requirements. Indeed, we had an initial discussion with one DNO presenting a proposal for BPDTs that collect tRESP data in BPDTWG2. This data can help us and NESO undertake this assessment to ensure ED3 business plans are consistent with the chosen pathway. The assessment is likely to help mitigate the LCT forecasting challenges we experienced in RIIO-ED2.

5.9 Therefore, we consider that the risks our RIIO-ED2 demand driven post-modelling adjustment was aiming to address are less relevant to ED3. LCT forecasts will be largely exogenous to the DNOs, reducing the risk to customers of over-forecasting LCT uptake leading to inflated ED3 baseline totex allowances. That is not to say there is no forecasting risk. The uncertainty on the pace of LCT take-up will remain an issue we need to consider in our ED3 regulatory framework. However, efficient ED3 totex allowances will be based on the best available NESO view of LCT take-up that is consistent with a net zero electricity distribution network by 2050. Overall, for the reasons set out above, our initial proposal is that we will not implement the demand driven post-modelling adjustment in ED3.

Disaggregation of allowances

5.10 A key step we have to undertake at the end of the ED3 cost assessment process is to disaggregate allowances into different cost categories. This is required to facilitate:

- input into the Price Control Financial Model (PCFM) – using bespoke PCFM categories;
- comparisons with outturn performance in ED annual reports – using the categories discussed in Chapter 4 (ie load, non-load, non-op capex, NOCs, CAIs, BSCs); and
- varying some cost allowances under volume drivers, PCDs and other price control mechanisms.

5.11 This disaggregation is not native to the overall benchmarking process and does not impact the level of efficient allowances. Since our approach in RIIO-ED2 included a combination of totex and disaggregated models, efficient allowances outputs match the underlying level of aggregation. This creates a need for a methodology on how to disaggregate allowances of the aggregate totex models to the disaggregated categories.

Disaggregation of allowances in recent energy price controls

5.12 In RIIO-ED2 Final Determinations, we used a combination of company submitted costs (50%) and the output of disaggregated models (50%) to disaggregate final efficient allowances. This reflected the fact that there are no readily available methodologies to disaggregate totex modelling outcomes into the very granular categories needed to complete the process.

5.13 The use of submitted cost shares was challenged by the sector in response to the RIIO-ED2 Draft Determinations due to the potential for misallocating costs across categories. This was driven by our demand driven post-modelling adjustment which effectively implemented a workload adjustment to the efficient modelled costs to scale them back to the FES 2022 System Transformation scenario for LCT uptake (see Post-modelling adjustments section). That meant that submitted DNO costs based on a higher LCT growth scenario might not reflect the implicit efficient level of LRE funded in RIIO-ED2 Final Determinations for the purposes of disaggregation.

5.14 After the RIIO-ED2 Final Determinations, the approach was formally challenged by Northern Powergrid (NPg) through the RIIO-ED2 CMA appeals process. NPg argued that our approach was erroneous because its submitted costs were based on decarbonisation planning scenarios that were 'manifestly different' from our System Transformation scenario used to set allowances.[21] The CMA upheld the appeal and referred the issue back to us for reconsideration and redetermination.[22] As a result, we implemented an updated proportion of 70% on the output of the disaggregated models and 30% on submitted costs to disaggregate NPg's RIIO-ED2 allowances.[23]

5.15 In GD, disaggregation of allowances generally follows the same high-level principles. For example, in our most recent RIIO-GD3 Draft Determinations, we used submitted Gas Distribution Networks (GDNs) proportions to split efficient RIIO-GD3 totex allowances. We note that we only use a totex modelling approach to set RIIO-GD3 totex allowances. Therefore, the triangulation approach between submitted and disaggregated allowances is not available in GD.

ED3 disaggregation of allowances

5.16 As extensively considered in RIIO-ED2, there is no single best way to disaggregate efficient allowances. The overarching principle is that we want the ED3 cost allowances per category to reflect the nature of our final ED3 modelling suite. So if we use a combination of totex, disaggregated models and mid models, our final allowances should utilise cost category split insights from all these modelling approaches. Using disaggregated shares only to set allowances is inconsistent with this high-level principle. Similarly, the same applies for any approach relying exclusively on totex modelling.

5.17 As we develop our ED3 cost assessment framework, we propose to reconsider the methodology for disaggregating efficient totex allowances. Our proposal not to apply a demand driven post-modelling adjustment (see Post-modelling adjustments section) directly impacts on our ED3 methodology. We consider that in the absence of this adjustment in ED3, our methodology to assign 50% triangulation weights on ED3 submitted costs and disaggregated allowances is likely to remain appropriate for ED3. This is to the extent that submitted shares are more likely to be similar to efficient allowances in the absence of an overarching post-modelling adjustment to impose a different pathway for LCT take-up.

[21] Competition and Markets Authority, Northern Powergrid (Northeast) Plc and Northern Powergrid (Yorkshire) Plc v Gas and Electricity Markets Authority, final report, September 2023, p. 45, paragraph 4.4.
[22] Competition and Markets Authority, Northern Powergrid (Northeast) Plc and Northern Powergrid (Yorkshire) Plc v Gas and Electricity Markets Authority, final report, September 2023, p. 122, paragraph 6.12.
[23] See Decision on the proposed modifications to the RIIO-ED2 Electricity Distribution standard and special licence conditions

5.18 However, we recognise that our objective to develop ED3 mid models is likely to add to the complexity of disaggregation. Taking this further, we are also actively considering the implications of a potentially more 'Plan & Deliver' approach to load / strategic investment projects for disaggregation of allowances. This might create the need to go further and establish discrete efficient allowances for separate projects / programmes that DNOs are then accountable to deliver. Where such projects are benchmarked as part of our wide suite of ED3 cost assessment models and not assessed separately, this is also likely to present new and different challenges for disaggregating allowances. Therefore, we welcome views how we can approach disaggregation of allowances in this context.

5.19 One alternative approach that we could consider for identifying cost category allowances in a totex framework is the use of the concept of 'implicit allowances'. This approach relies on the idea that we can estimate the implicit efficient costs funded for a cost category by excluding it from the scope of the dependent variable in the totex model (normalised totex) and comparing to the model with full scope. Since the excluded category is the only difference between the two models, any difference in the modelled allowance is considered the implicit allowance. This is an approach that is well established in the water sector where Ofwat uses it to assess implicit allowances for factors for which water companies request cost adjustment claims.[24] We presented a stylised version of the process of calculating implicit allowances in CAWG5.[25]

5.20 The first step in this process is to:

- run the totex suite with no exclusions to get an efficient triangulated totex allowance;
- run the totex suite excluding the category for which we want to calculate the implicit allowance (eg category X); and
- subtract the allowance with exclusions from the full allowance to get the implicit allowance for category X.

5.21 This process needs to be repeated for as many categories as needed to facilitate our ED3 disaggregation needs (x, y, z, … , n). However, due to the modelling approach taken to estimate implicit allowances, they might not exactly sum up to triangulated totex. Therefore, an additional step is to divide the efficient triangulated totex allowance by the sum of the implicit allowances to get a

[24] See 9.-PR24-final-determinations-Expenditure-allowances.pdf (section 2.2)
[25] See RIIO Engagement Portal - Documents - CAWG05 - All Documents

reconciliation factor. This reconciliation factor can correct for the potential mismatch and ensures that final triangulated allowances match the sum of implicit allowances. The last step is to multiply each implicit allowance per cost category with the reconciliation factor.

5.22 In summary, the implicit allowances approach can provide insights into the cost category allowances funded by our ED3 totex models which are not otherwise readily available. That could provide an alternative way to factor in a totex modelling approach in our methodology for disaggregating allowances. As a minimum, it could be used to sense check the RIIO-ED2 methodology and / or provide an alternative estimate we could consider.

5.23 However, the approach does bring an additional complexity and administrative burden associated with running a set of alternative models for all cost categories into which we want to break down modelled costs. In addition, by construction, it is informed by a totex modelling approach. That is associated with a level of modelling outcome uncertainty that we need to trade off against the benefits set out above. We are also cognisant of the close interaction of the disaggregation of allowances with the wider ED3 regulatory framework and in particular volume drivers and PCDs. This may create a risk of cherry picking and a lack of transparency late in the ED3 price review process due to the underlying complexity of the modelling technique. We welcome views whether implicit allowances can provide an alternative tool for disaggregation of allowances that we should add to our ED3 cost assessment toolkit.

Triangulation

5.24 Triangulation between our different modelling approaches is an important part of our ED3 cost assessment toolkit. It involves assigning a weight to different approaches when determining efficient ED3 totex allowances. As explained earlier in the document, we propose to use different modelling approaches (totex, disaggregated and mid). In addition, we propose to use a suite of models within each modelling approach for totex and mid models. That creates a need to set out some principles of how we will establish the weights assigned to each approach.

5.25 The overarching principle we propose to follow when triangulating is to set equal weights to all models and modelling approaches unless there is a strong economic and engineering rationale not to do so. Any more sophisticated approaches are unlikely to improve on this approach as they would involve significant regulatory judgement that may worsen modelling outcomes.

5.26 That is a well-established approach in GB economic regulation. In RIIO-ED2, we used equal weights for the totex and disaggregated modelling approaches. We also assigned equal weights to the three totex models we used. In PR24, Ofwat generally assigned equal weights to models at a different level of granularity.[26]

5.27 For the different modelling approaches, the principle of assigning equal weights means we recognise the advantages and disadvantages set out in Chapters 2-4. However, our assessment of triangulation options across our proposed ED3 modelling approaches needs to go further. We consider that our proposed mid models are disaggregated in nature and remain a 'bottom-up' view of efficiency. They are just calibrated using more aggregated cost categories to help us explore additional cost efficiency insights. Therefore, we propose to maintain our RIIO-ED2 approach and assign a weight of 50% on totex models and 50% on disaggregated and mid models (with a 25% weight on each).

5.28 When triangulating across ED3 models within our totex and mid model suites, we propose to assign equal weight to each model we use. We propose to set a high bar for departing from this approach. Provided the model is considered fit to add to our modelling suite after undertaking an assessment against our model selection criteria (see Model selection criteria section in Chapter 2), we propose to assign an equal weight to it as to other models in the suite.

Efficiency challenges and the ratchet

Efficiency challenges

5.29 We set efficiency challenges when determining the efficient cost of electricity distribution services. In RIIO-ED2, we set the efficiency challenge using several steps. First, we challenged DNOs with an average benchmark (in the totex models) and a median benchmark (in the disaggregated models). Second, we assigned a catch-up efficiency challenge that challenges lagging DNOs with an efficient benchmark of the electricity distribution sector. The efficient company was set at the 75th percentile with a glide path approach to the 85th percentile over the first three years of RIIO-ED2. Third, we set an ongoing efficiency challenge which even the most efficient DNOs should achieve that considers external productivity improvements across the GB economy (see Chapter 7 for an overview of our proposed approach to the ED3 ongoing efficiency challenge).

5.30 Our starting point in ED3 is that we will continue to set a catch-up efficiency challenge to the modelling outcomes from the ED3 cost assessment modelling

[26] See PR24-final-determinations-Expenditure-allowances-Base-cost-modelling-decision-appendix.pdf (sections 3.4.1, 4.4.1, 5.4 and 6.4.1)

suite to challenge the efficiency of ED3 business plans. Therefore, the level of the catch-up efficiency challenge is a key tool in our ED3 toolkit approach. The setting of an appropriate catch-up efficiency challenge is informed by regulatory precedent, the unique challenges of each sector subject to economic regulation and model robustness.

5.31 In RIIO-GD2 and RIIO-GD3 Draft Determinations, we used the 75th percentile with a glide path to the 85th percentile over three years as the catch-up efficiency challenge. Ofwat set the efficiency challenge at the 75th percentile in PR24 for base expenditure allowances.[27] It set a more stringent efficiency challenge to base expenditure in PR19 at the third company for wastewater (out of 10 companies) and the fourth for water (out of 17 companies).[28] This catch-up efficiency was incrementally higher than a 75th percentile benchmark. However, the CMA reduced the level of the PR19 catch-up efficiency challenge for appealing water companies to the 75th percentile.[29] In the PR24 enhancement models, Ofwat generally set a median benchmark (when using forecast data) or did not impose an additional catch-up efficiency challenge when using historical and forecast data.[30] Ofwat said that this reduced challenge was due to:

- the novelty of the scheme level enhancement modelling approach compared to company level modelling in PR19;
- the quality of the models; and
- more broadly the challenge for delivery and efficiency associated with the large size of the overall enhancement programme for the industry.

5.32 Overall, recent price controls provide a good starting point for the catch-up efficiency challenge we should consider in our ED3 models. Our starting point is that we will retain the RIIO-ED2 approach to use the 75th percentile with a glide path to the 85th percentile over three years as the basis for the catch-up efficiency challenge. However, we welcome evidence from stakeholders how the growth phase for the sector to facilitate net zero by 2050 might warrant a different approach.

