RIIO-ED1: Draft determinations for the slow-track electricity distribution companies

Business plan expenditure assessment

Supplementary annex to RIIO-ED1 overview paper

Publication date: 30 July 2014

Response deadline: 26 September 2014

Contact: Chris Watts

Team: RIIO-ED1

Tel: 0207 901 7333

Email: chris.watts@ofgem.gov.uk

Overview:

This document describes our methodology for the assessment of the business plan expenditure and results for the expenditures proposed in the settlement (draft determinations) for the five electricity distribution companies remaining in the price control review. The draft determinations are for the next price control (RIIO-ED1).

We have published this supplementary annex to provide further detail on our assessment of the companies' forecasts expenditures. Our assessment is summarised in the Overview document.

Context

In the RIIO-ED1 price control review we will set the outputs that the 14 electricity distribution network operators (DNOs) need to deliver for their consumers and the associated revenues they are allowed to collect. The review covers the eight year RIIO-ED1 price control period which lasts from 1 April 2015 to 31 March 2023.

In March 2013 we published our decision on the key elements of the regulatory framework (strategy) that the DNOs would need to understand in order to develop their business plans. The DNOs submitted their business plans in July, and in February 2014 we published our decision to set the price control of one group early. The remaining DNOs submitted revised plans in March. The documents we are publishing here summarise our assessment of these plans, and our draft determinations for the companies.

Associated documents

RIIO-ED1: Draft determinations for the slow-track electricity distribution companies – Overview
https://www.ofgem.gov.uk/publications-and-updates/riio-ed1-draft-determinations-consultation-slow-track-electricity-distribution-companies

RIIO-ED1: Draft determinations for the slow-track electricity distribution companies – supplementary annexes

- Assessment of the RIIO-ED1 re-submitted innovation strategies
- RIIO-ED1 business plan financial issues
- RIIO-ED1 draft determinations Financial Model
- RIIO-ED1 draft determinations detailed figures by company
- RIIO-ED1 draft determinations PWC advice on Ofgem's financeability assessment
- RIIO-ED1 Glossary

The supplementary annexes can be found on our website at the following link:
https://www.ofgem.gov.uk/publications-and-updates/riio-ed1-draft-determinations-consultation-slow-track-electricity-distribution-companies

Decision to fast-track Western Power Distribution
https://www.ofgem.gov.uk/ofgem-publications/86375/fast-trackdecisionletter.pdf

Assessment of RIIO-ED1 business plans and fast-tracking
https://www.ofgem.gov.uk/ofgem-publications/84600/assessmentofriio-ed1businessplansletter.pdf

Timing of decision on electricity distribution networks' revenue for 2015-16
https://www.ofgem.gov.uk/ofgem-publications/86768/ed1revenuechangedecision.pdf

Decision on our methodology for assessing the equity market return for the purpose of setting RIIO-ED1 price controls
https://www.ofgem.gov.uk/publications-and-updates/decision-our-methodology-assessing-equity-market-return-purpose-setting-riio-ed1-price-controls

Strategy Decision for RIIO-ED1 – Overview
https://www.ofgem.gov.uk/publications-and-updates/strategy-decision-riio-ed1-overview

Contents

1. Introduction

Overview

1.1. A key part of the RIIO (Revenue = Incentives + Innovation + Outputs) model is for companies to develop well-justified business plans. Following our decision to conditionally fast-track the four distribution network operators (DNOs) owned by Western Power Distribution (WPD), the remaining ten DNOs submitted and published their revised business plans on 17 March 2014 for the next electricity distribution price control (RIIO-ED1).[1]

1.2. The four WPD DNOs were assessed as the frontier based on our fast-track assessment. As part of their slow-track submissions the remaining ten DNOs have reduced their cost forecasts by over £700m and have provided further justification. WPD has not had this opportunity. WPD has provided updated narrative but the RIIO-ED1 numbers submitted have not changed. As we would expect, most DNOs have targeted meeting or exceeding the efficiency scores of WPD. In addition we have further refined our approach. This means that WPD's DNOs appear less efficient at the slow-track assessment. This is a predictable outcome of the fast-track process. We consider the overall benefits of fast-tracking are significantly greater than any apparent inefficiency of WPD at slow-track. Our comparative efficiency assessment has revealed further savings of over £650m the DNOs could have put in their business plans.

1.3. The WPD DNOs have been included in our slow-track assessment to provide a larger dataset. This improves the statistical benchmarking, the comparative assessment of unit cost and volumes and the comparative assessment of the narratives provided by all DNOs.

1.4. We describe the WPD DNOs in the assessment in a similar manner to the ten slow-track DNOs, but this is only for reference. The slow-track assessment does not change WPD's fast-track settlement.

Purpose and structure of this document

1.5. The purpose of this supplementary annex is to describe how we assessed the 'Resources (efficient expenditure)' criterion in slow-track assessment for RIIO-ED1. It contains details of our approach and key results from our analysis. It also includes details of refinements and changes since our fast-track assessment and our rationale.

1.6. The headline results are reported in Chapter 2 along with key results by each DNO. The remainder of the document is structured as follows:

- Chapter 3 provides an overview of the economic models we use.
- Chapter 4 discusses normalisations and other adjustments.
- Chapter 5 discusses the totex assessment.
- Chapters 6 to 10 set out the disaggregated assessment in detail.

---

[1] RIIO-ED1 begins on 1 April 2015 and ends on 31 March 2023.

- Chapter 6 covers load-related expenditure
    - Chapter 7 discusses asset replacement, refurbishment, civils and high value projects (HVPs)
    - Chapter 8 details our approach to non-core network investment
    - Chapter 9 discusses network operating costs (NOCs)
    - Chapter 10 discusses closely associated indirect (CAI) costs, business support costs (BSCs) and non-operational capex

  All forecast data reported in Chapters 6 to 11 is net before any normalisations (ie simply as submitted by the DNOs). the modelled view of submitted costs are net post reversal of normalisations, but before the application of real price effects (RPEs), smart grids adjustments and the interpolation under the Information Quality Incentive (IQI).
- Chapter 11 details our approach to smart grids and smart meters.
- Chapter 12 discusses our approach to adjusting for RPEs.

1.7. For the majority of chapters we use the following structure:

- the approach we used at fast-track
- key stakeholder comments following the fast-track assessment
- the approach we have used for the slow-track assessment
- the results of the slow-track assessment.

1.8. Figure 1.1 below provides a high level overview of the stages of our slow-track cost assessment with the chapters which provide the detail on each stage.

Figure 1.1: Stages of our slow-track approach and relevant chapters

Stage 1: Review and normalise all data. Exclude relevant data from the models.	Chapter 4
Stage 2: Run both totex models and the disaggregated model	Chapter 3 for summary Chapter 5 for totex models Chapters 6 to 10 for disaggregated models Appendix 2 for approach to econometric benchmarking Appendix 3 for statistical tests and regression results Appendix 4 for the calculation of the CSVs
Stage 3: Combine the results of 3 models	Chapter 3
Stage 4: Calculate and apply upper quartile	Chapter 3
Stage 5: Apply smart grids and RPE adjustments	Chapters 11 and 12

Notes

1.9. It is important that the following is considered when interpreting the findings in this supplementary annex:

- the slow-track assessment is different to the fast-track assessment in many areas and we would expect differences in results
- all DNOs except the four WPD have had the opportunity to resubmit data and justifications between fast-track to slow-track, again leading to an expectation of different results
- any figures presented in tables that relate to the four WPD licensees have been shaded in grey as their final allowances were set at fast-track.

DNO acronyms

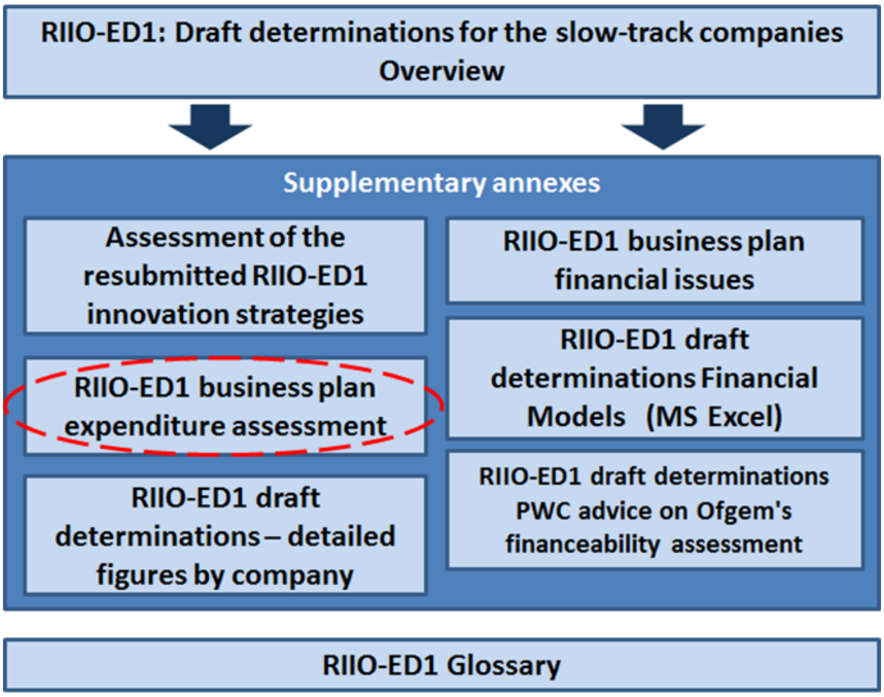
1.10. Table 1.1 provides a list of the DNO acronyms used in this annex.

Table 1.1: DNO acronyms

DNO Group		**DNO**	
ENWL	Electricity North West Limited	ENWL	Electricity North West Limited
NPg	Northern Powergrid	NPgN	Northern Powergrid: Northeast
		NPgY	Northern Powergrid: Yorkshire
WPD	Western Power Distribution	WMID	Western Power Distribution: West Midlands
		EMID	Western Power Distribution: East Midlands
		SWALES	Western Power Distribution: South Wales
		SWEST	Western Power Distribution: South West
UKPN	UK Power Networks	LPN	UK Power Networks: London Power Networks
		SPN	UK Power Networks: South East Power Networks
		EPN	UK Power Networks: Eastern Power Networks
SPEN	SPEN Energy Networks	SPD	SPEN Energy Networks: Distribution
		SPMW	SPEN Energy Networks: Manweb
SSEPD	Scottish and Southern Energy Power Distribution	SSEH	Scottish and Southern Energy Power Distribution: Scottish Hydro Electric Power Distribution
		SSES	Scottish and Southern Energy Power Distribution: Southern Electric Power Distribution

1.11. Figure 1.2 below shows all the RIIO-ED1 documents we have published today. There are links to all these documents in the 'Associated Documents' section at the top of this document.

Figure 1.2: Map of the RIIO-ED1 draft determinations documents



2. Headline results

Chapter Summary

High level results of our slow-track cost assessment, followed by more detailed results for each DNO.

High level results

2.1. The majority of slow-track DNOs have reduced expenditure from fast-track[2] and all took steps to improve the quality of their justification compared to fast-track. Table 2.1 shows that the ten slow-track DNOs reduced their requested totex by £711m in total. These figures include RPEs and smart grids savings.