[27] See 9.-PR24-final-determinations-Expenditure-allowances.pdf (section 2.1.3)
[28] See PR19-final-determinations-Securing-cost-efficiency-technical-appendix.pdf (section 3.1.9)
[29] Competition and Markets Authority, 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, final report', March 2021, para 4.495.
[30] See PR24-final-determinations-Expenditure-allowances-Enhancement-cost-modelling-appendix.pdf

5.33 In assessing alternative approaches, we will consider a range of tools in our ED3 cost assessment toolkit that drive the overall level of efficiency challenge for the sector (implicitly or explicitly) including:

- the use of time trends (see Time trends section in Chapter 2);
- the balance between historical and forecast data (see Sample size section in Chapter 2);
- our approach to ongoing efficiency (see Ongoing efficiency section in Chapter 7); and
- our approach to implement workload adjustments following our engineering assessment (see Cost and workload adjustments section in Chapter 6 and Chapter 8 on engineering assessment).

The ratchet

5.34 A related issue when considering our efficiency challenges is our approach to ratcheting efficient allowances. In a regulatory context, the ratchet is the process of imposing a 'min of' between DNO forecasts in ED business plans and our final efficiency benchmarks. That is, when DNO forecasts are below our independent view of efficient expenditure, we use the DNO forecast to set efficient allowances.

5.35 The application of a ratchet implicitly reflects our overarching regulatory objective to leverage DNOs' superior information when setting efficient allowances to deliver electricity distribution services. Where frontier-efficient DNOs identify efficiencies that our benchmarking models have not fully captured, the ratchet acts to return these to customers when setting efficient cost allowances. That also means that by construction, no DNO can be given a higher totex allowance than it has asked for.

5.36 However, the application of a ratchet has important incentive properties for DNOs that we need to consider. If DNOs anticipate being more efficient than our benchmarks, their incentive to reveal efficient costs might be reduced due to the ratchet. This is because the entirety of the efficiency they demonstrate in business plans is reflected in efficient allowances. As a result, the ratchet could potentially be inconsistent with another important regulatory objective - to encourage efficient and ambitious business plans that drive the rest of the sector forward and lead to improvements for customers. Indeed, we use incentives elsewhere in the regulatory framework such as the BPI to encourage high quality business plan submissions.

5.37 In RIIO-ED2, we applied ratchets at two levels in our modelling approach:

- across some of our disaggregated models when determining efficient allowances using the disaggregated modelling suite; and
- after triangulating between our totex and disaggregated models and applying the catch-up efficiency challenge.

5.38 Especially where the efficiency scores / unit cost range in our models is relatively wide (such as in some of our RIIO-ED2 disaggregated models), the ratchet carries a higher risk of impacting DNO incentives to reveal efficient costs. That can potentially drive perverse incentives and might be inconsistent with our intended regulatory objectives when using ratchets as stated above.

5.39 We propose to carefully consider the incentive properties of applying ratchets in our ED3 cost assessment modelling suite and the interaction with the BPI. For example, we will consider whether removing some or all ratchets is appropriate to help promote stronger incentives for DNOs to submit high-quality and efficient ED3 business plans. We would also consider whether amending our RIIO-ED2 ratcheting approach could act as an alternative to stage B of the BPI that assesses efficient cost (see Chapter 8 in ED3 SSMC for more detail on our proposed approach to the BPI in ED3). More broadly, we welcome stakeholder views on the application and design of ratchets in our ED3 cost assessment modelling suite.

Consultation questions

CAQ25. Do you agree with our proposal not to apply a demand driven post-modelling adjustment in ED3?

CAQ26. Do you have any proposals how we can improve the RIIO-ED2 methodology for disaggregation of allowances to consider for ED3?

CAQ27. Do you agree with our proposal to explore implicit allowances as an alternative approach to disaggregate efficient ED3 cost allowances?

CAQ28. Do you agree with our proposed ED3 triangulation principles?

CAQ29. Do you agree with our proposed approach to retain the RIIO-ED2 catch-up efficiency challenge of 75th percentile with a glide path to the 85th percentile over three years for ED3?

CAQ30. Do you agree with our proposal to inform our final decision on the ED3 catch-up efficiency challenge by considering the overall level of efficiency challenge for the sector?

CAQ31. Do you agree with our proposal to consider the design of the ratchets we apply in our ED3 modelling suite?

CAQ32. Do you agree with our proposal to consider the interaction between ratchets and stage B of the BPI in ED3?

6. Regional and company-specific factors

Introduction

6.1 As part of our RIIO-ED2 cost assessment process, we undertook a process we refer to as normalisation. We apply a range of pre-modelling adjustments that help to ensure that costs can be compared on a like-for-like basis across DNOs. These adjustments also include exclusions based on our engineering and technical assessments that remove or reduce costs where we assessed that the case for underlying workloads has not been well evidenced.

6.2 In previous ED price controls, we have applied five categories of factors that we adjust for to help normalise DNOs' costs:

- **Regional factors** – these are exogenous factors that result in higher costs in a particular part of GB.
- **Company-specific factors** – these are factors that capture unique characteristics of a particular network that result in materially higher costs for the affected DNO.
- **Exclusions** – these are costs that are excluded from our benchmarking because they:
  - are only incurred by a small number of DNOs;
  - are not explained by the cost drivers used in our cost models; and
  - reflect substantial changes in the nature of costs compared to previous price control periods.
- **Cost and workload adjustments** – these costs are removed or adjusted in our benchmarking following a technical or engineering review as the needs case for the underlying workloads has not been well evidenced.
- **Other adjustments** – these are factors applied to costs that are reclassified from one activity to another, or are reclassified from other reporting such as memo tables, have accepted updates, or relate to work that we have decided to separately assess.

6.3 To apply these adjustments, we carry out three key steps:

- select the criteria that identify the factors that can drive the efficient level of costs to vary in some regions and companies, and for exclusions;
- decide on the methodology to adjust costs for these factors / exclusions; and
- decide at what stage of the modelling to implement the adjustments - pre-modelling, within-modelling or post-modelling.

6.4 In the rest of this chapter, we consider each key step in further detail. In doing so, we set out a summary and assessment of approaches taken in ED and GD in recent price controls.

Selection criteria for factors

6.5 For RIIO-ED1, we focused on identifying regional and company-specific factors. We took the view that adjustments should only apply if DNOs could satisfy two criteria:

- That such an adjustment is justifiable, demonstrated by robust and transparent factors; and
- The DNO had managed those factors appropriately.

6.6 Similarly, in RIIO-GD1, we placed the onus on GDNs to justify their case for any proposed adjustments in line with the criteria above. In addition, we identified that there were two further distinctions for company-specific factors, relating to:

- Adjusting historical data to ensure comparability in benchmarking; and
- Forecast expenditure that should be assessed outside of the standard benchmarking model to ensure comparability.

6.7 For RIIO-ED2, where the focus was on regional and company-specific factors, we maintained that the onus was on DNOs to justify the case for any proposed adjustments. We applied a high evidential bar for accepting any cost adjustment claims and only considered adjustments where the following criteria were satisfied:

- the regional or company-specific factor in question was clearly defined;
- the factor, and the subsequent costs it drives, are beyond the control of an efficient company (having taken all the feasible measures to mitigate the costs); and
- the company (or a small number of companies) are impacted by a significant amount, and in a materially different way to others.

6.8 We applied cost exclusions where some costs were not explained by the cost drivers used, or there was a substantial change in the nature of the activity being undertaken. However, we took a consolidated approach in RIIO-GD2 to apply a set of questioning criteria to assess company-specific factors:

- Is the claim material in nature?
- Is the claim unique in nature?
- Is the claim outside the control of a company?

- Is the claim excluded from the cost drivers used in our econometric modelling?
- Is the claim excluded from our other adjustments, such as regional factors?

6.9 For RIIO-3, we have largely maintained the criteria used in RIIO-GD2. For ED3, we propose to maintain the RIIO-2 approach and to consolidate the criteria used across price controls. We will continue to set a high evidential bar for the acceptance of regional and company-specific factors. We maintain the position that the onus remains on DNOs to justify, through robust and transparent evidence a regional or company-specific adjustment is required.

6.10 In terms of setting the materiality threshold, we will consider regulatory precedent for regional and company-specific factors, as well as the alignment with RIIO-3 thresholds. This includes applying a materiality threshold of 0.5% of a DNO's gross unnormalised totex for company-specific factors.

Methodology for applying adjustments

Regional factors

6.11 In previous price control determinations, the regional factors that we have adjusted for were the relative cost of labour in different regions, urbanity and sparsity. We applied these adjustments to the cost data submitted by DNOs through their BPDTs before undertaking our cost assessment (ie pre-modelling adjustments). For each factor we have previously considered the following:

- **Regional labour adjustments** - we considered that differing levels of labour costs can influence the efficient cost for DNOs operating in different regions of GB. The degree to which the variance in labour costs influences costs will depend on a number of factors such as the magnitude of structural differences in labour costs across regions. For RIIO-ED2, we used ONS ASHE data at the 2-digit Standard Occupational Classification (SOC) level to construct and forecast regional cost indices equal to their five-year historical average. We then applied these indices as regional labour cost adjustments that normalised labour costs across all DNOs. We applied a three-region approach, with each DNO assigned to one of three regions: London, the South-East and elsewhere. We used notional (ie industry average) occupational weightings when applying the regional labour adjustment to individual activity areas.
- **Urbanity adjustments** – we considered that there may be additional costs incurred by DNOs that are solely driven by operating in urban areas. Whilst we did not adjust for this factor in RIIO-ED2, urbanity was accounted for in

RIIO-GD2 and RIIO-GD3 Draft Determinations by applying a London urbanity productivity factor that represented the lower productivity associated with working in the London area. This adjustment was applied to emergency, reinforcement, connections and repex costs. Additionally, we applied an adjustment to account for the reinstatement costs associated with working in highly dense urban areas. We treated these costs as labour costs and adjusted them for particular opex activities based on the indices used to make regional labour adjustments.

- **Sparsity adjustments** – in a similar approach to urbanity adjustments, we considered that there may be additional emergency and repair costs for DNOs that have sparsely populated areas. These adjustments compensate for reduced labour productivity associated with additional travel time. We did not apply sparsity adjustments in RIIO-ED2. However, for RIIO-GD2 and RIIO-GD3 Draft Determinations sparsity adjustments were made by constructing sparsity indices that were then applied to cost data based on their relative level of sparsity compared to the national average.

6.12 As a starting point, we propose to maintain the methodological approaches taken in RIIO-ED2 to account for the factors that have historically been identified as above. However, we welcome views on alternative methodological approaches and choices in accounting for these factors.

6.13 Where new factors are identified and submitted, we will require well evidenced submissions to consider accounting for them. We will work with stakeholders to develop a new methodological approach where appropriate using the CAWG and BPDTWG.

6.14 More broadly, we note that pre-modelling regional adjustments can introduce significant modelling complexity in our RIIO-ED2 cost assessment modelling suite. They could also risk biasing and / or worsening the performance of our ED3 cost assessment modelling suite when not calibrated appropriately. Therefore, we propose to assess the case for considering urbanity and sparsity adjustments and the continued appropriateness of applying the regional labour adjustment in ED3.

Company-specific factors

6.15 In RIIO-ED2, we accounted for company-specific factors by excluding costs that are company-specific prior to undertaking our ED3 cost assessment (ie at the pre-modelling stage). Our approach also included an assessment whether the full DNO claim in RIIO-ED2 business plans should be excluded or whether we should provide a partial allowance. This depends on our assessment of whether the DNO has provided a well evidenced case for an adjustment.

6.16 We propose to rely on the criteria set out above to assess DNO company-specific factors on a case-by-case basis. In previous price controls, we maintained a high evidential bar for company-specific factors and placed the onus on DNOs to provide the relevant evidence.

6.17 In RIIO-ED2, we provided efficient allowances for a total of five company-specific factor adjustments. We fully accepted only one claim in RIIO-ED2 from SP Manweb (SPMW). The rest of the claims were accepted on a partial basis. These factors related to:

- the unique nature of the streets in London (LPN);
- the disproportionate costs associated with operating in and around London (LPN & South Eastern Power Networks (SPN));
- the unique configuration of one company's meshed network (SPMW); and
- the costs associated with operating and maintaining subsea cable fleet (SSEH).

6.18 We rejected eight company-specific factor claims as they did not meet the materiality threshold or were not well evidenced.

6.19 We propose to maintain the high evidential bar in line with the criteria set for RIIO-2 when assessing ED3 company-specific factors. Similar to regional adjustments, company-specific factors applied pre-modelling impact on our ED3 cost modelling suite. A potential proliferation of company-specific factors can risk undermining our ED3 cost models. DNOs face a unique mix of regional characteristics with competing cost impacts that increase and decrease costs. The company-specific factor pre-modelling adjustment process risks to be one-sided in identifying factors that increase but not factors that decrease efficient costs. Therefore, we consider that maintaining a high bar when assessing evidence of additional ED3 cost factors remains appropriate for ED3. We also propose to retain a materiality threshold of 0.5% of gross unnormalised totex for us to consider company-specific factors.

Exclusions

6.20 In RIIO-ED2, we considered that costs should be included in our totex modelling suite whenever possible in order not to weaken the benefits of benchmarking. Therefore, costs should only be excluded when there is a strong rationale for doing so and the issues cannot be addressed through other benchmarking choices. We adopted the criteria set out in the Introduction section of this chapter to assess whether cost categories should be excluded from our RIIO-ED2 modelling suite.

6.21 In their RIIO-ED2 business plan submissions, several DNOs proposed further cost exclusions. We rejected several of these claims based on our assessment against the above criteria.

6.22 We undertook an assessment of projects that were bespoke or require further technical assessment to determine if they satisfy our criteria for exclusion. As a result, we excluded the following categories at the normalisation stage as a pre-modelling adjustment:

- cyber;
- quality of service (QoS);
- streetworks;
- rising and lateral mains (RLMs);
- worst served customers (WSCs); and
- physical security.

6.23 We propose to maintain this approach in ED3. For completeness, our proposed criteria for exclusions in ED3 are as follows:

- cost is only incurred by a small number of DNOs;
- cost is not explained by the cost drivers we use in the models; and
- cost substantially changed in nature between RIIO-ED2 and ED3.

6.24 At this early stage of the process, we do not consider that there is a strong case for any further exclusions. We note that one DNO stakeholder explored the scope for excluding LRE in CAWG1.[31] This issue was considered further in DNO presentations in CAWG3.[32] Although load is likely to substantially change in nature between RIIO-ED2 and ED3, excluding such a substantial and growing cost category will significantly impact the ED3 totex models. This can reduce the key advantages we set out in Chapter 2 around providing an estimate of total resource use. Therefore, we propose not to consider this option in ED3. More broadly, we will retain a high bar for pre-modelling exclusions for the same reasons.

[31] See RIIO Engagement Portal - Documents - CAWG01 - All Documents
[32] See RIIO Engagement Portal - Documents - CAWG03 - All Documents

Cost and workload adjustments

6.25 We implement workload adjustments to adjust the scope of activity in ED business plans where the scope is not sufficiently justified. These adjustments are informed by the engineering assessments that our engineering and technology directorate undertakes (see Chapter 8 for an overview). In summary, we set out a requirement for companies to submit Investment Decision Packs (IDPs) comprising Engineering Justification papers (EJPs) and CBAs. We use the evidence provided in these papers and wider business plan evidence to inform potential workload adjustments where DNOs have not sufficiently justified the need for investment. This process usually focuses on capex investments in the load and non-load categories.

6.26 In RIIO-ED2, we applied workload adjustments in the disaggregated modelling suite. We did not apply workload adjustments in our totex models other than the demand driven post-modelling adjustment (see Post-modelling adjustments section in Chapter 5). This approach was partly driven by the implementation difficulty of applying workload adjustment in totex models without a suitable workload cost driver. We recognise that our demand driven post-modelling adjustment did implement an adjustment to ensure the efficient scope of investment given our preferred LCT take-up forecasts scenario (FES 2022 System Transformation). However, it did so using a different approach that is not as targeted and not fully informed by RIIO-ED2 engineering assessments. In any case, as explained above, our proposal is not to implement the demand driven post-modelling adjustment in ED3.

6.27 We want to improve our approach in ED3 by implementing a more consistent approach in relation to workload adjustments across our ED3 cost assessment modelling suite. There is a single scope of efficient ED3 activity that will be determined by our engineering assessment of ED3 business plans. That is, DNOs will include in their business plans how their proposed scope best captures the challenges faced in their regions. We will then undertake our engineering assessment (see Chapter 8) which might amend this scope (ie implement workload adjustments) based on the evidence provided in the IDPs.

6.28 In RIIO-ED2, this assessment of efficient scope was not reflected in our totex modelling approach. However, we consider that there is no intrinsic reason for our approach not to apply workload adjustments in totex models other than the implementation difficulties to derive a workload driver as highlighted above. Therefore, our overarching objective for ED3 is for all proposed modelling approaches (totex, disaggregated and mid) to provide efficient allowances on a consistent basis where possible.

6.29 Particularly in the context of increasing ED3 investment requirements on the path to net zero, there is a correspondingly increasing need for our engineering assessments to result in recommendations for workload adjustments. This can help to protect customers from paying for investments that do not pass a needs case assessment, adequately meet the needs case, or where the proposed workload is not sufficiently justified.

6.30 Applying workload adjustments in totex models has regulatory precedent from RIIO-GD2 and RIIO-GD3 Draft Determinations. Even though we applied a totex modelling approach only for these determinations, we did apply workload adjustments to remove costs for activities that were not well justified. That was supported by having a workload driver in the models capturing the overall level of activity. We used this to remove inefficient volumes of activity and the associated submitted costs as a pre-modelling adjustment. We also made pre-modelling adjustments to remove capex activities that do not have an associated workload driver. In these cases, they were represented by MEAV as a scale driver.

6.31 In the water sector setting in England and Wales, the preferred scope of enhancement activity is largely statutory. It is prepared by regulators including the Environment Agency and the Drinking Water Inspectorate. This is supported by a strategic direction from the Department for the Environment, Food and Rural Affairs (Defra) which can introduce statutory duties adding additional scope to enhancement programmes. As a result, Ofwat does not actively need to consider scope for most of the enhancement programme which is statutory. This is because the decision whether and how to invest to enhance the level of service is outside of the management control of water companies. This limits the risk of inefficient scope given the extensive consultation process to agree the final scope of the enhancement programmes which fully considers the need (eg to improve the environment or improve drinking water quality).

6.32 We consider that the MEAV additions cost driver can help us implement more targeted workload adjustments that are consistent across our ED3 totex, disaggregated and mid models (see Longlist of alternative cost drivers for ED3 section in Chapter 2). Since this cost driver captures an aggregate summary of DNO investment programmes, it can control for the underlying level of activity (or workload) DNOs propose to undertake across asset classes. That would allow us to directly implement workload adjustments where our engineering assessment concludes there is an inefficient level of activity.

6.33 We want to emphasise that engineering assessments do not need to result in any workload adjustments. Where DNOs submit high-quality evidence to support their investments in their ED3 business plans across IDP submissions, BPDT data and relevant narrative, we are unlikely to implement any workload adjustments. Or we might challenge and seek more evidence in ED3 Draft Determinations only to receive sufficient evidence to support the needs cases. However, workload adjustments remain an important tool in our ED3 cost assessment toolkit to provide strong incentives for DNOs to provide high-quality evidence and if not, to protect customers by removing inefficient scope where ED3 business plans include investments with an unclear needs case.

6.34 We discussed our proposed approach in CAWG7.[33] This engagement identified some of the challenges to implement workload adjustments following our engineering assessment. DNO stakeholders also sought detail on how workload adjustments could work in practice.

6.35 We recognise that we need to develop our approach in this area further. We will engage with stakeholders, especially DNOs via CAWG and BPDTWG to refine our approach prior to SSMD publication in Spring 2026. At the request of DNOs, we have organised another CAWG (CAWG9 - 'ED3 Engineering assessment follow-up'). This will give an opportunity for DNOs to propose approaches that we should consider, having reviewed the principles and our emerging approach as set out in this chapter and Chapter 8.

Other adjustments

6.36 For RIIO-ED2, we applied two types of additional adjustments to the submitted cost data by DNOs:

- Reallocations between cost activities, where we viewed a cost to be reported in the incorrect activity and required it to be reallocated for consistency in benchmarking.
- Reallocations of costs that have been reported in BPDT memo tables instead of BPDT activity tables, where we viewed the costs to be part of the DNO’s Business Plan scenario and required it to be reallocated for consistency in benchmarking.

[33] See RIIO Engagement Portal - Documents - CAWG07 - All Documents

6.37 We propose to work closely with DNOs to develop the BPDTs in ED3 (see Chapter 9 for a wider discussion of our proposed BPDT process). Therefore, our objective is to limit the need for any adjustments based on incorrect allocations or reporting. This will be supported by ongoing engagement with the sector via CAWG and BPDTWG, leading to potential improvements to ED3 BPDTs and associated guidance. However, we propose to maintain the flexibility in our ED3 cost assessment modelling suite to adjust data to ensure correct allocation and formatting in ED3 submissions.

Application of adjustments

6.38 In previous price controls, we have primarily applied regional and company-specific factors, as well as exclusions and other adjustments at a pre-modelling stage. However, some of these adjustments can also theoretically be applied at the within model and post-modelling stages.

6.39 We propose to explore the application of the adjustments at different stages of the modelling process and to consider the impact on our cost benchmarking outcomes. However, we note that our approach to pre-modelling adjustments is well established across ED and GD. We propose to consider changing our approach where we find that applying adjustments at a different stage improves our benchmarking outcomes or where we receive well evidenced proposals to support an alternative approach.

6.40 We consider some potential advantages and disadvantages of applying the adjustments at the different modelling stages. The key advantage of the pre-modelling application is that this approach allows adjustments to be reversed within our modelling framework. For example, regional and company-specific factors can affect the accuracy of the modelling. Therefore, by removing these pre-modelling it provides a clearer monetary effect that can be related back to specific company activities.

6.41 The disadvantage of this approach is that the removal of costs pre-modelling can potentially reduce incentives for DNOs to mitigate them. Instead of actively focusing on how to efficiently manage their company-specific factors, DNOs might focus on making the case for why costs should be excluded from benchmarking with the assessment of the size of the factor reflecting an inefficient 'do nothing' approach. The pre-modelling application can also be sensitive to poor input data that informs the adjustment which affects wider modelling outcomes.

6.42 The within-modelling approach allows the use of cost drivers (see Chapter 2) to directly control for factors such as density, sparsity and regional factors. This increases the transparency of the modelling and potentially reduces the risks associated with the methodological choices and assumptions we make to adjust for these factors. The disadvantage of this approach is that it can be difficult to derive appropriate aggregated cost drivers that capture these regional characteristics. In addition, they are not as targeted in capturing specific activities that impact DNO efficient cost.

6.43 The post-modelling approach allows the use of unadjusted data. This allows the data to 'speak for itself' and can improve the transparency of the modelling. However, a key disadvantage of this approach is that it could incentivise the DNOs to use the post-modelling adjustment process as a ‘one-way’ bet to attain higher allowances. Applying cost adjustments post-modelling can risk the process becoming one-sided with DNOs claiming for upward-only cost adjustments. This is different to the established pre-modelling adjustments process where the exclusion of company-specific factors at the normalisation stage reduces efficient modelled costs for all DNOs. The partial or fully accepted company-specific factors are then added back in only for DNOs that have submitted such claims. In addition, the lack of normalisation could in theory affect the quality of our ED3 totex models if a material factor affecting costs is not corrected for pre-modelling.

6.44 We consider that using a within-modelling approach can potentially improve the robustness of our ED3 cost assessment approach. It can control for unique DNO characteristics that impact on efficient ED3 costs by directly controlling for the relevant factor in our ED3 cost models. This can capture any cost variation across DNOs and improve modelling outcomes without creating the potential for perverse incentives associated with pre-and post-modelling approaches as set out above. It also has the potential to simplify the modelling process significantly as it removes the need for collecting additional data and the disproportionately burdensome application of the adjustments in our ED3 cost assessment modelling suite.

6.45 However, in practice, a within-modelling approach is unlikely to be appropriate for all factors. For example, company-specific factors might be difficult to capture in the modelling stage as by definition they capture unique characteristics materially affecting one or a limited number of DNOs. This is likely to make it more difficult to capture a statistically significant impact within modelling even if we can derive an appropriate cost driver.

6.46 We consider that the application of regional adjustments as pre-modelling adjustments may not be appropriate for ED3 if we can develop new ED3 totex models using some of the alternative cost drivers set out in Chapter 2 (see Longlist of alternative cost drivers for ED3 section). For example, including our proposed WAD cost drivers (WAD MSOA / IA and WAD LAD from MSOA / IA) in our ED3 totex models can better capture the impact of regional wages, density and sparsity on the efficient cost of electricity distribution services. Our WAD measures directly capture WAD of the 14 DNO regions, allowing our models to control for density and sparsity regional factors within models. In addition, regional wages tend to be highly positively correlated with density (dense regions have higher wages on average). Therefore, we consider that calibrating our ED3 totex modelling suite using our two proposed WAD measures can potentially remove the need for any pre-modelling regional adjustments. We welcome stakeholder views on this issue which we will consider in ED3 model development.

Consultation questions

CAQ33. Do you agree with our proposed ED3 criteria for normalisation?

CAQ34. Do you agree with our proposed ED3 methodology for each factor?

CAQ35. Do you have any views on the stage at which we should apply the adjustments for each factor (where applicable)?

7. Real price effects and ongoing efficiency

Real price effects (RPEs)

7.1 We index efficient RIIO-ED2 totex allowances to our preferred general inflation measure of CPIH. This means that totex allowances grow in line with CPIH during the price control period. We refer to differences between input prices and CPIH as RPEs. We use RPE allowances to manage these differences through the price control period.

RPEs methodology in past price control periods

7.2 In RIIO-1, we set ex-ante allowances for RPEs across all sectors (T1, GD1 and ED1).[34] The ex-ante approach was based on forecasts of the input price variations at Final Determinations. We calculated RPEs for different cost categories including labour, materials, plant and equipment, transport and other. We used a notional cost structure to weight the cost categories when combining the different indices.