Table 2.1: Fast-track and slow-track submitted totex (2012-13 prices)

DNO Group	DNO	Fast-track submitted totex (£m)	Slow-track submitted totex (£m)	Difference (slow-track minus fast-track) (£m)	(%)
ENWL	ENWL	1,900	1,877	-23.0	-1.2%
NPg	NPGN	1,365	1,391	26.8	2.0%
	NPgY	1,859	1,842	-17.5	-0.9%
WPD	WMID	2,070	2,070	-	-
	EMID	2,084	2,084	-	-
	SWALES	1,080	1,080	-	-
	SWEST	1,693	1,693	-	-
UKPN	LPN	1,968	1,961	-7.2	-0.4%
	SPN	1,897	1,859	-38.5	-2.0%
	EPN	2,861	2,765	-96.3	-3.4%
SPEN	SPD	1,740	1,564	-176.3	-10.1%
	SPMW	2,220	1,927	-293.4	-13.2%
SSEPD	SSEH	1,230	1,210	-20.0	-1.6%
	SSES	2,490	2,425	-64.6	-2.6%
Total		**26,458**	**25,747**	**-710.6**	**-2.7%**

2.2. The NPg group has increased its costs from fast-track to slow-track. This is largely the result of rail electrification costs which were not submitted at fast-track. We are proposing an uncertainty mechanism for these costs for all slow-track DNOs so have not included this amount in our assessment.

[2] NPg's costs increased from fast-track to slow-track due to its inclusion of ex ante costs for the costs of diversions caused by Networks Rail's electrification programme. It did not include any costs for this at fast-track.

2.3. We have used three economic models for our benchmarking: a top down totex model using high level drivers, a bottom up totex model using an aggregated driver based on the drivers used in the disaggregated analysis, and a disaggregated activity based model.

2.4. In reaching our overall results, we place 50 per cent weight on the totex models (25 per cent for the top down and 25 per cent for the bottom up totex model) and 50 per cent on the disaggregated model.

2.5. Table 2.2 details the weight given to each model and the time period we use to model the costs at the slow-track assessment.

Table 2.2: Slow-track models

Model	Weight	Time Period
Top down totex	25%	2010-11 to 2022-23
Bottom up totex	25%	2010-11 to 2022-23
Disaggregated activity level	50%	2010-11 to 2022-23*

*time periods vary on individual disaggregated models.

2.6. We present the following combined results by DNO and by group:

- our t view of efficient expenditure before the application of RPEs and smart grids savings
- our view of efficient expenditure after the application of RPEs and smart grids savings
- our final view of efficient expenditure after the application of the IQI
- the difference between DPCR5 spend and our final view of RIIO-ED1 efficient expenditure.

Pre application of RPEs and smart grids savings

2.7. Tables 2.3 (by DNO) and 2.4 (by group) show the results of our comparative cost assessment prior to the application of RPEs and smart grids savings.

2.8. These results place SPD at the frontier of the ten slow-track DNOs, with an efficiency score of 96 per cent, followed by ENWL. The least efficient DNO is SPMW, closely followed by LPN, all with a score of 111 per cent.

2.9. At the group level, ENWL sets the frontier 99 per cent and UKPN is the least efficient 107 per cent.

Table 2.3: Results of cost assessment prior to the application of RPEs and smart grids savings – by DNO (2012-13 prices)

			Modelled costs before application of UQ				Modelled costs after the application of the upper quartile before application of RPEs and smart grid adjustments (£m)	Difference (modelled minus forecast)		Efficiency scores before application of RPEs and smart grid adjustments
DNO Group	DNO	RIIO-ED1 slow-track submitted totex (£m)	Top-down totex (£m)	Bottom-up totex (£m)	Disagg. activity-level analysis (£m)	Combined based on 25%/25%/ 50% weighting (£m)		(£m)	(%)	
ENWL	ENWL	1,794	1,927	1,881	1,800	1,852	1,810	15.6	0.9%	0.99
NPg	NPGN*	1,300	1,340	1,322	1,219	1,275	1,246	- 53.9	-4.1%	1.04
	NPgY*	1,725	1,805	1,818	1,659	1,735	1,696	- 29.4	-1.7%	1.02
WPD	WMID	1,931	1,882	1,871	1,869	1,873	1,831	- 100.2	-5.2%	1.05
	EMID	1,945	2,101	2,057	1,917	1,998	1,953	8.3	0.4%	1.00
	SWALES	1,011	1,067	1,066	1,019	1,043	1,019	8.5	0.8%	0.99
	SWEST	1,582	1,383	1,432	1,520	1,464	1,431	- 151.6	-9.6%	1.11
UKPN	LPN	1,883	1,803	1,757	1,702	1,741	1,701	- 181.9	-9.7%	1.11
	SPN	1,783	1,808	1,770	1,672	1,731	1,691	- 92.0	-5.2%	1.05
	EPN	2,652	2,539	2,595	2,591	2,579	2,521	- 131.9	-5.0%	1.05
SPEN	SPD	1,496	1,662	1,653	1,519	1,589	1,553	56.7	3.8%	0.96
	SPMW	1,840	1,637	1,662	1,752	1,701	1,662	- 178.1	-9.7%	1.11
SSEPD	SSEH	1,170	1,107	1,112	1,126	1,118	1,092	- 78.0	-6.7%	1.07
	SSES	2,343	2,449	2,520	2,311	2,397	2,343	0.5	0.0%	1.00
Total		24,456	24,509	24,515	23,675	24,094	23,549	- 907.4	-3.7%	
Total exc WPD		**17,988**	**18,076**	**18,089**	**17,350**	**17,716**	**17,316**	**- 672.4**	**-3.7%**	

*Costs exclude rail electrification.

Table 2.4: Results of cost assessment prior to the application of RPEs and smart grids savings – by group (2012-13 prices)

		Modelled costs before application of UQ				Modelled costs after the application of the upper quartile before application of RPEs and smart grid adjustments (£m)	Difference (modelled minus forecast)		Efficiency scores before application of RPEs and smart grid adjustments
DNO Group	RIIO-ED1 slow-track submitted totex (£m)	Top-down totex (£m)	Bottom-up totex (£m)	Disagg. activity-level analysis (£m)	Combined based on 25%/25%/ 50% weighting (£m)		(£m)	(%)	
ENWL	1,794	1,927	1,881	1,800	1,852	1,810	15.6	0.9%	0.99
NPg*	3,025	3,145	3,139	2,877	3,010	2,942	- 83.4	-2.8%	1.03
WPD*	6,469	6,433	6,427	6,326	6,378	6,234	- 235.0	-3.6%	1.04
UKPN	6,319	6,149	6,121	5,965	6,050	5,913	- 405.7	-6.4%	1.07
SPEN	3,336	3,299	3,315	3,271	3,289	3,215	- 121.4	-3.6%	1.04
SSEPD	3,513	3,556	3,632	3,436	3,515	3,436	- 77.5	-2.2%	1.02
Total	24,456	24,509	24,515	23,675	24,094	23,549	- 907.4	-3.7%	
Total exc WPD	**17,988**	**18,076**	**18,089**	**17,350**	**17,716**	**17,316**	**- 672.4**	**-3.7%**	

*Costs exclude rail electrification.

Post application of RPEs and smart grids savings

2.10. Table 2.5 (by DNO) and 2.6 (by group) take into account RPE and smart grids adjustments. They also compare our view of efficient costs to the fast-track and the slow-track submissions.

2.11. At the DNO level, SPD is at the frontier of the slow-track DNOs, followed by SSES and ENWL. SPMW is the least efficient DNO followed by LPN. At the group level, ENWL is the frontier company and UKPN the least efficient of the slow-track DNO groups.

Table 2.5: Results of cost assessment including RPEs and smart grids savings - by DNO (2012-13 prices)

DNO Group	DNO	RIIO-ED1 slow-track submitted totex	(a) Result without RPEs or smart grids		(b) RPE adjustments		(c) Smart grid adjustments		Ofgem's efficient view of totex**	Efficiency scores after application of RPEs and smart grid adjustments
		(£m)	(£m)	% change to slow-track submitted	(£m)	% change to slow-track submitted	(£m)	% change to slow-track submitted	(£m)	
ENWL	ENWL	1,877	16	0.8%	- 90	-4.8%	-36	-1.9%	1,766	1.06
NPg	NPGN*	1,362	- 54	-4.0%	- 68	-5.0%	-37	-2.7%	1,203	1.13
	NPgY*	1,810	- 29	-1.6%	- 93	-5.1%	-44	-2.5%	1,643	1.10
WPD	WMID*	2,070	- 100	-4.8%	- 147	-7.1%	-46	-2.2%	1,777	1.16
	EMID*	2,084	8	0.4%	- 148	-7.1%	-18	-0.9%	1,926	1.08
	SWALES*	1,080	9	0.8%	- 74	-6.8%	-38	-3.5%	977	1.11
	SWEST*	1,693	- 152	-9.0%	- 116	-6.9%	-39	-2.3%	1,386	1.22
UKPN	LPN	1,961	- 182	-9.3%	- 85	-4.4%	-16	-0.8%	1,678	1.17
	SPN	1,859	- 92	-5.0%	- 83	-4.5%	-23	-1.2%	1,661	1.12
	EPN	2,765	- 132	-4.8%	- 123	-4.5%	-49	-1.8%	2,461	1.12
SPEN	SPD	1,564	57	3.6%	- 75	-4.8%	-42	-2.7%	1,504	1.04
	SPMW	1,927	- 178	-9.2%	- 95	-4.9%	-47	-2.5%	1,607	1.20
SSEPD	SSEH	1,210	- 78	-6.4%	- 45	-3.7%	-29	-2.4%	1,059	1.14
	SSES	2,425	0	0.0%	- 93	-3.8%	-73	-3.0%	2,260	1.07
Total		25,686	- 907	-3.5%	- 1,335	-5.2%	-536	-2.1%	22,908	
Total exc WPD		**18,760**	**- 672**	**-3.6%**	**- 850**	**-4.5%**	**-396**	**-2.1%**	**16,841**	

*Costs exclude rail electrification.
**Ofgem efficient view of totex in these tables is prior to interpolation. Our final view of DNO totex under the IQI mechanism is based on 75 per cent of the Ofgem view and 25 per cent of the DNO forecast.

Table 2.6: Results of cost assessment including RPEs and smart grids savings - by group (2012-13 prices)

DNO Group	RIIO-ED1 slow-track submitted totex	(a) Result without RPEs or smart grids		(b) RPE adjustments		(c) Smart grid adjustments		Ofgem's efficient view of totex**	Efficiency scores after application of RPEs and smart grid adjustments
	(£m)	(£m)	% change to slow-track submitted	(£m)	% change to slow-track submitted	(£m)	% change to slow-track submitted	(£m)	
ENWL	1,877	16	0	- 90	-4.8%	-36	-1.9%	1,766	1.06
NPg*	3,172	- 83	-2.6%	- 161	-5.1%	-81	-2.6%	2,846	1.11
WPD*	6,926	- 235	-3.4%	- 485	-7.0%	- 140	-2.0%	6,066	1.14
UKPN	6,584	- 406	-6.2%	- 292	-4.4%	- 88	-1.3%	5,799	1.14
SPEN	3,491	- 121	-3.5%	- 170	-4.9%	- 89	-2.5%	3,111	1.12
SSEPD	3,635	- 78	-2.1%	- 137	-3.8%	- 102	-2.8%	3,319	1.10
Total	25,686	- 907	-3.5%	- 1,335	-5.2%	- 536	-2.1%	22,908	
Total exc WPD	**18,760**	**- 672**	**-3.6%**	**- 850**	**-4.5%**	**- 396**	**-2.1%**	**16,841**	

* Costs exclude rail electrification.
**Ofgem efficient view of totex in these tables is prior to interpolation. Our final view of DNO totex under the IQI mechanism is based on 75 per cent of the Ofgem view and 25 per cent of the DNO forecast.