7.3 In applying the ex-ante approach for RIIO-ED1, we found that there was a change in the trajectory of input prices indices in the aggregate since 2010-11, and 2004-05. This caused the RPE index to materially diverge from the long run average real growth rate. From 2003-04 to 2007-08, we found that the real growth rate had increased, whereas from 2008-09, the real growth rate started to decline. This made it difficult to anticipate if, and when, the RPE would return to a positive rate, as well as what level the growth would be. This led to an increased level of uncertainty in the forecasts of the RPE allowance and casted doubt over the use of an ex-ante forecast for an eight-year control period.[35]

7.4 We commissioned a review of the RIIO-1 framework in 2018. Our findings were that RPEs were likely to have been a source of material added returns for T1 and GD1 operators. This likely resulted in windfall gains for network companies that were not a result of operators' actions.[36]

7.5 In RIIO-ED2, we set an RPE allowance using an indexation approach. This approach aimed to address our concerns around the scope for windfall gains or losses in the context of RPE forecasting uncertainty. Whilst this approach used a similar notional structure and the same indices to forecast an RPE index as the ex-ante approach, we introduced a new annual 'true-up' mechanism. This

[34] At the time of the RIIO-ED1 price control, ED totex allowances were indexed using the Retail Price Index (RPI).
[35] See RIIO-ED1: Draft determinations for the slow-track electricity distribution companies Overview, paragraph 4.24.
[36] See CEPA Review of RIIO Framework and RIIO-1 Performance, section 4.5.

allowed us to make RPE adjustments annually based on outturn differences between CPIH and the RPE index for each input cost category.

7.6 The annual reconciliation of allowances helped to reduce the final true-up at the end of the price control period. We also introduced a high materiality threshold to focus the assessment of RPEs on significant and robust claims. This resulted in the cost categories of Labour and Materials passing the materiality threshold.

7.7 In RIIO-3 Draft Determinations, we have broadly maintained the key elements of the RIIO-2 RPE indexation approach. Network operators submitted additional indices in RIIO-3 business plans. We have proposed to accept some of the additional indices, whilst rejecting others based on a set of criteria. We used the same criteria to inform index selection in RIIO-ED2.[37] In addition, in applying the materiality threshold used for RIIO-2, we included the plant and equipment category which passed the materiality threshold for National Grid Electricity Transmission operator.[38]

Drivers of change

7.8 Given the scale and pace of investment required to reach net zero by 2050, we recognise that ED3 differs from previous ED price controls. This in relation to the scope of the programme and the associated delivery risks. The RPE mechanism is fundamentally an uncertainty mechanism that balances risk between DNOs and customers. However, we do not consider that the RPE mechanism is a cost-pass through for input price pressures within DNO management control.

7.9 As a starting point for ED3, we are maintaining the RPE indexation approach from RIIO-ED2. We discussed the RIIO-ED2 RPE methodology and our initial views on ED3 with DNOs and their representatives in CAWG8.[39] In this CAWG, stakeholders raised concerns regarding the ability of the RIIO-ED2 RPE indexation mechanism to capture the input price pressures DNOs face in RIIO-ED2.

7.10 DNOs have separately highlighted that the RPE allowances resulted in a negative adjustment in 2023-24 at a time when they face significant cost pressures in their supply chains. They state that this is counterintuitive as it causes a significant gap between the principle function that RPEs need to fulfil and the current mechanism. That is, to cover the movement in real input price pressures incurred by DNOs since allowances were set at RIIO-ED2 Final Determinations.

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[37] See RIIO-3 Draft Determinations Overview Document, paragraph 6.38.
[38] See RIIO-3 Draft Determinations Overview Document, paragraph 6.50.
[39] See RIIO Engagement Portal - Documents - CAWG08 - All Documents

7.11 We consider that the costs incurred by DNOs may not always be tracked by the RPE index. This is because there are two key aspects that can impact the assessment of RPEs - supply-side effects and demand-side effects.

7.12 Supply-side effects capture significant changes in input prices that arise outside of DNO-specific markets that are not sufficiently captured through CPIH. Significant changes in input prices are caused by sudden external factors that disrupt the costs or availability of raw materials and labour used in production across the economy. In economic terms, these external factors are defined as supply-side shocks and tend to occur upstream in the production process. For example, fuel prices fell from 2023 which contributed to declining input prices across the economy.[40] Their fall was at a faster rate than the declining rate of CPIH inflation. Since the RPE index uses general indices for materials that track input price inflation, it would capture any temporary declining effects of fuel prices. That can result in a negative RPE for the materials indices and an overall RPE across labour and materials that is lower than CPIH.

7.13 Demand-side effects capture the impact of changes in demand for goods and services at the intermediate stage of the production process where manufacturers and businesses are the market participants. Due to the global efforts to accelerate the clean energy transition, there has been a surge in demand for the goods and services that are required for the electricity sectors, including electricity distribution and transmission grid infrastructure. The surge in demand has come post COVID-19 where supply chains in the energy sector had started to wind down and could potentially face challenges in scaling up production to meet demand. This can cause a compounding upward pressure on prices specific to markets that both electricity transmission and distribution operators face that may go above and beyond input price inflation level across the economy.

7.14 From our engagement with DNOs, we understand that demand-side effects seem to be particularly prevalent in the last couple of years and potentially may persist for the rest of the RIIO-ED2 price control period. These effects may be offsetting the downside pressures caused by declining input prices across the economy. This could potentially result in a wedge between the RPE indexation mechanism and the costs DNOs face in purchasing goods and services that are specific to the clean energy transition.

[40] See Producer price inflation, UK - Office for National Statistics, Input and output PPI annual inflation rates, Figure 1 and Table 2.

7.15 In developing the RPE mechanism, we are keen to understand how these demand-side effects have evolved since RIIO-ED1 and are likely to evolve into the future. For example, what proportion of these effects are within DNOs' management control. Our overarching objective is to develop an ED3 RPE mechanism that accounts for external effects. We consider that the uncertainty and risk associated with supply chain and commercial decisions are best managed by the sector. The RPE mechanism is not designed to pass-through potentially inefficient practices leading to additional input price pressures. Instead, the RPE mechanism should be limited to capturing how exogenous external effects lead to divergences from CPIH on a material and sustained basis.

7.16 We set out the key aspects of our ED3 RPE indexation methodology below and provide initial alternatives that have been submitted previously. We provide our initial proposed option for each aspect. However, we will undertake additional stakeholder engagement with DNOs through CAWGs ahead of SSMD to develop alternatives.

Input notional cost structure

7.17 In RIIO-ED2, we used the breakdown of totex across expenditure categories implied by our Final Determination allowances to determine the notional input cost structure. We used the expenditure categories below and the information provided by DNOs in their RIIO-ED2 BPDTs:

- load related capex;
- non-load related capex – asset replacement;
- non-load related capex – other, faults;
- tree cutting; and
- controllable opex.

7.18 For each of the expenditure categories above we calculate the proportion of the input cost categories that the expenditure accounts for. We aggregate expenditure per input cost category and calculate the average across the 14 DNO regions. We set out the proportions we used for RIIO-ED2 below:

- general labour (25%);
- specialist labour (38%);
- materials (25%);
- plant and equipment (3%);
- transport (2%); and

- other (7%).

7.19 The advantage of maintaining a notional cost structure is that it mitigates against the risk of rewarding potentially inefficient cost structures. In addition, it allows us to reflect a mix of different business models DNOs have to efficiently deliver electricity distribution services. This could also affect the split due to labour intensity of operations, degree of outsourcing to third-parties, size of the DNO capex investment programme, etc.

7.20 In CAWG8, DNOs and their representatives raised concerns around fluctuations of asset installations and how that can change the proportions of input cost categories through the price control period. It suggested that this could be accounted for in the RPE mechanism through a true-up that would adjust the notional input cost structure to reflect the outturn number of asset installations.

7.21 The RIIO-ED2 input cost structure currently accounts for 88% of totex allowances. A true-up mechanism could in theory more accurately reflect the number of asset installations through the price control. However, it would add an additional layer of uncertainty and complexity into the RPE mechanism that is not within the scope of changes that the RPE mechanism is designed to account for.

7.22 Asset installation outturns often differ compared to forecasts in business plans across all price controls. This is due to an ongoing process of prioritisation and optimisation that all regulated companies go through when they mobilise their programmes post settlement. As such, the timing of asset installations is firmly within management control. This differs from the purpose of RPEs as defined above which is to account for supply and demand shocks driven by external factors outside of the control of DNOs.

Selection of indices and their weightings

7.23 In RIIO-ED2, we applied a two-step criteria approach in selecting the indices that had passed the materiality threshold:[41]

- **thresholds assessment criteria** - this covered the accuracy and independence of the indices; and
- **detailed assessment criteria** – this covered simplicity, credibility, accuracy, transparency and the timeliness of publication and revisions.

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[41] See RIIO-ED2 Draft Determinations | Ofgem RIIO-ED2 Draft Determinations Technical Annex, EPA_Paper_FrontierShift_v8_REDACTED, Figure 5.3.

7.24 We also excluded indices that exhibited duplicative trends within the same input cost category. We are open to exploring different ways we could improve the selection criteria, particularly pertaining to how volatility and persistence of shocks are measured for each input cost category.

7.25 The final selection of indices for RIIO-ED2 were:

- **labour general - ONS AWE**: Private Sector Index: Seasonally Adjusted Total Pay Excluding Arrears, K54V;
- **labour general** – ONS ASHE: Median Hourly Earnings for All Employers (Gross Annual);
- **labour specialist** - BCIS PAFI Civil Engineering Labour, 4/CE/01;
- **labour specialist** - BEAMA Electrical Engineering Labour;
- **labour specialist** - BCIS Electrical Engineering, 4/CE/EL/01;
- **materials** - BCIS PAFI 3/59 Pipes and Accessories: Aluminium;
- **materials** - BCIS PAFI 3/58 Pipes and Accessories: Copper;
- **materials** - BCIS 3/S3 Structural steelwork – Materials: Civil Engineering work; and
- **materials -** BCIS FOCOS Resource Cost Index of Infrastructure Materials.

7.26 The plant and equipment and transport categories did not pass the materiality thresholds of RIIO-ED2. However, for completeness, the indices used for these categories are as follows:

- **plant and equipment** – C28 Machinery and equipment; and
- **transport** – 90/2 Plane and Road Vehicles (Operatives and fuel are not included).

7.27 In RIIO-ED2, the final RPE index composition was determined by the weights for each cost category and the weights of the individual indices within each category. Each category was weighted according to its share of efficient costs, while the indices within each category were equally weighted.

7.28 In previous price control periods, asset-based indices have been suggested. We are open to exploring different indices for ED3. However, it is important that indices are exogenous, and represent general measures of changes in input prices in the economy that DNOs face.

Materiality thresholds

7.29 We applied a two-step materiality threshold for each input cost category in RIIO-ED2. To be considered material, each input cost category must pass at least one of two materiality tests:[42]

- **Test 1** - identifying cost categories that represent a relatively large share of totex (10% or more). If the share of totex represented by the cost category is above the threshold of 10%, we assumed that even small input price variations could result in a material change in DNO expenditure. If the cost category does not meet the totex share threshold, we then apply a second test.
- **Test 2** - identifying cost categories that fall between 5% and 10% of totex where large input price variations could materially impact DNO expenditure. We compared the simple average outturn values over the last ten years of the price indices used in RIIO-ED1 against the evolution of the CPIH. This gave an indication of the level of RPEs that would have occurred over that period if an indexation mechanism had been in place for this cost category. We then calculated the impact on totex of the estimated price volatility for this cost area. We use a threshold of 0.5% of totex over RIIO-2.

7.30 In previous price controls, DNOs have challenged our approach arguing that materiality thresholds are arbitrary and do not hold any value. Materiality thresholds have been applied across all sectors subject to economic regulation in GB. We generally apply materiality thresholds to strike a balance between transferring significant risks onto customers which are external to DNOs and the complexity of the associated uncertainty mechanism. Where cost categories represent a small share of totex, we consider that annual fluctuations can be expected to only have a relatively immaterial impact on total costs. Therefore, DNOs should maintain the ability and incentive to manage these cost pressures through their procurement and supply chain management strategies.

Forecasting

7.31 This section sets out our approach to forecasting RPEs for each of the indices we used in RIIO-ED2. For the general labour index, we calculated the difference between the OBR's average earnings growth forecast and its forecast of CPI up to 2026, and then 1.0% thereafter based on the long-term average RPEs for the

[42] See RIIO-ED2 Draft Determinations | Ofgem, RIIO-ED2 Draft Determinations Technical Annex, CEPA_Paper_FrontierShift_v8_REDACTED, section 5.2.2.

AWE private sector index (over a period consistent with the approach to other benchmark price indices).

7.32 For all other benchmark price indices, we calculated the long term historical average RPE (2001 – 2020) calculated as the average historical difference between the annual growth in each price index and CPIH. This results in an RPE forecast that is constant across the RIIO-ED2 period.

7.33 In previous price controls, alternative options of forecasting were suggested. For example, using the average historical of RPE of each proposed price index or using more sophisticated forecasting methods such as ARIMA approaches. We are open to exploring different forecasting methods only where they can materially improve forecasting accuracy.

7.34 We also note that our starting point of retaining an RPEs indexation approach for ED3 significantly reduces the importance of forecasting as compared to our RIIO-1 ex-ante approach. This is because final ED3 RPEs allowances will reflect outturn RPE indices. Therefore, the impact of forecasting accuracy is temporary until the annual true-up adjustment is applied in-period.