IQI and final Ofgem view of efficient expenditure

2.12. We have adjusted the break-even point in the IQI matrix to an IQI score of 102.9 rather than 100. This means that a DNO group that forecasts 2.9 per cent above our efficient cost benchmark and achieves its forecast will earn its cost of capital but no additional reward or penalty.

2.13. Table 2.7 describes the IQI matrix for the slow-track assessment, with Table 2.8 detailing the outcome of the IQI for each slow-track DNO group.

Table 2.7: IQI matrix

DNO:Ofgem Ratio	90	95	100	105	110	115	120	125	130
Efficiency Incentive	65%	63%	60%	58%	55%	53%	50%	48%	45%
Additional income (£/100m)	3.1	2.4	1.7	0.9	0.1	-0.8	-1.8	-2.8	-3.9
Rewards & Penalties									
Allowed expenditure	97.50	98.75	100.00	101.25	102.50	103.75	105.00	106.25	107.50
Actual Exp									
90	7.95	7.9	7.7	7.4	7.0	6.4	5.7	4.9	4.0
95	4.7	4.76	4.7	4.5	4.2	3.8	3.2	2.5	1.7
100	1.5	1.6	1.7	1.6	1.5	1.1	0.7	0.1	-0.6
105	-1.8	-1.5	-1.3	-1.2	-1.3	-1.5	-1.8	-2.2	-2.8
110	-5.1	-4.6	-4.3	-4.1	-4.1	-4.1	-4.3	-4.6	-5.1
115	-8.3	-7.7	-7.3	-7.0	-6.8	-6.7	-6.8	-7.0	-7.3
120	-11.6	-10.9	-10.3	-9.9	-9.6	-9.4	-9.3	-9.4	-9.6
125	-14.8	-14.0	-13.3	-12.7	-12.3	-12.0	-11.8	-11.7	-11.8
130	-18.1	-17.1	-16.3	-15.6	-15.1	-14.6	-14.3	-14.1	-14.1
135	-21.3	-20.2	-19.3	-18.5	-17.8	-17.2	-16.8	-16.5	-16.3
140	-24.6	-23.4	-22.3	-21.4	-20.6	-19.9	-19.3	-18.9	-18.6
145	-27.8	-26.5	-25.3	-24.2	-23.3	-22.5	-21.8	-21.2	-20.8
150	-31.1	-29.6	-28.3	-27.1	-26.1	-25.1	-24.3	-23.6	-23.1

Table 2.8: IQI results for the DNO groups (2012-13 prices)

DNO Group	DNO submitted	Ofgem UQ benchmark	IQI ratio	Allowed expenditure	Efficiency incentive rate	Ex ante reward/penalty	
	(£m)	(£m)		(£m)	%	% totex	(£m)
ENWL	1,877	1,766	106	1,794	57%	0.7%	13
NPG	3,172	2,846	111	2,928	54%	-0.2%	-5
UKPN	6,584	5,799	114	5,995	53%	-0.6%	-32
SP	3,491	3,111	112	3,206	54%	-0.3%	-10
SSE	3,635	3,319	110	3,398	55%	0.2%	5

2.14. Tables 2.9 and 2.10 present our view of efficient expenditure and our final view of efficient expenditure after the application of the IQI at DNO and group level.

2.15. The ten slow-track DNOs forecast £19,531 at fast-track. They reduced this to £18,760 at slow-track and we propose to allow £16,841 in draft determinations, a 7.7 per cent reduction from the slow-track forecast costs.

2.16. All slow-track DNOs have costs that we have judged not to be efficient. This ranged from 4.4 per cent for ENWL to 8.9 per cent for UKPN. On average we deem 7.7 per cent of the slow-track DNOs' forecast costs to be higher than our benchmark.

Table 2.9: Final view of efficient expenditure - by DNO (2012-13 prices)

DNO Group	DNO	RIIO-ED1 fast-track submitted totex	RIIO-ED1 slow-track submitted totex	Slow-track Ofgem view	RIIO-ED1 totex in draft determinations**	% reduction to slow-track submitted	Slow-track rank
		£m	£m	£m	£m	%	
ENWL	ENWL	1,900	1,877	1,766	1,794	-4.4%	2
NPg	NPgN*	1,365	1,362	1,203	1,243	-8.8%	7
	NPgY*	1,859	1,810	1,643	1,685	-6.9%	4
WPD	WMID*	2,070	2,070	2,070	2,070	-	-
	EMID*	2,084	2,084	2,084	2,084	-	-
	SWALES*	1,080	1,080	1,080	1,080	-	-
	SWEST*	1,693	1,693	1,693	1,693	-	-
UKPN	LPN	1,968	1,961	1,678	1,749	-10.8%	9
	SPN	1,897	1,859	1,661	1,710	-8.0%	5
	EPN	2,861	2,765	2,461	2,537	-8.3%	6
SPEN	SPD	1,740	1,564	1,504	1,519	-2.9%	1
	SPMW	2,220	1,927	1,607	1,687	-12.5%	10
SSEPD	SSEH	1,230	1,210	1,059	1,097	-9.4%	8
	SSES	2,490	2,425	2,260	2,301	-5.1%	3
Total		**26,458**	**25,687**	**23,769**	**24,248**	**-5.6%**	
Total exc WPD		**19,531**	**18,760**	**16,841**	**17,321**	**-7.7%**	

*Costs exclude rail electrification.
**Our final view of efficient totex is based 75 per cent on the Ofgem view and 25 per cent on the DNO forecast.

Table 2.10: Final view of efficient expenditure - by DNO group (2012-13 prices)

DNO Group	RIIO-ED1 fast-track submitted totex	RIIO-ED1 slow-track submitted totex	Slow-track Ofgem view	RIIO-ED1 totex in draft determinations**	% reduction to slow-track submitted	Slow-track rank
	£m	£m	£m	£m	%	
ENWL	1,900	1,877	1,766	1,794	-4.4%	1
NPg*	3,224	3,172	2,846	2,928	-7.7%	3
WPD*	6,927	6,927	6,927	6,927	-	-
UKPN	6,726	6,584	5,799	5,995	-8.9%	5
SPEN	3,960	3,491	3,111	3,206	-8.2%	4
SSEPD	3,720	3,635	3,319	3,398	-6.5%	2
Total	**26,458**	**25,687**	**23,769**	**24,248**	**-5.6%**	
Total exc WPD	**19,531**	**18,760**	**16,841**	**17,321**	**-7.7%**	

*Costs exclude rail electrification.
**Our final view of efficient totex is based 75 per cent on the Ofgem view and 25 per cent on the DNO forecast.

2.17. Tables 2.11 and 2.12 compare the annual average forecast costs in DPCR5 to the forecast costs at fast-track and slow-track.

Table 2.11: Annual average DPCR5 and RIIO-ED1 costs - by DNO (2012-13 prices)

DNO Group	DNO	DPCR5 totex (based on 4yrs actual)	DPCR5 totex (based on 4yrs actual, 1yr forecast)	RIIO-ED1 totex in draft determinations*	Difference (DPCR5 all years and RIIO-ED1)	
		£m	£m	£m	£m	%
ENWL	ENWL	240	244	224	-19.5	-8.0%
NPg	NPGN	160	163	155	-8.0	-4.9%
	NPgY	210	221	211	-10.8	-4.9%
WPD	WMID	270	275	259	-15.9	-5.8%
	EMID	262	262	260	-1.1	-0.4%
	SWALES	124	125	135	10.3	8.3%
	SWEST	179	182	212	29.2	16.0%
UKPN	LPN	209	220	219	-1.5	-0.7%
	SPN	226	228	214	-14.6	-6.4%
	EPN	340	344	317	-26.9	-7.8%
SPEN	SPD	194	198	190	-7.8	-3.9%
	SPMW	227	239	211	-27.7	-11.6%
SSEPD	SSEH	123	125	137	11.9	9.5%
	SSES	271	283	288	4.7	1.7%
Total		**3,035**	**3,109**	**3,031**	**-77.5**	**-2.5%**
Total exc WPD		**2,201**	**2,265**	**2,165**	**-100.0**	**-4.4%**

Table 2.12: Annual average DPCR5 and RIIO-ED1 costs - by DNO Group (2012-13 prices)

DNO Group	DPCR5 totex (based on 4yrs actual)	DPCR5 totex (based on 4yrs actual, 1yr forecast)	RIIO-ED1 totex in draft determinations*	Difference (DPCR5 all years and RIIO-ED1)	
	£m	£m	£m	£m	%
ENWL	240	244	224	-19.5	-8.0%
NPG	370	385	366	-18.8	-4.9%
WPD	834	843	866	22.5	2.7%
UKPN	775	792	749	-42.9	-5.4%
SPEN	421	436	401	-35.5	-8.1%
SSEPD	394	408	425	16.6	4.1%
Total	**3,035**	**3,109**	**3,031**	**-77.5**	**-2.5%**
Total exc WPD	**2,201**	**2,265**	**2,165**	**-100.0**	**-4.4%**

Key results by DNO

2.18. We summarise below the high level results for each of the ten slow-track DNOs. We present five key results:

- the change from fast-track to slow-track forecast costs (summarised in Table 2.1)
- the findings from each of our three benchmarking models and our combined assessment after the application of the upper quartile (UQ) (Tables 2.3 and 2.4)
- our view of RPE and smart grids adjustments (Tables 2.5 and 2.6)

- our final expenditure view of efficient expenditure after applying all adjustments (Tables 2.9 and 2.10), and
- the difference between DPCR5 spend and our view of efficient RIIO-ED1 expenditure (Tables 2.11 and 2.12).[3]

ENWL

2.19. ENWL cut £23m from its fast-track submission in its slow-track submission.

2.20. It performs well in our comparative benchmarking models with our combined UQ benchmark 0.9 per cent higher than ENWL's submitted forecast. It performs well on all our models, with strongest performance in both our totex models. It is the frontier DNO group and is ranked 2nd of all 14 DNOs in this assessment.

2.21. As with other DNOs it has submitted high RPE forecasts and has not identified sufficient smart grids savings. Our modelling suggests £90m and £36m of further savings could be made to ENWL's submitted costs to reflect our view of RPE and smart grids adjustments.

2.22. Our final view of efficient expenditure taking these factors into account is 4.4 per cent below ENWL's forecast. ENWL ranks 2nd of the ten slow-track DNOs and is at the frontier of the 5 DNO groups.

2.23. Our efficient view of annual average expenditure for RIIO-ED1 is 8.0 per cent lower than the annual average DPCR5 expenditure.

NPgN

2.24. NPgN increased its slow-track submission by £27m from fast-track. This increase is due to costs for rail electrification which were not part of the fast-track submission.