Ongoing efficiency

Introduction

7.35 We set an annual Operating Efficiency (OE) target to model the productivity improvements we expect DNOs to make over the price control period. The OE target represents productivity improvements that we consider even the most efficient company can achieve year-on-year over the price control period. This means that the OE target is distinct to the concept of catch-up efficiency and is applied across all DNOs. It is therefore not company specific.

7.36 Setting an OE target ensures DNOs are continually identifying and exploiting productivity improvements that are not fully captured within our cost assessment. Given the level of investment required for distribution networks to facilitate net zero, the OE target will incentivise DNOs to keep up with wider technological trends, promote ongoing innovation and adopt new ways of working. By setting the OE target, we expect that efficiencies will be made that reflect continuous cost reductions, which are driven by advancements in technology, optimisation of operations and wider economy productivity growth. This ensures that networks can remain resilient in the face of change and secure value for money for customers.

7.37 The OE target is not designed to capture increases in productivity due to an increase in the input level (ie productivity growth from economies of scale).

Rather, it encompasses productivity improvement caused by the reduction in the volume of inputs required to produce a given volume of output. Therefore, in developing the methodology for setting the targets, we measure efficiency based on this definition.

Approach to OE in past price control periods

7.38 In RIIO-ED1, we requested DNOs to submit their own proposals for OE targets. These were based on their own view of what OE assumptions should be within the price control. These assumptions ranged between targets of 0.8% to 1.1% per year.[43] We accepted these assumptions for OE targets as they were in line with our view of the savings a notional efficient company could make at the time.

7.39 For RIIO-ED2, we considered a wide evidence base to inform our OE targets:

- growth accounting analysis;
- historical performance of DNOs, including the potential to make the use of the company historical data;
- forward looking productivity forecasts for the UK economy; and
- wider evidence on the scope for productivity improvements (eg as a result of innovation funding received by DNOs during RIIO-1).

7.40 In RIIO-2, we set the ongoing efficiency challenge at 1% per annum based on Total Factor Productivity estimates produced using EU KLEMS data and wider evidence.[44]

7.41 We developed OE assumptions using a growth accounting approach. This approach uses the EU KLEMS database to identify historical productivity improvements in other sectors that are comparable to electricity and gas transmission and distribution activities. Comparator sectors were chosen based on the similarity of their business process such as their comparable use of labour, materials and other inputs in the production process.

7.42 We did not use the electricity, gas and water supply sector as a direct comparator. This was because it would be difficult to isolate productivity improvements due to structural changes, such as the impact of privatisation and the introduction of incentive-based regulation using the database. Additionally, direct productivity measures in the electricity, gas and water supply sector would incorporate the upstream supply and production sectors, which are not

[43] For slow-tracked DNOs.
[44] EU KLEMS: capital, labour, energy, materials and service - Economy and Finance

comparable to the distribution and transmissions sectors in the activities undertaken.[45]

7.43 In RIIO-3 Draft Determinations, we proposed to broadly retain the RIIO-2 approach that used a wide range of evidence for setting our ongoing efficiency target. We applied a two-step approach in our assessment. Firstly, our independent advisors considered the outputs of the quantitative analysis to establish a broad range from which to select an OE target. This included an in-the-round assessment of different sources of evidence such as the EU KLEMS database, forward-looking productivity forecasts for the UK economy and recent regulatory precedent. This resulted in a broad range of 0.1% - 1.3%.[46] Secondly, we narrowed this range to 0.7% - 1.3% to better reflect the potential for above-average technological change and the need to provide a sufficiently strong incentive to improve productivity. We then determined a target within this range based on an in-the-round assessment of different sources of evidence, taking into account both quantitative analysis and qualitative considerations. In our RIIO-3 Draft Determinations, we proposed a 1% OE target, which was the mid-point of the range. This was a balanced view, which was grounded in quantitative analysis while giving appropriate weight to qualitative considerations on the potential for disembodied technical change and the use of the value added (VA) metric. It also gave some weight to the expectation that companies should expect to see productivity benefits from their historical investments in RIIO-2 and planned investments in RIIO-3 in information technologies and telecommunications, data and digitalisation and innovation projects.

ED3 approach

7.44 We consider that maintaining the approach of using a wide range of evidence is the most appropriate approach for ED3. Setting an OE target is inherently a forward-looking exercise. It therefore requires us to exercise an element of our regulatory judgment as it involves forming a view on the extent of productivity improvements that can be made given the current and likely future wider economic landscape. To inform our judgement, we maintain that using historical views on productivity remain informative. However, we recognise that this

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[45] For RIIO-ED2, see RIIO-ED2 Draft Determinations | Ofgem, Technical Annex, CEPA_Paper_FrontierShift_v8_REDACTED.pdf, footnote 93. For RIIO-2, see RIIO-2 Final Determinations for Transmission and Gas Distribution network companies and the Electricity System Operator | Ofgem, Technical Annex part one, Final Determinations - Frontier Shift Annex (CEPA, paragraph 3.2.1). For RIIO-1, see riiot1_and_gd1_initial_proposals_real_effects_1.pdf, paragraph 3.11.

[46] This was informed by applying the Gross Output (GO), considering a full historical time period (covering 1970-2019) and applying an unweighted approach to comparator sectors.

approach has its limitations and cannot be applied mechanistically. For our assessment of OE targets, we propose to use a holistic framework that blends:

- historical and forecast evidence; and
- qualitative and quantitative evidence.

Key principles

7.45 The key principles that we consider are important in our approach to setting OE target:

- **Regulatory precedent alignment –** given that the OE target captures cost reductions due to wider technological advancement and operational optimisation within the economy, we consider that the approach for setting the OE target should be consistent with best practices and decisions made in comparable regulated sectors. This includes consistency with the wider RIIO-3 determinations.
- **Considerations of historical, current and potential future macroeconomic conditions** - the approach should consider historical, current and potential future trends across the wider economy. This includes reflecting key macroeconomic factors such as inflation, wage growth, and supply chain pressures that may influence companies' capacity to deliver cost efficiencies during the price control period.
- **Considerations of the characteristics of the energy sector** - the approach should capture the distinct characteristics of the energy sector, as well as emerging challenges and opportunities associated with the energy transition and net zero. This includes considerations on the degree of challenge required to create strong and sustained incentives for DNOs to pursue productivity improvements in the context of an increased level of investment.

7.46 Given the principles above, we propose to maintain the use of growth accounting and wider evidence to set the OE target. We discuss the proposed pieces of evidence below.

Growth accounting

7.47 For RIIO-ED2 and RIIO-3, we used a growth accounting approach to establish an initial range of quantitative OE targets. While we do not consider that this approach should be used mechanistically to select an OE target, we consider that it provides a relatively robust basis to quantify historical productivity measures across comparable sectors. Additionally, the growth accounting approach has been commonly used across other regulated sectors and therefore is supported by strong regulatory precedent.

7.48 The growth accounting approach consists of four key choices. The rest of this section provides an overview of each of the choices as follows:

- dataset;
- time period;
- comparators; and
- productivity metrics.

Dataset

7.49 In previous price controls we have typically used the EU KLEMS dataset to set a range of possible OE targets. We have previously used two separate EU KLEMS datasets. These vary in time period, included metrics and industry classification:

- The 2011 release of the EU KLEMS database uses the NACE 1.1 industry classification, contains long-run data covering the period between 1970 to 2007 and productivity data based on Gross Output (GO) and Value Added (VA) output measures;
- The 2019 release of the EU KLEMS database uses the NACE 2 industry classification, covers the period 1997 to 2016 and contains productivity data based on VA output measures only. This dataset covers the global financial crisis and the period of lower productivity growth that has been subsequently recorded in the UK.

7.50 For RIIO-ED2, we based our analysis on the evidence from the 2019 EU KLEMS dataset, as we considered that the growth accounting should account for the most recently available evidence on UK productivity growth. The 2011 dataset was used for sensitivity testing. As there is regulatory precedent of using the EU KLEMS dataset in other regulated sectors, we maintain the position of using the EU KLEMS database as our primary source of data and considering other datasets for sensitivity testing.

Time period

7.51 We have previously considered that a robust approach is to assess the average productivity growth over a complete business cycle. There are a number of different ways of identifying business cycles, which includes using the growth rates identified in the EU KLEMS. However, we consider that there is no clear consensus on the most appropriate definition of a business cycle for the purpose of setting OE targets. Therefore, we propose to maintain the RIIO-ED2 approach previously used, which was to estimate productivity growth over a two-step approach:

- assess productivity growth over different definitions of the most recent complete cycles; and
- use the entire time series available from a particular EU KLEMS dataset.

Comparators

7.52 We used two comparator sets in RIIO-ED2. First, two sets of comparator industries chosen for comparability of activities with those in the electricity distribution network sector. Comparability was determined based on whether these sectors had similar business processes to the networks (ie their comparable use of labour, materials, and other inputs in the production process) for the type of cost activity considered (eg opex or capex):

- **First set** - represented a narrow range of an unweighted average of construction, wholesale and retail trade – repair of motor vehicles and motorcycles, transportation and storage, financial and insurance activities.
- **Second set** – represented an expanded comparator set that included additional industries of professional, scientific – technical- administrative - support service activities, and information and communication activities.

7.53 Second, an economy wide sample that represents the average of the market economy figures in EU KLEMS. This was all industries excluding real estate activities, public administration & defence, education, health & social work activities, arts, entertainment and recreation, other social services, activities of households as employers and activities of extraterritorial organisations. These figures were weighted by the contribution of the sector to GDP.

Productivity metrics

7.54 For RIIO-ED2, we used the Total Factor Productivity (TFP) as a measure of long-term efficiency using data from EU KLEMS. There are two measures of TFP that can be calculated from the EU KLEMS database:

- Value Added (VA) measure of TFP – measures the value of gross output minus the value of intermediate inputs (energy, materials and services) required to produce the final output. The inputs for VA are therefore labour and capital.
- Gross Output (GO) measure of TFP – measures the value of the output of an industry, ie the combined turnover of the companies within that industry. The inputs for GO are therefore capital, labour, energy, materials and services.

7.55 Consistent with regulatory precedent (incl. RIIO-ED2), we propose to maintain the approach of using both measures of TFP to inform our assessment when setting the OE target. We are also open to considering other productivity measures outside of TFP to inform sensitivity analysis around OE judgments. This includes using partial factor productivity metrics, labour, capital and intermediate inputs productivity metrics.

7.56 We note that productivity improvements can be categorised into embodied and disembodied technical change. Embodied technical change refers to the productivity gains which are made from employing new inputs relative to the use of a comparable amount of pre-existing inputs. Disembodied technical change refers to the productivity gains which are made through the process by which output is produced from inputs of a given quality.

7.57 We recognise that TFP estimates developed using EU KLEMS database may not capture the potential for productivity improvements which operate through embodied technical change. We intend to consider both categories of technical change to inform our approach to setting OE targets for ED3.

Wider evidence

7.58 In setting the OE target, we will consider the following wider pieces of evidence:

- **Historical performance of DNOs** - for RIIO-ED2, we considered using network companies' historical performance data from previous price control periods to understand how outturn efficiency improvements compare to RIIO-ED2 forecasts. The limitation of using historical performance of DNOs is that it could embed historical efficiency into future targets within a different delivery landscape. Additionally, we are conscious that DNO-specific historical efficiency performance can capture the impacts of privatisation and regulatory change.
- **Productivity forecasts from authoritative macroeconomic sources** - to assess the forward-looking wider economic outlook on productivity we propose to consider using productivity forecasts by the Office of Budget Responsibility (OBR) and Bank of England (BoE) amongst other sources. This would inform our assessment on the scope of DNOs' potential future efficiency gains.
- **Innovation funding impacts** – for RIIO-ED2, we considered whether innovation funding previously awarded to DNOs could deliver efficiency benefits over the next price control period. Consumers have funded innovation in the energy sector for over a decade via various innovation

mechanisms as part of the price control or through innovation competitions. This regulatory funding is not available to competitive industries in the wider economy. As DNOs innovate and embed new practices in their day-to-day operations and business models, this should increase their efficiency. As a result, including the impact of previous innovation funding could inform DNOs' future efficiency gains.

- **DNO-specific productivity forecasts** – similarly to RIIO-ED2, we propose to use DNO-specific OE forecasts as reported by DNOs separately in the BPDTs. This would supplement our forward-looking view on the market-specific considerations in our assessment.

7.59 We are proposing to maintain the position from RIIO-ED2 of applying OE targets across the entirety of the totex base (ie including RPEs). However, we are open to further exploring the link between RPE-indexation and ongoing efficiency assumptions, including for non-RPE cost areas subject to CPIH general price indexation. That can draw on relevant considerations from the RIIO-3 cost assessment process to date.

Consultation questions

CAQ36. Do you agree with our proposal to maintain an RPE indexation approach for ED3?

CAQ37. What alternatives should we consider for the key methodology aspects of our ED3 approach including the input cost structure, selection of indices, materiality threshold and forecasting?

CAQ38. Do you agree with the key principles we propose to inform our assessment of ED3 OE targets?

CAQ39. Do you agree with the growth accounting approach and the choices used when setting ED3 OE targets? If not, what alternatives should we consider?

CAQ40. Do you agree with the selection of wider pieces of evidence when setting ED3 OE targets? If not, what alternatives or additions should we consider?

8. Engineering assessment

Introduction

8.1 As part of their RIIO-3 Business Plan submissions, GT, and ET companies were required to provide IDPs which outline the needs case, optioneering, scope, costs and benefits of proposed investments. These packs, consisting of an EJP and CBA, intend to provide both quantitative and qualitative assessments of the proposed investments underpinning the high-level outputs contained in the Business Plans. We propose to retain the requirement for DNOs to produce IDPs comprising EJPs and CBAs in their ED3 business plan. Please refer to the CBA Chapter 10 for more detail on our initial thinking in relation to our emerging approach to CBAs in ED3.

8.2 As part of our RIIO-3 Business Plan Guidance,[47] we issued IDP Guidance setting out EJP types, information and data requirements, alongside EJP templates for each of the relevant sectors. We intend to issue updated guidance relevant to the electricity distribution sector alongside ED3 Business Plan Guidance in December 2025.

8.3 In RIIO-ED2, we used a single narrative based EJP for both high value individual investment proposals (>£2m) and for aggregated investment schemes or a portfolio of similar works. This meant that we often had little or no visibility of the individual investments making up the portfolio of investments proposed for both load and non-load related works. This limited our ability to scrutinise both the proposed investments and any subsequent changes in delivery, reducing our ability to ensure the best outcome for customers. We therefore consider that there is a need for greater granularity of data across both load and non-load related works.

8.4 In RIIO-ET3, we introduced an excel based portfolio EJP covering all assets. This provided asset and condition data for each individual asset, alongside the needs case, optioneering, scope and costs for all investment proposed within the price control period, and investment signals for future price controls. This profoundly increased our ability to understand and scrutinise portfolios of similar works in relation to the overall asset base. We propose to introduce a similar data driven excel based EJP in ED3.

8.5 We propose to retain a narrative based EJP for high-value projects. However, to help minimise the burden of producing EJPs, we consider that a significant

[47] RIIO-3 Business Plan Guidance | Ofgem

number of portfolio investments could be submitted via the excel based EJP submission alone if appropriately designed. We presented and discussed our initial views on the use of EJPs in ED3 and initial considerations of data required within the excel based EJP with DNOs at CAWG7.[48] Our initial views are summarised below.

Proposed approach

8.6 We propose to introduce three types of EJP in ED3:

- **Major Project EJP -** This will be a narrative based EJP intended to be used for individual investment projects and/or site strategies where the forecast cost exceeds £4m. There should be a clear link between all investment proposed within a Major Project EJP;
- **Portfolio EJP -** This will be a data driven excel based EJP intended to be used for all other investment on an asset-by-asset basis. We intend for this to cover all Common Network Asset Indices Methodology (CNAIM) assets, as well as LV Mains, HV, EHV and 132kV conductors, and pole mounted plant (switchgear and transformers); and
- **Portfolio Narrative EJP -** This will be a narrative based EJP intended to be used for investment not covered under either Major Project EJP or Portfolio EJP, where the forecast project or portfolio cost exceeds £2m. We expect this to be the case for example, for asset classes not covered by the excel Portfolio EJP, or where individual assets for intervention are not known at the time of business plan submission. This EJP may also be used to provide supporting narrative for a portfolio of investments within the Portfolio EJP, though this is not mandatory.

Engineering assessment framework

8.7 Our proposed EJP assessment framework remains broadly similar to that used within RIIO-ED2. We propose to assess EJPs with respect to the:

- **Needs case** - Licensees must outline and evidence the engineering problem that the investment seeks to address, including adherence to engineering standards, tRESP load forecasts, and maintaining the health, reliability and operability of the network. This should be supported by load forecasts (aligned to the tRESP), power flow assessments, asset condition (CNAIM or equivalent used), performance, ratings, and degradation data to ensure both load and non-load needs are considered holistically. Licensees should

[48] See LINK

further include references to the outputs of other industry standard process or assessment methodologies.

- **Optioneering and scope** - Licensees must demonstrate that all credible options to meet the needs case have been identified, including do nothing or minimum intervention. Licensees must present clear reasons for rejecting options and outline the benefits and risks of all credible options. All credible options should be progressed to a CBA which should be used to inform the preferred solution.
- We expect licensees to consider future proofing in their proposals to ensure the long-term needs of the network can be met. We expect the scope and costs of this futureproofing to be identified explicitly. We consider the overrating of assets to meet future network needs to be BAU. However, examples of future proofing include the procurement of additional land, additional civil construction or additional electrical assets being installed in preparation for future network needs.
- **Cost** - Licensees must identify project progress to date and demonstrate the maturity and robustness of their costing. We intend to consider incremental costs associated with future proofing with respect to its benefits.
- **Risk and deliverability** - Licensees must identify key risks associated with their preferred option and its delivery and demonstrate how they will manage or mitigate these risks.

EJP design

8.8 We anticipate that the Major Project and Portfolio Narrative EJPs will use similar templates. They will be designed to capture data and narrative relevant to our intended assessment criteria. As such, we propose for there to be sections on project background, needs case, optioneering, preferred solution, cost, risk and deliverability. All EJPs will need to align with, and reference, the cost, volume and output data underpinning the ED3 business plan submissions, as submitted in the BPDTs. Further to this, we expect:

- Major Project EJPs to include system diagrams and explanation of the existing network arrangements and all credible options considered. We expect a CBA to be carried out on each credible option and used to inform the licensee's preferred solution;
- Portfolio Narrative EJPs to include system diagrams and explanations representative of the existing network arrangements. They should also

include case studies for each investment type comprising the portfolio options considered. We expect a CBA to be carried out at the portfolio level to inform the volume of interventions. However, we note that individual investment level CBAs may be used to inform the individual investments that comprise the portfolio of proposed investments; and

- Licensees to be able to provide a comprehensive breakdown of condition and defect data for asset health investments on asset categories not covered within the excel Portfolio EJP.

8.9 We note that the lack of mandatory Portfolio Narrative EJPs for portfolio works could hinder our ability to understand the overall strategies employed by licensees. However, we consider this to be mitigated by designing a flexible excel based Portfolio EJP template to allow licensees to add additional data they consider relevant to their decision-making process. We are also allowing licensees to submit Portfolio Narrative EJPs to support their data submissions.

8.10 We also note that at CAWG7, some licensees expressed a desire to avoid duplication of data already captured and submitted in the BPDTs, for example CNAIM, load indices and capacity released, by combining the Portfolio EJP into the BPDTs themselves. We do not consider this to be appropriate as it would hinder the intended flexibility to allow licensees to add additional data. We therefore consider it most appropriate to have a separate Portfolio EJP, with data aligned to BPDT data where relevant.

8.11 We intend to produce a single excel based Portfolio EJP template to cover all CNAIM assets as well as LV Mains, HV, EHV and 132kV conductors, and pole mounted plant (switchgear and transformers) as this will provide a comprehensive view of all assets. To reduce the burden on licensees, we intend to aggregate linear assets (eg overhead lines or underground circuits) to a single line entry per circuit route. For all other assets, we expect a single line entry per asset. We intend to include an excel tab for circuits, switchgear and transformers at each voltage level.

8.12 Whilst we intend to allow licensees flexibility to add additional data, we propose to capture the following data as a minimum to align to our proposed assessment criteria:

- **EJP (Major Project and Portfolio Narrative) and BPDT references** - this is to ensure alignment with the cost, volume and output data underpinning the business plan submissions, as submitted in the BPDTs. We note that we intend to include Major Project EJP references to support a holistic view of licensee plans. We do not expect intervention details to be populated for such assets as this will be covered in the Major Project EJP itself.

- **Historic intervention indicators** - this is to inform our view of the efficiency of investments proposed including a consideration of historic investments. We anticipate this will indicate the previous price control period in which investment was made.
- **Asset and condition data** - this is to allow us to build a picture of the location and network connectivity of the assets and their condition to inform our view of the efficiency of the licensee proposals. We expect condition data to encompass all CNAIM data inputs as well as asset health and criticality scores for each asset at the start and end of ED3, or equivalent for non CNAIM assets.
- **Load forecasts** - this will form the primary needs case for load related investments. We expect these forecasts to be aligned to the tRESP/RESP and to provide a view of anticipated constraints, alongside the current asset loading.
- **Forecast asset health intervention** - we expect licensees to provide their best view of when a non-load related investment will be required in the future. We anticipate that this will be aggregated to 5-year periods.
- **Planned investment** - this is to allow licensees to denote investment proposed in ED3, as well as future investment needed in ED4 and ED5, alongside their drivers (ie load or non-load related). This is to evidence the alignment of ED3 investments with the DNO's long-term integrated network development plan that is proposed in Chapter 2 of the ED3 SSMC. To align with this plan, we expect licensees to state the year of proposed intervention through to 2035 but denote a price control period for proposed intervention thereafter until the end of ED5.

  We note that we intend to include a column for licensees to denote assets considered for intervention in ED3 within a Portfolio Narrative EJP, where the actual assets comprising the proposal are unknown at the time of submission.
- **Planned intervention details** - we anticipate this will capture:
  - the scope of proposed investment (replace / refurbish, civils etc.);
  - year of proposed investment;
  - future asset ratings;

   - network limiting factor (preventing the full asset rating from being released);
   - year of next forecast constraint;
   - alternative option(s) considered;
   - cost;
   - future proofing incremental scope and cost; and
   - risk.

8.13 We note that some data, for example alternative options or future proofing works, may not be particularly relevant to portfolio investments, especially at low voltages. We will work with licensees to ensure the Portfolio EJP template captures all data relevant to our assessment, whilst minimising administrative burden. We will also work with licensees to standardise data inputs for the Portfolio EJP as far as possible to ensure consistency in submission and in our understanding. To support this, we are sharing a draft Portfolio EJP template with licensees alongside this publication. We will seek to engage with licensees to refine the Portfolio EJP template and develop appropriate EJP guidance for ED3. We have organised a CAWG9 - 'ED3 Engineering assessment follow-up' to consider stakeholder feedback to help inform our approach. In the future, we may undertake further stakeholder engagement through the CAWG and/or the BPDTWG, or other dedicated working group forums.

Consultation questions

CAQ41. Do you agree with our proposal to introduce an excel based Portfolio EJP to capture all known investment proposals?

CAQ42. Do you agree with our proposal to use this Portfolio EJP to inform a holistic long-term view of the needs of the networks?

CAQ43. Do you agree with our proposed data requirements within this Portfolio EJP, and do you consider this to be relevant and effective across all voltages and asset categories?

CAQ44. Do you agree with our proposal to retain the use of CBAs at a portfolio level for portfolios of investment?

CAQ45. Do you consider there is a need for any further EJP types?

9. Business plan data tables

Introduction

9.1 The ED3 BPDTs will form a core component of the information we require from DNOs to support our assessment of ED3 business plans and the setting of ED3 revenue allowances. To support consistent and streamlined submissions, we will develop accompanying guidance documents, including:

- Business Plan Guidance (BPG);
- EJPs Guidance; and
- CBA Guidance.

9.2 In this chapter, we set out some of our initial views on the development of ED3 BPDTs. We have published an early ED3 BPDTs draft on the GitLab ED3 BPDTs portal. This is a portal where DNOs can submit questions, suggest edits, new tables, etc. We have provided access to all relevant DNO stakeholders. We will use GitLab to support the ongoing development of ED3 BPDTs. It is a tool that can support our assessment of DNO stakeholder feedback. The feedback is also visible to other DNOs which can help coordination of proposals and promote the development of high quality ED3 BPDTs. We will have a standing item in the agenda of forthcoming BPDTWG engagement to discuss the feedback we receive on GitLab.

9.3 We will be guided by the following high-level principles for BPDT development now that we have formally initiated the ED3 BPDT consultation process:

- **Continuity with RIIO-ED2 reporting** - RIIO-ED2 Regulatory Reporting Packs (RRPs) are serving as the default starting point for ED3 BPDT development. This ensures continuity in reporting and reflects any updates made to the RRPs since the RIIO-ED2 BPDTs. However, we are conscious that in some areas (eg NARM or Reinforcement), the RIIO-ED2 BPDTs may provide a more appropriate starting point.
- **Cross-cutting design** - while the ED3 cost assessment team will lead the BPDT development process, the templates will contain data relevant to all aspects of the ED3 price review. This includes inputs for policy development, regulatory finance, engineering and other teams. Cross-functional input will be essential to ensure the tables meet the needs of all areas of the ED3 price review to facilitate our assessment of ED3 business plans.
- **Alignment with RRP updates** - initial BPDTs are based on the 2024–25 RRPs. Any proposed changes to RRPs for 2025–26 should be considered in parallel to ensure consistency across ED3 reporting frameworks.