2.25. In our comparative benchmarking our combined UQ benchmark is 4.1 per cent lower than NPgN's submitted forecast. It performs well on both our totex models but we have identified some potential inefficiencies in our disaggregated modelling.

2.26. We believe that NPgN could make £68m and £37m of further savings to reflect RPE and smart grids adjustments, respectively.

2.27. Our final view of efficient expenditure is 8.8 per cent below NPgN's forecast. NPgN ranks 7th of the ten slow-track DNOs in our slow-track assessment.

2.28. Our view of efficient annual average expenditure for RIIO-ED1 is 4.9 per cent lower than the annual average DPCR5 expenditure.

---

[3] DPCR5 costs are based on the actual costs for the first four years of DPCR5 and the forecast costs for the final year.

NPgY

2.29. NPgY reduced its slow-track submission by £18m (1 per cent) from fast-track. Savings have been made in some areas from fast-track to slow-track but the introduction of rail electrification costs in the slow-track submission means that the overall reduction is relatively small.

2.30. In our comparative benchmarking our combined UQ benchmark is 1.7 per cent lower than NPgN's submitted forecast. NPgN performs well on both our totex models but we have identified some potential inefficiencies in our disaggregated modelling.

2.31. Our modelling suggests £93m and £44m of further savings could be made to NPgY's submitted costs to reflect our view of RPE and smart grids adjustments, respectively.

2.32. Our final view of efficient expenditure is 6.9 per cent below NPgN's forecast. NPgY ranks 4th of the ten slow-track DNOs in our slow-track assessment.

2.33. Our efficient view of annual average expenditure for RIIO-ED1 is 4.9 per cent lower than the annual average DPCR5 expenditure.

LPN

2.34. LPN reduced its slow-track submission by £7m (0.4 per cent) from fast-track.

2.35. In our comparative benchmarking our combined UQ benchmark is 9.7 per cent lower than LPN's submitted forecast. Our modelled costs in all three models are lower than LPN's submitted costs, with performance worse in the disaggregated model.

2.36. We believe LPN can make further savings of £85m and £16m to reflect our view of RPE and smart grids adjustments, respectively.

2.37. Our final view of efficient expenditure is 10.8 per cent below LPN's forecast. LPN ranks 9th of the ten DNOs in our slow-track assessment.

2.38. Our efficient view of annual average expenditure for RIIO-ED1 is 0.7 per cent lower than the annual average DPCR5 expenditure for LPN.

SPN

2.39. SPN reduced its slow-track submission by £39m (2.0 per cent) from fast-track.

2.40. Our combined UQ benchmark is 5.2 per cent lower than SPN's submitted forecast. Our modelled costs are lower than SPN's submitted costs for both the bottom up totex and disaggregated models. SPN performs better in the top down totex model.

2.41. Our modelling suggests £83m and £23m of further savings could be made to SPN's submitted costs to reflect our view of RPE and smart grids adjustments, respectively.

2.42. Our final view of efficient expenditure is 8.0 per cent below SPN's forecast. SPN ranks 5th of the ten DNOs in our slow-track assessment.

2.43. Our efficient view of annual average expenditure for SPN for RIIO-ED1 is 6.4 per cent lower than the annual average DPCR5 expenditure.

EPN

2.44. EPN reduced its slow-track submission by £96m (3.4 per cent) from fast-track.

2.45. In our comparative benchmarking our combined UQ benchmark is 5.0 per cent lower than EPN's submitted forecast. Our modelled costs in all three models are lower than EPN's submitted costs, with performance worse in the top down totex model.

2.46. We believe EPN can make further savings of £123m and £49m to reflect our view of RPE and smart grids adjustments, respectively.

2.47. Our final view of efficient expenditure is 8.3 per cent below EPN's forecast. EPN ranks 6th of the ten DNOs in our slow-track assessment.

2.48. Our efficient view of annual average expenditure for EPN for RIIO-ED1 is 7.8 per cent lower than the annual average DPCR5 expenditure.

SPD

2.49. SPD reduced its slow-track submission by £176m (10.1 per cent) from fast-track.

2.50. Our combined UQ benchmark is 3.8 per cent higher than SPD's submitted forecast. It performs well across all three models, with strongest performance in the two totex models.

2.51. We believe further savings of £75m and £42m can be made by SPD to reflect RPEs and smart grids adjustments.

2.52. Our final view of efficient expenditure is 2.9 per cent below SPD's forecast. SPD is at the frontier of all ten slow-track DNOs.

2.53. Our efficient view of annual average expenditure for SPD for RIIO-ED1 is 3.9 per cent lower than the annual average DPCR5 expenditure.

SPMW

2.54. SPMW reduced its slow-track submission by £293m (13.2 per cent) from fast-track.

2.55. Unlike SPD, SPMW performs poorly in our comparative benchmarking. Our combined UQ benchmark is 9.7 per cent lower than SPMW's submitted forecast. Our modelled costs in all three models are lower than SPMW's submitted costs for SPMW, with the difference greater for the two totex models.

2.56. We believe further savings of £95m and £47m can be made by SPMW to reflect RPEs and smart grids adjustments.

2.57. Our final view of efficient expenditure is 12.5 per cent below SPMW's forecast. Our assessment places SPMW as the least efficient of the ten slow-track DNOs.

2.58. Our efficient view of annual average expenditure for SPMW for RIIO-ED1 is 11.6 per cent lower than the annual average DPCR5 expenditure.

SSEH

2.59. SSEH reduced its slow-track submission by £20m (1.6 per cent) from fast-track.

2.60. Our combined UQ benchmark is 6.7 per cent lower than SSEH's submitted forecast. Our modelled costs in all three models are lower than SSEH's submitted costs, ranging from 3.8 to 5.4 per cent of SSEH's forecast costs.

2.61. We believe further savings of £45m and £29m can be made by SSEH to reflect RPEs and smart grids adjustments.

2.62. Our final view of efficient expenditure is 9.4 per cent below SSEH's forecast. SSEH ranks 8th of the ten DNOs in our slow-track assessment.

2.63. Our efficient view of annual average expenditure for SSEH for RIIO-ED1 is 9.5 per cent higher than the annual average DPCR5 expenditure.

SSES

2.64. SSES reduced its slow-track submission by £65m (2.6 per cent) from fast-track.

2.65. Our combined UQ benchmark is 0.02 per cent higher than SSES's submitted forecast. It performs across all models, particularly in the two totex models.

2.66. We believe further savings of £93m and £73m can be made by SSES to reflect RPEs and smart grids adjustments.

2.67. Our final view of efficient expenditure is 5.1 per cent below SSES's forecast. SSES ranks 3rd of our ten slow-track DNOs.

2.68. Our efficient view of annual average expenditure for SSES for RIIO-ED1 is 1.7 per cent higher than the annual average DPCR5 expenditure.

3. Summary of slow-track cost assessment models

Chapter Summary

An overview of the cost assessment models we adopt and how we combine the results of these models. It details the main changes from our fast-track assessment and the reasons for these changes.

Overview of our expenditure assessment methodology

3.1. Building on the fast-track assessment, we have again applied a broad toolkit approach to our cost assessment at slow-track. We continued to make use of quantitative and qualitative assessment, DNO narrative and supporting evidence, historical cost and performance data and company forecasts. We carried out benchmarking at the totex level and at the disaggregated level. This was to ensure no single approach was deterministic in setting our view of the efficiency of DNOs' expenditure.

3.2. We made greater use of qualitative evidence in our disaggregated analysis at slow-track and where appropriate made adjustments to our quantitative benchmarking. We also had a number of meetings with the DNOs prior to and during the slow-track review.

3.3. This chapter reviews our approach to the cost assessment models. For details of our approach to the IQI and adjustments for RPEs and smart grids savings, please refer to Chapter 4 of the Overview document.

Cost assessment models

Fast-track assessment

3.4. For our fast-track assessment we carried out comparative analysis at a totex level (using two different totex models) and on a cost activity level basis (using disaggregated modelling).

3.5. For both totex models and for the majority of elements in the disaggregated model we estimated the parameters of each cost model using historical data and then rolled these forward to take account of forecast RPEs and changes in volumes and outputs.

3.6. For all three models we benchmarked the efficient level of totex for each DNO using the UQ for each model separately rather than the frontier. This allowed for other factors that influence the DNOs' costs to be taken into account. For our disaggregated analysis we summed forecast and modelled costs back up to the totex level and calculated an overall efficiency for each DNO before calculating the UQ benchmark. This reduced the risk of cherry-picking between activities.

Key comments on the fast-track assessment

3.7. Chapter 5 provides detail on the comments we received on the totex models and Chapters 6 to 10 provides the detailed comments on the disaggregated analysis.

3.8. We received general comments and suggestions covering both totex models and the disaggregated approach:

- placing greater weight on the totex models
- placing greater weight on historical efficiency
- the need for data cleansing, particularly ensuring that the input and cost driver data is reliable
- questioning statistical properties of regression analysis, with the use of regressions with low R-squared
- the need to clearly justify the use of scalars and ratchets to reduce our base model costs
- a general call for greater transparency, especially with regards to qualitative adjustments.

3.9. Comments specific to the totex models centred on:

- greater clarity on our approach to calculating the macro and bottom up composite scale variables (CSVs)
- the activities that should be excluded/included in the totex regressions.

3.10. Specific comments on the disaggregated analysis were:

- for load-related expenditure it was suggested that we: should account for past as well as future load growth for the assessment of primary and secondary reinforcement; should not use modern equivalent asset value (MEAV) in the modelling for secondary reinforcement; and should not use unit cost benchmarking for EHV connections
- for asset replacement it was suggested that we should: make greater use of the survivor modelling rather than run rates volume assessment; use an age profile that considers both historical and forecast data; review some of the combinations of unit costs for some asset replacement categories; undertake qualitative adjustments on a line-by-line basis; and take greater account of trade-offs between asset replacement and refurbishment
- for refurbishment there was a call for greater consistency in the unit cost rather than a mixture of mean, median and expert view run rates.
- for CAI costs it was suggested that: weighted MEAV as a cost driver should not be used and other cost drivers should be considered; and the analysis should be run at a company group level as well as at DNO level
- for BSCs it was suggested that we: review the approach to the fixed costs normalisation; include insurance costs in the modelling; and use only endogenous cost drivers
- for IT and telecoms (IT&T) DNOs suggested that we employ an expert to assess IT&T costs
- for troublecall and ONIs DNOs stated that benchmarking of fault rates to the median was inappropriate.

Revised approach for the slow-track assessment

Top down totex model

3.11. For the top down totex model we continue to use regression analysis to determine efficient costs relative to a CSV. The key differences from the fast-track approach are that the CSV is now a combination of MEAV and customer numbers and we use a time trend because we are using a longer period of data. We use statistical techniques to derive the weights to apply to each element (see Appendix 4 for more detail). We are able to use MEAV[4] rather than weighted MEAV because the slow-track data is more robust than at fast-track.

3.12. We use 13 years of data (five years of DPCR5 and eight years of RIIO-ED1). We consider that this better takes account of the scope for efficiency savings which are reflected in the DNO data. At fast-track we only used three years of historical data for DPCR5 to estimate the model parameters as there were data issues with the forecast cost drivers and the models using forecast data performed poorly in terms of our statistical tests. We also applied a scaling adjustment to bring our modelled results into line with the total industry forecast.

3.13. The use of 13 years of data is more consistent with our disaggregated benchmarking where we have made extensive use of forecast data. There are a number of areas, notably CAI costs and BSCs, where DNOs are making significant savings in RIIO-ED1. These savings would not be reflected if we base our analysis only on historical data. That was the rationale for applying high level scalars at fast-track to bring our modelled costs into line with the total industry forecast.

3.14. We identified a small number of areas where we consider it is appropriate to exclude costs from the totex benchmarking. These are detailed in Chapter 4.

Bottom up totex model

3.15. Given the limitations of the high level CSV we also constructed an alternative totex model. The bottom up totex model also uses 13 years of data and excludes the same cost activities as the top down totex model. It includes a time trend. The key difference between the two is the cost drivers used to estimate efficient costs. The bottom up totex models aggregates drivers used in the disaggregated analysis into a single cost driver.

Disaggregated model

3.16. The disaggregated analysis incorporates a mixture of cost assessment techniques including regression analysis, ratio analysis, trend analysis and technical assessment. The approach is tailored to the activity being assessed. In particular, for asset

---

[4] MEAV used throughout slow-track excludes the following assets in its calculation: rising and lateral mains (RLM), LV service associated with RLM, batteries at ground mounted HV substations, batteries at 33kV substations, batteries at 66kV substations, batteries at 132kV substations, pilot wire overhead, pilot wire underground, cable tunnels (DNO owned), cable bridges (DNO owned), and electrical energy storage. These exclusions have ensured greater consistency in the data between DNOs.

replacement we continue to use a bespoke age-based model to assess a substantial part of the asset replacement costs.

3.17. We have considered a number of key issues raised following the fast-track assessment.

3.18. For asset replacement at fast-track we put approximately one third of asset categories into the age-based model and used historical run rates for the remaining two-thirds. This was criticised by the DNOs. They argued we were not taking sufficient account of the age or condition of their assets or the justification provided in their narrative. We now include two thirds of asset categories within the model and together with our expert engineering consultants, DNV GL, have completed a detailed qualitative assessment. This involved cross-checking our model results against historical and forecast information, secondary deliverables for asset health and criticality, scheme papers and other justification. Where appropriate we make qualitative adjustments to our modelled results to take this into account.

3.19. We ensure greater consistency between refurbishment and replacement, and scrutinise individual schemes in detail, such as moving outdoor equipment indoors (see Appendix 6 for more detail).

3.20. We conducted a detailed review of load-related expenditure looking at whether particular schemes are justified and assessing the appropriateness of unit costs. Our engineering consultants analysed a range of scheme papers and we adjusted our modelling to reflect their conclusions.

3.21. For other areas of network investment, we adopt a bespoke approach considering the engineering evidence in conjunction with our engineering consultants, who provide detailed input where required and high level sense checking elsewhere.

3.22. For BSCs and CAI costs we have considered the comments received on the cost assessment technique, cost drivers, time periods, level of aggregation of activities, group versus DNO level analysis, and fixed cost adjustments. In finalising our approach we undertook significant testing of all the alternatives, reviewed economic literature and reviewed previous Ofgem practice.

3.23. The majority of BSCs are assessed at an aggregate level using ratio benchmarking based on 13 years of data for the DNO groups. We use MEAV as the cost driver. We do not apply a singleton adjustment for fixed costs. IT and telecoms are assessed separately with a combination of ratio analysis and consultant's qualitative views.

3.24. For CAIs, we use a combination of regression analysis, ratio analysis, run rate analysis and qualitative review. Eight categories of CAI costs are aggregated and assessed using regression analysis. The regression has been run using eight years of forecast data for RIIO-ED1. As detailed in Chapter 10, a model based on DPCR5 data provides most DNOs with significantly greater modelled costs than their forecast costs. Models that combine DPCR5 and RIIO-ED1 do not pass our statistical tests due to a structural break in the data. At fast-track we applied a scaling adjustment to bring our modelled results into line with the total industry forecast and this was criticised. Using forecast data means that this is no longer required. We consider that modelling based on RIIO-ED1 data is an improved approach for the slow-track assessment that fully reflects the scope for efficiency savings during RIIO-ED1.

3.25. For network operating costs (NOCs) we are now holding DNOs to their historical fault rates rather than benchmarking fault rates across the DNOs. This recognises differences across networks and ensures greater consistency with the approach in the Interruptions Incentive Scheme (IIS), which uses 10 year averages for EHV and 132kV customer interruptions (CI) and customer minutes lost (CML).

Combining the results of our totex and activity level assessment

Fast-track assessment

3.26. As noted above, at fast-track we conducted a separate analysis for each of our three cost assessment models. We applied our assumptions of RPEs to each of these models and then calculated the UQ for each model separately. We finally combined all models by giving a 12.5 per cent weighting to each of the totex models and a 75 per cent weighting to our disaggregated analysis.

3.27. We adjusted the final UQ efficiency scores to take into account cases where companies had offered up tighter CI or CML targets than our benchmarking methodology process. These were valued at the relevant incentive rates. We adjusted the efficiency level to ensure our testing was robust to downside cost of equity scenarios.

Sensitivity analysis

3.28. We carried out a range of sensitivity analyses in our quantitative work to ensure the appropriateness of our assessment. These sensitivities gave us confidence that the overall conclusions were appropriate.

Key comments on the fast-track assessment

3.29. Most DNOs suggested that there should be greater weight on the totex modelling as this was a more appropriate approach. They noted that there were much higher levels of R-squared in the totex regressions and there were a number of weaknesses in the activity level assessment. Others suggested that we should continue to place greater weight on the disaggregated analysis.

Revised approach for the slow-track assessment

3.30. We have made a number of changes to how we bring our cost modelling together for the slow-track assessment.

3.31. At slow-track the DNOs made major improvements to the quality of their business plan data and we have undertaken intensive scrutiny of the information following the submissions through our supplementary question and answer process. The totex models now cover the full 13-year period which we consider both takes into account the latest DPCR5 information and better reflects efficiencies over the RIIO-ED1 period. We therefore have more confidence in the totex models and think we should give them greater weight. We are now applying a 25 per cent weighting to each of our totex models and a 50 per cent weighting to our disaggregated activity-based modelling.

3.32. We benchmark the efficient level of totex for each DNO using the UQ rather than the frontier to allow for other factors that may influence the DNOs' costs. The UQ level of efficiency (lower quartile level of costs) is the 25th percentile in the distribution of efficiency scores. At fast-track we calculated the UQ for each of our three models, and then combined the results. For slow-track we have assessed the UQ after we have combined the results from the three models. This addresses the risk that the combination of three separate UQ benchmarks might result in a benchmark that is tougher than any DNO forecasts.

3.33. This method works well for areas of costs where there are differences in efficiency across companies and forecasts reveal information about comparative efficiency across the DNOs. It does not cater for instances where we consider all the DNOs to be inefficient. This is the case for the RPEs and smart grids assessments. We have therefore applied the RPE and smart grids adjustments after the application of the UQ.

Fast-track vs. slow-track approach

3.34. Figure 3.1 is a high level summary of the approach we used at fast-track and at slow-track.

Figure 3.1: Fast-track vs. slow-track approach

	Fast-track		Slow-track
Submitted information	Review all data and documentation.	**Submitted information**	Review all data and documentation.
Cleansing and adjustments	Apply normalisations and regional cost adjustments to ensure benchmarking DNOs on a comparable basis. Exclude certain costs.	**Cleansing and adjustments**	Apply normalisations and regional cost adjustments to ensure benchmarking DNOs on a comparable basis. Exclude certain costs.
Run totex models	Run totex regression models based on three years' historical data (2010-11 to 2012-13) Top down totex model: high level driver Bottom-up totex model: activity level driver.	**Run totex models**	Run totex regression models based on 13 years' of data (2010-11 to 2022-23). Top down totex model: high level driver Bottom-up totex model: activity level driver.
Run disagg. model	For non-regressed cost activities carried out quantitative, qualitative and technical assessment to determine efficient costs. For regressed activities run regression models. Sum the results.	**Run disagg. model**	For non-regressed cost activities carried out quantitative, qualitative and technical assessment to determine efficient costs. For regressed activities run regression models. Sum the results.
RPEs	Add Ofgem's view of RPEs to derive modelled costs.	**Combine all 3 models**	Combine the three models applying 25% weight to each totex model and 50% weight to disaggregated model.
Calculate UQ	Calculate efficient costs at the UQ level of performance for each model separately, measured as the ratio of total submitted costs to total modelled costs for each DNO.	**Calculate UQ**	Calculate efficient costs at the UQ level of performance for 3 models combined, measured as the ratio of total submitted costs to total modelled costs for each DNO.
Reverse adjustments	Add back an efficient view of normalisations/adjustments.	**Reverse adjustments**	Add back an efficient view of normalisations/adjustments.
Apply UQ	Apply UQ to calculate efficient costs for all 3 models.	**Apply UQ**	Apply UQ to total costs of all 3 models to calculate efficient costs.
Combine all 3 models	Combine the three models applying 12.5% weight to each totex model and 75% weight to disaggregated model.	**RPEs and smart grids**	Add Ofgem's view of RPEs and smart grids to derive modelled costs.
Efficient costs	Apply 75% of Ofgem view and 25% DNO view.	**Efficient costs**	Apply 75% of Ofgem view and 25% DNO view.
Monetisation of outputs	Adjustment for monetisation of higher CI/CML targets offered by some DNOs and the downside cost of equity scenarios.		

4. Normalisations and other adjustments

Chapter Summary

A description of the normalisation and cost adjustments we make to costs prior to benchmarking.

Question 1: Do you agree with our approach to regional labour cost adjustments?
Question 2: Do you agree with our approach to adjusting for company specific factors?
Question 3: Do you agree with the costs excluded from our totex assessment?

Overview

4.1. In both fast-track and slow-track assessments we considered whether DNOs' submitted data required adjustments to ensure that the comparisons for our benchmarking are on a like-for-like basis. Where we decided that adjustments were appropriate, we adjusted company forecast costs before our totex and disaggregated assessments.

4.2. Our adjustments fall into the following categories:

- regional labour cost adjustments on the basis that operating in certain parts of the country attracts significantly higher labour costs
- company specific factors – additional costs associated with operating particular DNO networks
- other adjustments where we have concerns with the robustness of the data or to bring DNOs onto a consistent basis
- exclusion of costs that are inappropriate for comparative benchmarking because they are only incurred by a small number of DNOs, where costs are not explained by cost drivers that are being used or where there is a substantial change in the nature of costs between DPCR5 and RIIO-ED1
- exclusion of costs outside the price control where the costs relate to activities that should not be funded through the price control.

Regional labour cost adjustments

Fast-track assessment

4.3. In our RIIO-ED1 fast-track assessment we applied a higher hurdle for regional labour adjustments and company specific factors compared to previous network price controls. Companies were required to provide appropriate quantitative evidence of cost differentials as part of their well justified business plans and explain what steps they were taking to mitigate these costs differences.

4.4. We considered the evidence presented by the DNOs and our own internal analysis on regional labour cost adjustments and decided that it was reasonable to make some regional labour adjustments prior to carrying out our cost benchmarking.