- **Collaborative development** - we propose for ED3 BPDT development to be a collaborative process. We welcome proposals from DNOs on improvements to structure, content and reporting approaches that support the ED3 price review. We will use the BPDTWG to consider DNO proposals and encourage presentations on any aspects of the BPDTs. Particularly in areas where DNOs consider that collection of new data or changing existing reporting can help to facilitate the ED3 price review and improve transparency.
- **Iterative but proportionate approach** - we propose to refine BPDTs through an iterative process up to the publication of the final ED3 BPDTs in September 2026. However, proposals for new tables or significant changes to existing reporting should be supported by a clear and strong rationale to ensure the process remains proportionate and manageable. Continuity in reporting is essential to support our ED3 cost assessment which relies on historical and forecast data. It also supports our ongoing ED monitoring work programme and our ability to hold DNOs to account. Therefore, we propose to set a high bar for implementing changes that might impact on this continuity.

Timeline

9.4 We set out the proposed timelines for ED3 BPDT development below. This sets out some of the high-level milestones split into three phases.

Phase 1: Pre-SSMC (Up to October 2025)

9.5 Focus: Early scoping and engagement:

- initial working group discussions on structure and scope of BPDTs;
- review of RIIO-ED2 BPDTs and feedback to identify areas for retention, removal or addition;
- DNOs propose new tables, formats and data approaches;
- Ofgem prepares early draft BPDTs and supporting guidance, informed by stakeholder feedback via working groups and Ofgem requirements on areas such as cost, policy and engineering; and
- emphasis on scoping, feasibility and ensuring alignment with expected ED3 policy direction.

Phase 2: SSMC publication to SSMD (October 2025 – Spring 2026)

9.6 Focus: Collaborative development and policy alignment:

- early draft BPDTs shared with DNOs alongside ED3 SSMC publication;

- BPDT working groups continue to meet regularly to refine tables and address any emerging data collection needs;
- Ofgem shares emerging ED3 policy positions and clarifies expectations for data granularity, consistency and comparability;
- draft ED3 BPDTs shared with stakeholders for comment in December 2025; and
- Ofgem conducts internal testing of tables to ensure usability and alignment with ED3 methodologies.

Phase 3: Post-SSMD (Spring 2026 – September 2026)

9.7 Focus: Finalisation and submission:

- BPDT working groups focus on final adjustments based on SSMD decisions and stakeholder feedback;
- draft BPDTs with early view of data in ED3 business plans (ie no dummy data) submitted to us for review in July 2026, aligning with RRP submission process;
- validation checks and feedback provided by Ofgem; and
- guidance documents and instructions for BPDT completion are finalised and issued in September 2026.

ED3 BPDTs priorities

9.8 The early draft of ED3 BPDTs contain similar data to that collected in RIIO-ED2 RRPs and BPDTs as a starting point. However, we will review the structure and content of the tables going forward to ensure that they support robust ED3 cost assessment and reflect evolving policy needs. Areas that may be subject to change include:

- data that helps to inform policy, for example to enable us to assess costs associated with proposed PCDs to determine output targets;
- data that helps to inform how we develop our cost assessment approach;
- data that helps to capture cost drivers suitable for our ED3 cost assessment approach;
- where we think the context or level of uncertainty has changed from RIIO-ED2 to ED3 with implications for the data required to assess costs (eg data to help assess alignment with tRESP);
- the BPDTs format that will adapt reporting requirements while improving our cost assessment process and aligning with best practices; and

- clearer or simplified reporting in selected categories, where that can improve our ED3 cost assessment and wider ED3 business plan assessment.

9.9 We will also consider the treatment of historical data, including the use of RIIO-ED1 and RIIO-ED2 data to support benchmarking and challenge ED3 business plan submissions. Our early ED3 BPDTs draft includes historical data from the RIIO-ED1 and RIIO-ED2 price control periods and forecast data for ED3. This approach aligns with the current RRP reporting packs time period covering RIIO-ED1 and RIIO-ED2. We also welcome views whether additional data collection beyond ED3 is appropriate.

9.10 In the first two BPDTWGs we held ahead of ED3 SSMC, we undertook an initial assessment to evaluate the role and relevance of each table in supporting ED3 business plan submissions. This includes considering whether each table reflects a change in practice, facilitates forecasting and cost assessment and whether it can be streamlined or rationalised. We are also assessing the extent to which tables may need to evolve in response to anticipated ED3 policy developments or proposals emerging from other Ofgem working groups. This process is being informed by DNO feedback and will continue throughout the BPDT development period to ensure the tables remain proportionate, relevant and aligned with the broader ED3 price review methodology.

9.11 The response to our ED3 SSMC consultation is due on 3 December 2025. This will come towards the end of upcoming BPDTs engagement using the BPDTWG which is planned with a view to sharing the draft ED3 BPDTs with stakeholders in December. Therefore, where possible, DNO stakeholder proposals in relation to ED3 BPDTs responding to the SSMC should be shared with Ofgem during November (ie ahead of the formal ED3 SSMC response deadline). This will help to provide additional time to fully consider stakeholder proposals ahead of sharing the draft BPDTs in December.

Consultation questions

CAQ46. Do you agree with the proposed phased approach and timeline for ED3 BPDT development?

CAQ47. What are your priority areas for ED3 BPDT development? Please explain their relevance and include BPDTs proposals where possible.

10. Cost benefit analysis

Introduction

10.1 The CBA framework was designed to help DNOs justify investment decisions under the RIIO-ED2 price control period (2023–2028). It ensured that proposed interventions deliver value for money and are compared against alternative options.[49] As designed, CBAs are a decision-making tool. We expect DNOs to submit CBAs to justify a wide range of potential interventions with them being closely related to EJPs.

10.2 The purpose of the CBA is to assist Ofgem in the understanding of a particular strategy or proposal in significant areas of investment. The CBA will provide information on other alternatives that have been considered and an understanding of the key assumptions that have been made which support a proposal.

10.3 We propose to continue the use of CBAs. However, we would like to use the opportunity of the SSMC consultation to check for any changes or improvements for ED3. In this section, we summarise the RIIO-ED2 CBA approach, highlight some of the potential challenges and propose some changes to the way we conduct CBAs in ED3.

Key components of the RIIO-ED2 CBA guidance

10.4 When a CBA is required:

- CBAs are expected for significant investment proposals;
- required where costs are notably higher than previous strategies or peers; and
- must be proportionate to the scale of expenditure.

10.5 Scope of CBA:

- can be applied at asset category / class level or project level; and
- homogeneous projects may be grouped; unique schemes require individual CBAs.

10.6 Interaction with the BPI:

- CBAs are a minimum requirement under Stage 1 of the BPI; and
- must align with other submissions like EJPs, BPDTs, and NARM data.

10.7 Identification of options:

[49] RIIO-ED2 CBA Guidance

- DNOs must identify a range of options, including a 'do minimum' or status quo scenario; and
- options should be clearly documented, including those rejected.

10.8 Valuing costs and benefits:

- costs and benefits are assessed incrementally over the baseline; and
- must include whole system costs, including impacts on other DNOs.

10.9 Societal benefits and non-market goods:

- guidance includes how to value societal impacts and non-market goods; and
- encourages use of monetisation where feasible.

10.10 Decision rule:

- CBAs should support transparent decision-making; and
- Net Present Value (NPV) is the primary metric, but qualitative factors may also be considered.

10.11 Uncertainty and sensitivity analysis:

- DNOs must assess how sensitive results are to key assumptions; and
- required to demonstrate robustness of preferred options.

10.12 Spackman Approach outlines the application of the Spackman method[50] which adjusts for financing effects in public sector investment appraisal.

Proposed adjustments to the CBA guidance

10.13 The current CBA guidance is wide ranging and potentially covers any proposal for expenditure in capital or operating costs. However, we think it may be necessary to provide additional guidance to address some of the new issues and challenges we face in ED3.

10.14 Some of the key areas that will be covered are climate change resilience, flexibility solutions, proactive LRE and future proofing (future proofing being investment to reduce the cost or disruption caused by the next intervention).

10.15 In relation to climate change resilience, we are interested in ways of capturing long-term avoided impacts from interruptions. As we explain in ED3 SSMC, we recognise that updating our CBA guidance to capture these avoided impacts is not feasible within the ED3 timeframes. However, we would like to explore how

[50] See discounting-for-cost-benefit-analysis-involving-private-investment-but-public-benefit.pdf

this could be included in the CBAs, beyond the Value of Lost Load (VoLL) which is already incorporated, for example as a qualitative assessment.[51]

10.16 The ED3 price control methodology reflects the shift toward strategically planned proactive investment in new capacity to prepare the network for higher demand and distributed generation connections (see Chapter 2 in the ED3 SSMC). The RIIO-ED2 CBA framework has supported structured decision-making for network investments. However, as we move towards a more proactive stance in ED3, there is a growing recognition that the risks to consumers from underinvestment such as delayed LCT uptake, reduced resilience and repeated network disruption are likely to outweigh the risks associated with investing ahead of need.

10.17 To reflect this shift, potential enhancements to the CBA methodology could be necessary to better capture the full long-term value of proactive investment. Key drivers for change include:

- **Undervaluation of proactive investment** - Current CBA modelling and uniform assumptions, for example the treatment of electricity losses, may fail to reflect future system needs and undervalue interventions that avoid increases in future losses, delayed decarbonisation or repeated network disruption.
- **Incorporating uncertainty** - A structured approach to uncertainty such as sensitivity analysis can help assess performance across plausible futures and help identify low-regret decisions.
- **Wider societal impacts** - Expanding the scope of CBA to better reflect the societal and system value of investment by including future constraint avoidance, future outage or network disruption avoidance (associated with incremental investments), network resilience and decarbonisation enablement.
- **Streamlining the assessment of high-volume interventions** - For HV / LV networks, where proactive investment may involve large volumes of similar interventions, programme-level CBAs can support proportionate and efficient decision-making.
- **Improving consistency and transparency -** Updated guidance and tools could help ensure consistent interpretation across DNOs, particularly in areas such as sensitivity analysis and non-monetised benefits.

[51] An updated VoLL figure would feed through to the ED3 templates. However, we have not decided yet if this would be a single figure or a range of values covering different types of interruptions.

10.18 We expect DNOs to futureproof their proposals to ensure the longer-term needs of the network can be met. This could affect the CBAs that include flexibility options. Where one or more of the options that have been considered by the DNO are flexible solutions / services then we welcome views whether these may be evaluated using the common evaluation methodology (CEM tool). We may revise the parameters in the CBA to make sure the benefits of anticipatory investments and the efficiencies from avoided duplication or network disruption of future investment ('touch-the-network-once') are rigorously accounted for in the CBAs.

10.19 Finally, we are concerned that, if deferred, electricity distribution investment could be subject to significant supply chain inflation, as well as challenges in achieving the sharp ramp-up in investment that will be required in the early 2030s.

Consultation questions

CAQ48. Do you think current CBA guidance should be updated to reflect climate resilience?

CAQ49. How should the CBA framework be updated to better reflect the long-term consumer value associated with low-regret proactive investment?

CAQ50. Do you think we should review CBA guidance and the interaction with CEM to assess flexibility proposals?

CAQ51. Do you think we should change the approach to inflation to account for future supply chain constraints?

Appendices

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Appendix 1 Consultation questions

Cost assessment overview

CAQ1. Do you have any comments on the format and use of the engagement forums we use to develop our cost assessment methodology so far including CAWG and BPDTWG?

Totex models

CAQ2. Do you agree with the continued use of totex models in ED3?

CAQ3. Do you agree with the advantages and disadvantages of totex models we set out?

CAQ4. Do you agree with the ED3 cost driver principles we propose to use to select cost drivers in our ED3 totex models?

CAQ5. Do you agree with the ED3 model selection criteria we propose to use when specifying ED3 totex models?

CAQ6. Do you agree with the advantages and disadvantages of RIIO-ED2 totex model cost drivers we set out?

CAQ7. Do you agree with the longlist of alternative cost drivers we propose to consider when developing ED3 totex models and the advantages and disadvantages we have set out?

CAQ8. Do you recommend adding other alternative ED3 cost drivers to our longlist? In your answer, please clarify if these rely on existing reporting or might require data collection and back-casting and submit them alongside your response where possible.

CAQ9. Do you agree with our characterisation of bottom-up, top-down and LCT composite variables?

CAQ10. Do you have any preference between the use of a bottom-up and top-down CSVs?

CAQ11. Do you have any proposals for improvements of our composite variables methodology across the three composite variables we used in RIIO-ED2?

CAQ12. Do you agree with our proposal to consider an alternative approach of separate models in ED3?

CAQ13. Do you agree with our proposal to use the log-log functional form when developing ED3 totex cost models?

CAQ14. Do you agree with our proposal to use the entire sample period RIIO-ED1 - ED3 (2016 - 2033) to estimate our ED3 totex models?

CAQ15. Do you agree with our proposal to undertake a full assessment of the scope and purpose of including time trends in our ED3 totex models?

CAQ16. Do you agree with our proposal to retain the OLS estimation approach and to evaluate a random effects estimation approach when developing ED3 totex models?

CAQ17. Do you agree with our proposed set of statistical diagnostic tests we intend to use to evaluate the robustness of ED3 totex models?

Disaggregated models

CAQ18. Do you agree with the continued use of disaggregated models in ED3?

CAQ19. Do you agree with the advantages and disadvantages of disaggregated models we set out?

CAQ20. Do you agree with our proposed principles for disaggregated model development in ED3?