4.5. Labour cost differentials exist between London, the South East and elsewhere in Great Britain and we calculated labour indices using the Office of National Statistics (ONS) Annual Survey of Hourly Earnings (ASHE) data. We took into account the additional labour costs associated with working in London and the South East and considered the proportion of work that is done in these areas and elsewhere. These adjustments affected all DNOs.

Key comments on the fast-track assessment

4.6. One DNO felt that rather than applying an adjustment for London and the South East only, different wage indices should be developed for each area of the country. Another thought that the adjustment overstated the impact of London and the South-East, and that differences between the weightings for different types of employee were not credible. This DNO also felt that the weights on the amount of work carried out locally appeared to be arbitrary.

Revised approach for the slow-track assessment

4.7. We maintained our fast-track approach to regional labour adjustments for the slow-track assessment. This is consistent with the approach we used in RIIO-GD1. We do not consider that there is sufficient evidence to support applying regional wage differentials for each region of the UK given the mobility in the labour market.

Company-specific factors

Fast-track assessment

4.8. Four DNOs proposed company-specific factors they considered should be taken into account in our fast-track assessment.

4.9. SSEPD provided evidence of additional costs associated with working in remote Highland and Island areas of Scotland. We considered that the submission was generally sound and included 92 per cent of its proposed adjustments in our benchmarking models.

4.10. UKPN included costs associated with working in London in addition to the regional labour case. These costs were divided into a number of distinct areas:

- transport and travel – it argued that there are significant additional costs associated with London congestion charging, the application of parking fines in Central London and increased costs associated with servicing vehicles in London. It also indicated there are additional costs associated with delivery of large items of plant in London.
- excavation – it suggested that there are significantly higher costs associated with excavations in the London area.
- security – it argued that there are significant additional costs associated with preparation of major events and the rescheduling of planned work as a result of these.
- property – it identified additional insurance required for its properties in the London area.
- resourcing and contracting – it suggested that there are significant additional costs of working in the London area including different labour rates, transport, travel costs and standby charges.

4.11. We accepted 32 per cent[5] of UKPN's proposed adjustment for LPN, taking into account limitations in the evidence that they provided and overlaps with other adjustments. We assessed the additional direct and contract labour costs associated with working in London separately as part of the regional labour adjustment. We also assessed streetwork costs separately.

4.12. SPEN indicated that there are additional costs associated with operating and maintaining the interconnected network in its SPMW licence area. It noted that SPMW has smaller transformers than the industry standard, which are run constantly interconnected at all voltages. It also noted that standard cable sizes are used throughout. It notes that around 55 per cent of the SPMW network is designed and run as an X-Type network, solidly interconnected at 33kV, 11kV and LV, rather than the more conventional Y-Type network.

4.13. SPEN stated that the SPMW network has greater complexity, involves more components and is more expensive to construct and maintain than the standard industry network design. It suggested that its network is 30 per cent more costly to run than a standard design, but did not put forward sufficient quantitative evidence to show how this figure had been calculated or how they would mitigate it.

4.14. On this basis we decided not to apply a company specific factor at the fast-track assessment for SPMW.

4.15. ENWL is the only DNO operating a single licence. It proposed we make an adjustment for fixed costs associated with running a network as part of our analysis. It proposed that single licensees are unable to obtain economies of scale and as such fixed costs may be higher than those for groups with multiple licensees. Our view was that single DNO status is not an inherent characteristic and ENWL proposed no means of protecting their customers should their status change. We undertook sensitivity analysis on the basis of ENWL's view of fixed costs as part of our overall benchmarking for fast-track. ENWL remained above our benchmark under these sensitivities. The evidence that ENWL presented for our fast-track assessment was not sufficiently compelling for us to incorporate it.

Key comments on the fast-track assessment

4.16. SPEN put forward a significantly more detailed and defensible case for the SPMW special case at slow-track.

4.17. ENWL disagreed with our view not to allow fixed costs adjustments for smaller DNO groups. For slow-track it again put forward the case for a fixed cost adjustment and proposed a licence condition removing this uplift if it is subsequently bought by another DNO group.

4.18. Some DNOs felt it was inappropriate for fixed cost normalisations for BSCs to be the same for each DNO. One DNO suggested that although fixed costs rise with the size of the DNO group, they do not rise proportionally as the number of DNOs in the group increases.

---

[5] This excluded streetworks and labour costs.

Revised approach for the slow-track assessment

4.19. SSEPD, UKPN, and SPEN have submitted updated cases for company specific adjustments with their slow-track business plans. UKPN has included additional costs associated with its network strategy including additional costs for a 24 hour a day operational presence and enhanced inspections and maintenance programme in the London region. As for the fast-track assessment, we have assessed labour costs separately.

4.20. SPEN included additional supporting evidence for their SPMW special case and proposed adjustments for specific cost areas. It has determined the value of their submitted operating costs for SPMW through using two methods, a bottom up totex modelling approach, based on a comprehensive evaluation of development stages of both interconnected and radial networks, and a top down theoretical modelling approach.

4.21. We, along with our technical consultants have reviewed all of the company-specific cases to assess the need for a special case.

4.22. For SSEPD, we agreed with 83 per cent of their submitted company-specific costs (compared to 92 per cent at fast-track). The difference from our fast-track assessment, is mainly due to the reassessment of the forecast costs for IT&T from our technical experts. We assessed SSEPD's case for fixed diesel generation and subsea cable costs separately.

4.23. We accept 41 per cent of UKPN's claims for LPN.[6] This is because the information UKPN provided, in particular in relation to their network strategy did not provide sufficient justification for their company specific case.

4.24. We accept 85 per cent of SPEN's company specific claims for the SPMW network. The case it presented for slow-track better justified the costs of operating an interconnected network, and included detailed adjustments for related cost assessment areas.

4.25. We have looked at the fixed costs proposal from ENWL more closely. We believe that rather than applying just to ENWL, it is an issue of scale that applies to all DNOs to varying degrees. If we applied a fixed cost scalar to each of the DNO allowances, we would need to change it if a DNO was subsequently purchased by, or divested from, a DNO group. We do not think that this is appropriate, and so have not included a fixed cost adjustment in our draft determinations.

[6] This includes streetworks and excludes labour costs. Excluding streetworks we accept 35 per cent.

London strategic investment[7]

4.26. In its business plan, UKPN proposes £100m of strategic investment projects in London. These projects and associated costs have been assessed in detail as part of our disaggregated model including our assessment of reinforcement and benchmarking of high value projects (HVPs). We think these projects are justified. Strategic investment is investment made in network assets in anticipation that customers will subsequently request to make use of them. There is a difficult question of who should bear the risk (and cost) of the assets if the connecting customers do not emerge. We stated in our strategy decision that we were open to DNOs submitting a case for strategic investment projects in their business plans if they appropriately shared the risk of stranded assets between themselves, connecting customers and all other customers (DUoS customers). We stated that if a DNO could demonstrate benefits to DUoS customers of a strategic approach, then we would consider allowing DUoS customers to fund up to the level they would have done under an incremental approach. In practice, we said we would expect DNOs to pass some of the cost benefits on to DUoS customers in recognition of the increased risk they are taking. UKPN has demonstrated that the strategic investment projects it proposes are significantly lower cost and less disruptive for all its London customers than incremental approaches.

Other adjustments and exclusions from the benchmarking

Fast-track assessment

Indirect cost allocations

4.27. A number of cost activities, in part or in full, are carried out at a group level rather than by individual DNOs, for example BSCs and CAI costs. Each company has its own methodology and preferred cost allocation drivers for allocating such costs between its DNOs and other companies within the same group. We considered whether companies using different drivers to allocate these costs might distort our totex or disaggregated activity analysis.

4.28. We concluded that it was appropriate to continue to use the companies' own allocations for the purposes of our cost benchmarking as at fast-track we were considering whether or not to consider accepting a DNO's plan. However, we ran sensitivity analysis with common allocation drivers for all groups.

Excluded costs

4.29. We excluded certain costs in DNOs' submissions from our main benchmarking analysis either because they are only incurred by a small number of DNOs or are subject to different treatment.

We added our efficient view of costs associated with these activities to our benchmark expenditure assessment. The excluded costs at fast-track were:

---

[7] We note that strategic investment is not a normalisation or adjustment, but believe it sits best in this chapter.

- streetworks
- insurance costs associated with business support
- ETR 132 tree cutting activity
- wayleave payments from CAI activities
- rail electrification.

Adjustments to low carbon technology related secondary reinforcement expenditure

4.30. In order to ensure comparability of low carbon technology (LCT)-related secondary reinforcement benchmarking we had to make adjustments to some DNOs' costs.

Non-controllable costs

4.31. We excluded costs that are subject to cost pass-through mechanisms from the fast-track assessment as there are separate arrangements in place to fund DNOs for these costs.

Reversal of adjustments

4.32. Once we estimated modelled costs for each activity and for totex, we add back in an efficient view of those cost items excluded from our fast-track benchmarking analysis for separate assessment. We also add back in an efficient view company specific factor adjustments and reverse the regional labour adjustments. This determined the total modelled costs for each DNO.

Key comments on the fast-track assessment

4.33. Some DNOs believed that insurance costs should be included in the benchmarking and one asked that transmission connection point (TCP) charges be excluded from totex.

Revised approach for the slow-track assessment

Indirect cost allocations

4.34. As for fast-track, we use the DNOs cost allocation for CAI costs and BSCs.

Excluded costs

4.35. In terms of excluded costs, we continue to exclude ETR 132 tree cutting activity and wayleave payments from CAI activities prior to benchmarking and from our totex modelling.

4.36. We no longer exclude insurance costs from our BSCs modelling. We believe our analysis should account for the savings in insurance costs for those DNOs willing to take on greater risk. We believe that the LPN regional adjustments account for higher insurance costs reasonably incurred in London.

4.37. We have excluded the rail electrification costs that NPgN and NPgY included in their slow-track plans. We have excluded them from both the modelling and NPgN's and

NPgY's forecasts so that they do not affect the IQI assessment. These costs will be subject to the uncertainty mechanism that we are proposing for all slow-track DNOs.

4.38. For streetworks we only remove new streetwork costs (see Chapter 10 for further detail) from our disaggregated analysis and totex modelling.

4.39. At slow-track, we have also excluded the costs associated with a number of activity areas from our totex benchmarking. We have then brought them back in with efficiencies from the totex regressions applied. We think it is reasonable that the overall level of efficiency should apply to these other activities.

4.40. These excluded costs are listed in Table 4.1.

Table 4.1: Exclusions from totex

Activity Area	Rationale for exclusion
Flood mitigation	Costs associated with flood mitigation are dependent on flood plains development outside of DNOs' control and can vary significantly between DNOs.
BT 21st century costs	Few DNOs have costs in this area during RIIO-ED1.
Losses and environmental	Each scheme is specific to the relevant DNO and the costs within this vary greatly between DNOs.
Critical national infrastructure (CNI)	The classification of sites as CNI is driven by the government and is outside DNOs' control.
Rising and lateral mains (RLMs)	This only affects a small number of DNOs.
Ex ante call out costs for smart meters	There is no equivalent level of costs in the DPCR5 historical data used for the regressions. RIIO-ED1 smart metering costs are subject to a volume driver.
TCP charges	There is a significant change in the treatment and level of these costs between DPCR5 and RIIO-ED1.
Operational and non-op capex IT&T	We place a 75 per cent on our qualitative analysis in our disaggregated model. We therefore consider it appropriate to exclude these costs from the totex regressions.

Adjustments to low carbon technology related secondary reinforcement expenditure

4.41. Our approach to adjustments for LCT reinforcement, non-controllable costs and reversal of adjustments is the same at slow-track as it was for fast-track. These are discussed in more detail in Chapter 6.

Non-controllable costs

4.42. Our approach at slow-track is the same at fast-track.

Reversal of adjustments

4.43. Our approach at slow-track is the same at fast-track.

Results

4.44. The tables below detail the normalisations made to the totex and disaggregated models.

Table 4.2: Totex normalisations and exclusions (£m gross 2012-13 prices)

DNO Group	DNO	Regional costs adjustments		Exclusions for separate assessment*	Costs excluded from the totex regression	Total adjustments over RIIO-ED1	Average annual adjustments
		Labour cost adjustments	Other company specific factors				
ENWL	ENWL	28	0	-15	149	12	2
NPg	NPGN	26	0	-37	99	-11	-1
	NPgY	33	0	-28	133	5	1
WPD	WMID	24	0	-64	86	-40	-5
	EMID	23	0	-54	94	-31	-4
	SWALES	13	0	-40	58	-28	-3
	SWEST	20	0	-53	66	-34	-4
UKPN	LPN	-191	-87	-29	145	-307	-38
	SPN	-79	0	-27	118	-106	-13
	EPN	-37	0	-50	197	-87	-11
SPEN	SPD	25	0	-45	171	-19	-2
	SPMW**	31	-109	-52	146	-129	-16
SSEPD	SSEH	16	-32	-63	137	-79	-10
	SSES	-59	0	-49	115	-108	-14

* Exclusions for separate assessment include ETR 132, wayleaves and new streetworks costs.
**The company specific factor adjustments for SPMW differ between totex and the disaggregated activity analysis as some of the adjustments in the activity based analysis are implemented as qualitative adjustments (such as changes to unit costs and volumes) rather than as a high level adjustment to costs.

Table 4.3: Disaggregated model normalisations (£m gross 2012-13 prices)

DNO Group	DNO	Regional costs adjustments		Exclusions for separate assessment*	Total adjustments over RIIO-ED1	Average annual adjustments
		Labour cost adjustments	Other company specific factors			
ENWL	ENWL	28	0	-15	12	2
NPg	NPGN	26	0	-37	-11	-1
	NPgY	33	0	-28	5	1
WPD	WMID	24	0	-64	-40	-5
	EMID	23	0	-54	-31	-4
	SWALES	13	0	-40	-28	-3
	SWEST	20	0	-53	-34	-4
UKPN	LPN	-191	-87	-29	-307	-38
	SPN	-79	0	-27	-106	-13
	EPN	-37	0	-50	-87	-11
SPEN	SPD	25	0	-45	-19	-2
	SPMW**	31	-35	-52	-56	-7
SSEPD	SSEH	16	-32	-63	-79	-10
	SSES	-59	0	-49	-108	-14

5. Totex modelling

Chapter Summary

Detail of our two totex models and the changes that have been made since the fast-track assessment. Results of both models are presented, as are the disaggregated results.

Fast-track assessment

5.1. At fast-track we used two different models for the totex analysis, using a single regression for each model.

5.2. The first model, the top down totex model, made use of a high level composite scale variable (CSV), based on an equal weighting of customer numbers, network length and units distributed.

5.3. The second approach, the bottom up totex model, used a cost driver which was a weighted composite of the cost drivers used in our disaggregated analysis. The weights for the CSV were based on industry spend proportions for the activity level cost areas to which the drivers apply. Where no obvious activity level driver existed we used the scale variable weighted MEAV as a proxy driver to assess the residual costs. We considered this approach took into account the relative importance of each cost driver based on our knowledge of DNOs' costs.

5.4. We only used historical data to estimate the cost function for totex at fast-track due to concerns over the robustness of some of the underlying forecast data and because the models incorporating forecasts performed poorly against our statistical tests.

5.5. DNOs forecast a decrease in costs from average annual costs in DPCR5 to average annual costs in RIIO-ED1. We scaled our modelled result so that the total modelled costs were in line with the total industry forecast. This approach was consistent with our assessment of activity level regressed costs.

Key comments on the fast-track assessment

5.6. Key issues raised following the fast-track assessment were:

- **application of qualitative (scaling) adjustments:** a number of DNOs questioned our application of scaling adjustments where our modelled costs were above DNO forecasts. It was also stated that the scaling adjustments for the bottom up totex model had been incorrectly applied to the top down totex model.
- **use of alternative cost drivers:** most DNOs did not support using weighted MEAV. Some thought that the fast-track totex models and disaggregated regression results could be strengthened through using alternative drivers. One DNO also identified issues with the cost drivers used in the top down totex model. These included customer numbers not matching with figures from the Interruption Incentive Scheme returns and different versions of network length being used in the top down and bottom up CSVs.

- **use of alternative estimation techniques:** it was suggested that alternative estimation techniques, such as random effects (RE), Stochastic Frontier Analysis (SFA) and data envelopment analysis (DEA) could be employed, with one DNO citing the results of statistical tests to justify such approaches.
- **weight placed on historical efficiency:** one DNO suggested placing greater weight on historical rather than forecast efficiency comparisons. For example by using the results of a regression assessing historical efficiency to determine the appropriate level of efficiency adjustments to apply to forecast costs.
- **period used in the regression:** it was suggested that the three year time period for historical data was too short to provide reliable results.
- **performance of the macro CSV:** one DNO questioned why the top down totex model CSV was declining relative to the bottom up totex CSV. This DNO felt that the CSV in the bottom up totex model did not have an obvious economic interpretation and was concerned that its formulation collapsed down to unit cost analysis.
- **exclusions from the totex analysis:** one DNO felt that TCP charges should be excluded from the totex regression.

Revised approach for the slow-track assessment

Top down totex

5.7. In the top down totex model we use regression analysis to determine efficient costs and use a Pooled Ordinary Least Squares (pooled OLS) estimator. Further detail is provided in Appendix 2 and Appendix 3.

5.8. As at fast-track we use a CSV, but this now comprises MEAV and customer numbers. It no longer includes network length. We use statistical techniques to derive the weights to apply to each driver. We undertook extensive data cleansing and we are in a position to use MEAV as a cost driver rather than weighted MEAV.[8] We also incorporate a time trend as we are using a longer period of data.

5.9. We have used 13 years of data (four historical and nine forecast) to estimate the cost parameters compared to using only historical data in the fast-track. Using 13 years of data better reflects the scope for cost savings during the RIIO-ED1 price control and takes account of the latest historical information. It is also more consistent with the disaggregated model. There are a number of areas, notably closely associated indirect (CAI) costs and business support costs (BSCs), where DNOs are making significant savings in RIIO-ED1. Basing our analysis only on historical data does not reflect such reductions and overestimates what DNOs require. At fast-track we applied scaling adjustments to bring the overall results of our totex modelling into line with the industry forecasts. This was criticised. Using 13 years of data to estimate the model parameters removes the need for such scaling.

[8] The unweighted MEAV is a better reflection of network scale than the weighted MEAV which weighted the components of MEAV based on associated asset replacement and refurbishment spend over the first three years of DPCR5. We used weighted MEAV at fast-track because of concerns over the quality of the underlying data. There have been significant improvements in the quality of the data submitted by the DNOs and we have now excluded elements of MEAV where questions remain over the consistency of reporting.

5.10. While we recognise that totex should be as broad as possible so as to avoid cherry picking, we believe it is appropriate to exclude some costs from the main totex modelling. This is explained in Chapter 4.

Bottom up totex

5.11. In the bottom up totex model we also use a pooled OLS estimator, 13 years of data, with the same exclusions as the top down totex model. The key difference is the cost drivers used to estimate the efficient costs. Given the limitations of the top down CSV used in the fast-track assessment, this alternative totex model combines the more intuitive cost drivers in the disaggregated analysis into a single cost driver. We have also used a time trend in this model.

Results

5.12. Collectively the ten slow-track DNOs have submitted £17,988m in ex ante costs for RIIO-ED1. Both our totex models suggest higher costs of £18,076m (top down totex model) and £18,089m (bottom up totex model).[9]

Table 5.1: Top down totex modelled costs (2012-13 prices)[10]

DNO Group	DNO	RIIO-ED1 slow-track submitted totex (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	1,794	1,927	132.3	7.4%
NPg	NPgN*	1,300	1,340	40.0	3.1%
	NPgY*	1,725	1,805	80.2	4.7%
WPD	WMID*	1,931	1,882	- 48.9	-2.5%
	EMID*	1,945	2,101	156.3	8.0%
	SWALES*	1,011	1,067	56.5	5.6%
	SWEST*	1,582	1,383	- 199.4	-12.6%
UKPN	LPN	1,883	1,803	- 80.5	-4.3%
	SPN	1,783	1,808	24.4	1.4%
	EPN	2,652	2,539	- 113.6	-4.3%
SPEN	SPD	1,496	1,662	166.2	11.1%
	SPMW	1,840	1,637	- 203.4	-11.1%
SSEPD	SSEH	1,170	1,107	- 63.1	-5.4%
	SSES	2,343	2,449	105.9	4.5%
Total		**24,456**	**24,509**	**52.8**	**0.2%**
Total exc WPD		**17,988**	**18,076**	**88.3**	**0.5%**

*Costs exclude rail electrification.

[9] Allowances are post reversal of adjustments but before the application of RPEs, smart grids savings and the IQI interpolation.
[10] The submitted costs in tables 5.1 to 5.3 match those submitted in tables 2.3 and 2.4 in Chapter 2. These tables exclude RPEs. Other tables reported in Chapter 2 report submitted costs including RPEs.

Table 5.2: Bottom up totex modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 slow-track submitted totex (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	1,794	1,881	86.9	4.8%
NPg	NPgN*	1,300	1,322	22.1	1.7%
	NPgY*	1,725	1,818	92.3	5.4%
WPD	WMID*	1,931	1,871	- 59.6	-3.1%
	EMID*	1,945	2,057	112.6	5.8%
	SWALES*	1,011	1,066	55.4	5.5%
	SWEST*	1,582	1,432	- 150.4	-9.5%
UKPN	LPN	1,883	1,757	- 126.7	-6.7%
	SPN	1,783	1,770	- 13.4	-0.8%
	EPN	2,652	2,595	- 57.8	-2.2%
SPEN	SPD	1,496	1,653	157.4	10.5%
	SPMW	1,840	1,662	- 178.6	-9.7%
SSEPD	SSEH	1,170	1,112	- 58.5	-5.0%
	SSES	2,343	2,520	177.0	7.6%
Total		**24,456**	**24,515**	**58.8**	**0.2%**
Total exc WPD		**17,988**	**18,089**	**100.8**	**0.6%**

*Costs exclude rail electrification.

5.13. We present the total modelled costs that our disaggregated model suggests below for comparative purposes. The disaggregated modelled costs are lower than the forecast costs, at £17,350m.