Mid models

CAQ21. Do you agree with our criteria for level of aggregation when developing ED3 mid models and disaggregated models?

CAQ22. Do you agree with our proposal to consider mid models in our ED3 cost assessment toolkit approach?

CAQ23. Do you agree with our proposed level of aggregation for the mid models? If not, please state your alternative proposal.

CAQ24. Do you agree with our hybrid specification of the ED3 mid models to combine approaches from ED3 totex and disaggregated modelling?

Cross-cutting issues

CAQ25. Do you agree with our proposal not to apply a demand driven post-modelling adjustment in ED3?

CAQ26. Do you have any proposals how we can improve the RIIO-ED2 methodology for disaggregation of allowances to consider for ED3?

CAQ27. Do you agree with our proposal to explore implicit allowances as an alternative approach to disaggregate efficient ED3 cost allowances?

CAQ28. Do you agree with our proposed ED3 triangulation principles?

CAQ29. Do you agree with our proposed approach to retain the RIIO-ED2 catch-up efficiency challenge of 75th percentile with a glide path to the 85th percentile over three years for ED3?

CAQ30. Do you agree with our proposal to inform our final decision on the ED3 catch-up efficiency challenge by considering the overall level of efficiency challenge for the sector?

CAQ31. Do you agree with our proposal to consider the design of the ratchets we apply in our ED3 modelling suite?

CAQ32. Do you agree with our proposal to consider the interaction between ratchets and stage B of the BPI in ED3?

Regional and company-specific factors

CAQ33. Do you agree with our proposed ED3 criteria for normalisation?

CAQ34. Do you agree with our proposed ED3 methodology for each factor?

CAQ35. Do you have any views on the stage at which we should apply the adjustments for each factor (where applicable)?

Real price effects and ongoing efficiency

CAQ36. Do you agree with our proposal to maintain an RPE indexation approach for ED3?

CAQ37. What alternatives should we consider for the key methodology aspects of our ED3 approach including the input cost structure, selection of indices, materiality threshold and forecasting?

CAQ38. Do you agree with the key principles we propose to inform our assessment of ED3 OE targets?

CAQ39. Do you agree with the growth accounting approach and the choices used when setting ED3 OE targets? If not, what alternatives should we consider?

CAQ40. Do you agree with the selection of wider pieces of evidence when setting ED3 OE targets? If not, what alternatives or additions should we consider?

Engineering assessment

CAQ41. Do you agree with our proposal to introduce an excel based Portfolio EJP to capture all known investment proposals?

CAQ42. Do you agree with our proposal to use this Portfolio EJP to inform a holistic long-term view of the needs of the networks?

CAQ43. Do you agree with our proposed data requirements within this Portfolio EJP, and do you consider this to be relevant and effective across all voltages and asset categories?

CAQ44. Do you agree with our proposal to retain the use of CBAs at a portfolio level for portfolios of investment?

CAQ45. Do you consider there is a need for any further EJP types?

Business plan data tables

CAQ46. Do you agree with the proposed phased approach and timeline for ED3 BPDT development?

CAQ47. What are your priority areas for ED3 BPDT development? Please explain their relevance and include BPDTs proposals where possible.

Cost benefit analysis (CBA)

CAQ48. Do you think current CBA guidance should be updated to reflect climate resilience?

CAQ49. How should the CBA framework be updated to better reflect the long-term consumer value associated with low-regret proactive investment?

CAQ50. Do you think we should review CBA guidance and the interaction with CEM to assess flexibility proposals?

CAQ51. Do you think we should change the approach to inflation to account for future supply chain constraints?

Appendix 2 Bottom-up CSV cost / cost driver mapping

Cost category	**Cost driver**
Connections	Customers
New Transmission Capacity	Peak Demand
Total Reinforcement	Capacity released
Civil Works Condition Driven	MEAV
Electricity System Restoration	MEAV
Legal	MEAV
Flood Mitigation	MEAV
Overhead Line Clearances	Overhead network length (LV and HV)
Losses	MEAV
Environmental Reporting	MEAV
Operational IT and telecoms	MEAV
Visual Amenity	MEAV
Total Diversions	Network length
Total Asset Replacement	MEAV
Total Refurbishment	MEAV
Total NonOp Capex	MEAV
Total HVP	Units distributed
Tree Cutting	Spans affected
Faults op	Faults driver
Severe Weather 1-in-20	Overhead network length (LV and HV)
ONIs	ONIs driver
Inspections	MEAV
Repair and Maintenance	MEAV
Dismantlement	MEAV
Remote Generation Opex	MEAV
Substation Electricity	MEAV
Smart Metering Roll Out	Customers
Total CAI	MEAV

Cost category	**Cost driver**
Total Business Support	MEAV

Appendix 3 Top-down CSV cost / cost driver mapping

Cost category	**Cost driver**
Connections	Customers
New Transmission Capacity Charges	Peak demand
Primary Reinforcement	Peak demand
Secondary Reinforcement	Peak demand
Fault Level Reinforcement	Peak demand
Civil Works Condition Driven	MEAV
Electricity System Restoration	MEAV
Legal & Safety	MEAV
QoS & North of Scotland Resilience	N/A
Flood Mitigation	MEAV
Physical Security	N/A
Rising and Lateral Mains	N/A
Overhead Line Clearances	Network Length
Losses	Network Length
Environmental Reporting	MEAV
Operational IT and telecoms	MEAV
BT21CN	N/A
Worst Served Customers	N/A
Visual Amenity	MEAV
Diversions (excl. Rail Electrification)	Network Length
Diversions (Rail Electrification)	Network Length
NARM Asset Replacement	MEAV
Non-NARM Asset Replacement	MEAV
Civils Driven Asset Replacement	MEAV
Non-NARM Refurbishment	MEAV
NARM Refurbishment	MEAV
IT and Telecoms (Non-Op)	MEAV
Property (Non-Op)	MEAV

Cost category	**Cost driver**
Vehicles and Transport (Non-Op)	MEAV
Small Tools and Equipment	MEAV
HVP DPCR5	MEAV
HVP RIIO-ED1	MEAV
HVP RIIO-ED2	MEAV
Shetland	N/A
Tree Cutting	Customers
Faults	Total faults
Severe Weather 1 in 20	Customers
ONIs	Customers
Inspections	Network Length
Repair and Maintenance	Network Length
Dismantlement	Customers
Remote Generation Opex	Customers
Substation Electricity	Customers
Smart Metering Roll Out	Customers
Core CAI	Network Length
Wayleaves	Network Length
Operational Training	MEAV
Vehicles and Transport	Network Length
Core BS	Network Length
IT & Telecoms (BS)	MEAV
Property Management (BS)	MEAV

Appendix 4 RIIO-ED2 disaggregated models summary

A4.1 We set out the activity and associated cost assessment method for each category in our RIIO-ED2 disaggregated models below.

Load-related expenditure (LRE)

A4.2 **Primary reinforcement** - hybrid approach using industry median unit cost benchmarks and volume ratio benchmarks (75%), supplemented by Engineering Justification Paper (EJP) adjustments (25%).

A4.3 **Secondary reinforcement** - unit cost benchmarking by asset type and voltage level, with reinforcement volumes benchmarked against forecast LCT demand growth calibrated to the FES 2022 System Transformation scenario. Separate adjustments applied for transformer types, circuit types, and proactive / reactive service reinforcement.

A4.4 **Fault level reinforcement** - combined approach disaggregated unit cost benchmarking by voltage and asset type, and MEAV benchmarking by network level. RIIO-ED1 and RIIO-ED2 data used with equal weighting across both methods.

A4.5 **Connections** - unit cost benchmarking by voltage and connection type, using RIIO-ED1 and RIIO-ED2 data. MPANs connected used as the cost driver. DNO-specific unit costs applied for two categories.

A4.6 **New Transmission Capacity Charges (NTCC)** - we carried out a qualitative review.

Non load-related expenditure

A4.7 **Asset replacement** - unit cost benchmarking using the industry median across RIIO-ED1 and RIIO-ED2. Volume assessment based on submitted workloads, supplemented by run-rate analysis and qualitative review.

A4.8 **Refurbishment** - unit cost benchmarking using the industry median across RIIO-ED1 and RIIO-ED2. Submitted volumes accepted in full.

A4.9 **Civil works (asset replacement driven**) - industry median benchmark using the ratio of total asset replacement driven civil works to total asset replacement expenditure and RIIO-ED1 and RIIO-ED2 data.

A4.10 **Civil works (condition driven)** - industry median benchmark per asset class using the ratio of annual average condition driven civil works volumes to their associated Total Asset Register asset volumes and RIIO-ED1 and RIIO-ED2 data.

A4.11 **Diversions** - industry median unit cost benchmark per diversion activity category and voltage using RIIO-ED2 data.

A4.12 **Rail diversions** - n/a.

A4.13 **Legal and safety** - ratio benchmarking, using MEAV as the cost driver and an industry median benchmark ratio based on RIIO-ED1 and RIIO-ED2 data. Other costs assessed separately through qualitative review.

A4.14 **Overhead line clearance** - industry median unit cost based on RIIO-ED1 and RIIO-ED2 data, complemented by engineering review to determine volume adjustments.

A4.15 **Electricity system restoration** - qualitative assessment, accepted costs as submitted.

A4.16 **Quality of Service (QoS) and North of Scotland Resilience (NoSR)** - disallowed all QoS costs. Accepted SSEH's remote generation capex costs at Battery Point following engineering review; NoSR costs reallocated to Worst Served Customers.

A4.17 **Physical security** - qualitative assessment, accepted costs as submitted, with PCD for SSEH control rooms.

A4.18 **Flood mitigation** - industry median unit cost based on RIIO-ED1 and RIIO-ED2 data, complemented by an engineering review to determine volume adjustments.

A4.19 **Rising and Lateral Mains (RLM)** - accepted submitted costs and volumes.

A4.20 **Worst Served Customers (WSC)** - ex ante UIOLI allowance set based on submitted costs.

A4.21 **Losses**:

i) **Transformer replacement** - RIIO-ED2 expert asset replacement industry median unit cost for the relevant asset type with engineering review to determine volume adjustments.

ii) **Other costs** - accepted in full.

A4.22 **Environmental reporting excluding PCBs** - either industry median or DNO own median unit cost benchmark depending on the cost category, based on RIIO-ED1 and RIIO-ED2 data. Some costs accepted as submitted or disallowed, following engineering review.

A4.23 **Polychlorinated Biphenyls (PCBs)** - assessed at an individual category level using either CV7 expert unit cost benchmark or industry median unit cost benchmark and RIIO-ED2 data. PMT replacement costs funded at ex ante and subject to a volume driver.

Non-Operational Capex

A4.24 **Small Tools, Equipment, Plant and Machinery (STEPM)** - industry median ratio benchmark with RIIO-ED1 and RIIO-ED2 data with qualitative review.

Network Operating Costs (NOCs)

A4.25 **Faults and Occurrences Not Incentivised (ONIs)** - regression analysis pooling Faults and ONIs costs using RIIO-ED1 and RIIO-ED2 data, and weighted Faults volumes and ONIs volumes as independent variables. RIIO-ED2 dummy time trend included.

A4.26 **Tree cutting** - for ENATS 43-8, industry median unit cost benchmark at individual voltage and category level using spans affected and RIIO-ED1 and RIIO-ED2 data. For ETR-132, industry median unit cost benchmark at sub-category level using RIIO-ED1 and RIIO-ED2 data. Volumes modelled on the run-rate of DPCR5 and RIIO-ED1 actuals.

A4.27 **Severe weather** - 1-in-20 - excluded from cost assessment. UIOLI with zero starting allowance.

A4.28 **Inspection and repairs and maintenance** - MEAV ratio benchmarking over RIIO-ED2, with industry median as the benchmark.

A4.29 **NOCs other**:

i) **Dismantlement** - MEAV ratio over RIIO-ED1 and RIIO-ED2, with industry median as the benchmark.

ii) **Substation electricity** - accepted submitted costs.

iii) **Remote generation ope**x - accepted submitted costs.

A4.30 **Smart meter rollout** - industry median unit cost benchmark based on RIIO-ED2 data.

Closely Associated Indirects (CAIs)

A4.31 **CAIs, excluding vehicle and transport** - regression analysis using RIIO-ED1 and RIIO-ED2 data with MEAV as an explanatory variable and a RIIO-ED2 time period dummy.

Business Support Costs (BSCs)

A4.32 **Core business support** - regression at DNO level using RIIO-ED1 and RIIO-ED2 data with MEAV as an explanatory variable and two linear time trends.

Pooled categories

Non load-related expenditure, Non-Operational Capex, Business Support

A4.33 **Operational, non-operational and business support Information Technologies and Telecommunications (IT&T)** - industry median benchmark ratio using a subset of MEAV as a cost driver based on RIIO-ED2 data. Installation of monitoring equipment assessed separately using an industry median unit cost approach.

Non-Operational Capex, Business Support Costs (BSCs)

A4.34 **Property** - industry median benchmark ratio using RIIO-ED1 and RIIO-ED2 data.

Non-Operational Capex, Closely Associated Indirects (CAIs)

A4.35 **Vehicles and transport** - DNO median ratio benchmark using network length as a driver and RIIO-ED1 and RIIO-ED2 data.