Table 5.3: Disaggregated model totex modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 slow-track submitted totex (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	1,794	1,800	5.4	0.3%
NPg	NPgN*	1,300	1,219	- 81.3	-6.3%
	NPgY*	1,725	1,659	- 66.7	-3.9%
WPD	WMID*	1,931	1,869	- 61.4	-3.2%
	EMID*	1,945	1,917	- 27.6	-1.4%
	SWALES*	1,011	1,019	8.3	0.8%
	SWEST*	1,582	1,520	- 62.1	-3.9%
UKPN	LPN	1,883	1,702	- 181.4	-9.6%
	SPN	1,783	1,672	- 111.3	-6.2%
	EPN	2,652	2,591	- 61.4	-2.3%
SPEN	SPD	1,496	1,519	23.4	1.6%
	SPMW	1,840	1,752	- 88.3	-4.8%
SSEPD	SSEH	1,170	1,126	- 44.7	-3.8%
	SSES	2,343	2,311	- 32.1	-1.4%
Total		**24,456**	**23,675**	**- 781.2**	**-3.2%**
Total exc WPD		**17,988**	**17,350**	**- 638.3**	**-3.5%**

*Costs exclude rail electrification.

6. Load-related expenditure

Chapter Summary

Detail of our approach to the assessment of load-related expenditure. It considers primary reinforcement, secondary reinforcement (including low carbon technology (LCT) reinforcement), transmission connection point charges and connections.

Question 1: Do you agree with our approach to assessing primary reinforcement and n-1 primary reinforcement?
Question 2: Do you agree with our approach to assessing secondary reinforcement (both low carbon technology (LCT) reinforcement and non-LCT reinforcement)?
Question 3: Do you agree with our approach to assessing transmission connection point (TCP) charges?
Question 4: Do you agree with our approach to assessing connections?

Overview

6.1. The DNOs' business plans include a range of measures to accommodate and account for any forecast changes in demand patterns within the RIIO-ED1 period. For both the fast-track and slow-track assessments we have broken down our analysis of load-related expenditure, by the technical nature of the activity. This ensures that each activity is assessed consistently against common expenditure drivers. We have carried out more aggregated analysis to ensure that the boundaries between different categories do not unfairly impact on the result for specific DNOs.

6.2. The load related expenditure categories are:

- primary reinforcement schemes
- n-1 primary reinforcement
- low carbon technology (LCT) driven reinforcement
- secondary reinforcement (non-LCT)
- fault level reinforcement
- transmission connection point (TCP) charges
- connections.

Primary network reinforcement

Fast-track assessment

6.3. DNOs were required to provide a list of asset installations and disposals for each proposed primary network reinforcement scheme in RIIO-ED1. The costs of these schemes were also split across asset types. We assessed the unit costs of assets using the same approach as for asset replacement (see Chapter 7). Across each of the reinforcement schemes, the submitted unit costs were compared to our expert view of unit costs for asset replacement.[11] We applied a percentage adjustment (positive or negative) to each DNO's forecast costs covering all primary network reinforcement.

6.4. We reviewed the accompanying reinforcement scheme papers to give a qualitative assessment of the rationale presented for the needs case for the network intervention, the appropriateness of the solutions considered and the forecast costs.

Key comments on the fast-track assessment

6.5. We received no substantive comments on our fast-track assessment of primary network reinforcement.

Revised approach for the slow-track assessment

6.6. With few substantive issues raised on the fast-track assessment, the approach for slow-track remained largely the same. The only significant difference to the approach was that we updated our expert view of unit costs for asset replacement.

N-1 primary reinforcement

Fast-track assessment

6.7. We modelled expenditure relating to n-1 primary reinforcement and other work captured in the Load Index (LI) secondary deliverables using bespoke assessment including the following:

- **unit cost adjustments:** the eight-year RIIO-ED1 forecast for reinforcement work covered by the Load Index was adjusted by the average percentage adjustment from the following calculations:
  - the difference between the DNO view on unit cost in scheme papers and our expert view of unit costs
  - the difference between the DNO and industry median unit cost of delivering one MVa of capacity from Primary network n-1 reinforcement schemes
  - the median ratio of the DNO forecast unit costs for delivering one MVa of additional capacity and the historical unit cost of delivering one MVa of additional capacity based on dividing the MEAV for EHV+ assets by the firm capacity presently on the network
- **volume adjustment**: for the relevant schemes in each DNO's business plan, the ratio of forecast capacity added relative to the increase in demand above firm capacity was benchmarked at the industry mean. Where a DNO's forecast was above the mean we reduced it to the mean. Otherwise we made no adjustment

6.8. Following this modelling we sought to combine the results with the outcome of the qualitative review that was carried out by our technical consultants. This review covered a sample of individual scheme papers, the overall DNO strategy and the consistency of intervention timing.

[11] We worked with our technical consultants, DNV GL, to determine our expert view of unit costs.

6.9. As the results of this qualitative review were consistent with our quantitative modelling, we did not feel it was appropriate to make any adjustments to the results.

Key comments on the fast-track assessment

6.10. There was a suggestion that the qualitative engineering assessment of individual substation schemes should have been incorporated further into the modelling, rather than featuring as an element of the wider qualitative assessment.

6.11. One DNO felt that assessment of primary reinforcement should take into account past as well as future load growth. This DNO suggested it would be more appropriate to use data covering the past two regulatory periods in addition to RIIO-ED1 for the modelling.

6.12. Concern was also raised that the high level primary network modelling failed to fully take into account the location-specific and bespoke nature of loading issues at individual primary network substations.

Revised approach for the slow-track assessment

6.13. In order to address the comments raised on the fast-track assessment, we sought to further integrate the qualitative review of primary network reinforcement schemes into the modelling.

6.14. The modelling that was carried out at fast-track has been re-run with the updated business plan submissions. The ratio benchmarks that were previously only used for making unit cost and volume adjustments to DNOs have now been used to identify the individual reinforcement schemes that are causing specific DNOs to be outliers in our analysis[12].

6.15. For each DNO that our quantitative analysis points to as being inefficient either in terms of capacity being added or unit costs, a list of individual schemes that fell outside of the relevant benchmark has been drawn up. Our technical consultants reviewed a sample of these schemes. These outlier schemes have been assessed with a view to determining whether the costs put forward for the relevant schemes are efficient both in terms of the needs case and the efficiency of the proposed delivery solution. We have prioritised the expert review on the outlier schemes of greatest value. We have then assessed our efficient view of the sample of scheme relative to the DNO forecast. The efficient funding for the outlier schemes in total is based on our percentage adjustments made to those that have been reviewed. Each individual scheme that lies within Ofgem's benchmarks is deemed to be efficient.

6.16. Wherever possible, our technical consultants have sought to provide their view of the appropriate costs for the schemes reviewed. Where there remains uncertainty

---

[12] Only the third unit cost adjustment calculation in paragraph 6.6, "the median ratio of the DNO forecast unit costs for delivering one MVa of additional capacity and the historical unit cost of delivering one MVa of additional capacity", was used for the unit cost ratio. This is because it is the only element of the three that only relates to schemes within the n-1 LI modelling.

around the reasonableness of the costs or the needs case, we have relied upon the modelling. For these schemes we have adjusted the costs downwards to the benchmark level of the quantitative modelling.

Low carbon technology (LCT) reinforcement

Fast-track assessment

6.17. We modelled low carbon technology (LCT) related secondary network reinforcement having made a number of adjustments to the forecasts to ensure they were on a comparable basis.

6.18. Most DNOs used the Transform model to assist forecasting the LCT related reinforcement requirements. This model estimates the frontier combination of conventional and smart interventions for LCT related reinforcement for a specified level of load growth. The Transform model applies a 110 per cent optimism bias to conventional intervention unit costs. Those DNOs who used the Transform model retained the optimism bias. We felt DNOs should be able to accurately forecast the cost of LCT related reinforcement interventions and that their use of the Transform model may have overstated their costs of conventional reinforcement so we applied a normalisation adjustment to address this.

6.19. We used the Transform model to estimate the cost of conventional solutions to the reinforcement required to connect LCTs. We ran the Transform models provided by the DNOs to calculate the expenditure forecasts for RIIO-ED1 with the optimism bias removed. We normalised each DNO's forecast expenditure to the lower of either the amount submitted for conventional solutions or the results of our run of its Transform model (excluding optimism bias) scaled by the ratio between the Transform model output as used by the DNOs and the total cost for LCT related reinforcement. We used the adjusted forecasts in our assessment of LCT-secondary reinforcement.

6.20. We excluded NPg's expenditure for unbundling of shared services and assessed this separately as they were the only DNO to forecast expenditure in this area as LCT-related reinforcement. Our technical consultants advised that while unbundling could be driven by heat pumps and electric vehicles, it is unlikely to be driven by installation of photovoltaics (PV) as forecast by NPg. We used NPg's unit cost and applied this to the total volume of heat pumps and electric vehicles multiplied by a diversity factor of 0.6. This diversity factor was applied to account for customers who have both low carbon technologies. We defined the diversity factor with the advice of our technical consultants and using evidence from other DNOs' business plans.

6.21. UKPN did not forecast volumes for conventional solutions. In order not to affect the benchmarking, we used the industry average unit cost for conventional interventions to derive a modelled volume for inclusion in our benchmarking.

6.22. We benchmarked each DNO's eight-year RIIO-ED1 forecast of network interventions per MW of LCTs connected to the industry median. We also adjusted their unit costs for LCT related intervention to the industry median. The unit cost and volume adjustments were made to the total normalised expenditure.

6.23. In our assessment of business plans for fast-track, we did not make adjustments to DNOs' forecast LCT volumes.

Key comments on the fast-track assessment

6.24. There were no significant comments received on the fast-track approach to assessing LCT.

Revised approach for the slow-track assessment

6.25. As at fast-track we benchmarked each DNO's eight-year RIIO-ED1 forecast of network interventions per MW of LCTs connected to the industry median. We also adjusted their unit costs for LCT related intervention to the industry median. The unit cost and volume adjustments were made to the total normalised expenditure. We did not use the Transform model at slow-track.

6.26. We have excluded NPg and ENWL cost forecasts for the unbundling of shared service cables from our modelling and subjected them to a separate technical review.

Secondary reinforcement

Fast-track assessment

6.27. The volume of interventions and capacity released are difficult to capture for reinforcement of the secondary network that is not attributable to LCTs Our starting point was to apply the median DNO forecast and then apply an adjustment factor based on the network characteristics of each DNO. This adjustment factor was based on the following factors:

- DNO HV/LV MEAV as a percentage of the industry median HV/LV MEAV. Our modelled costs were reduced where a DNO had smaller than median secondary network MEAV and increased where a DNO had a larger than median secondary network MEAV.
- the percentage of DNO total MEAV that relates to HV/LV assets as a percentage of the industry median. Our modelled costs were reduced where a DNO had a smaller than median percentage of their overall MEAV made up of secondary network assets, It was increased where a DNO had a larger than median percentage of their overall MEAV made up of secondary network assets.

Key comments on the fast-track assessment

6.28. One DNO suggested that the fast-track assessment did not sufficiently account for the efficiency of work forecast by the DNOs. This DNO suggested that the modelling should be based on growth in capacity and load. Revised approach for the slow-track assessment

6.29. We continue to believe that the analysis carried out at fast-track was proportionate for the level of expenditure forecast in this area. However, we cross-reference the results of the updated fast-track modelling with the efficiency of the unit costs forecast for an MVa of capacity across the secondary network to determine whether any qualitative adjustments are required.

6.30. In the majority of cases, this additional analysis broadly confirmed the findings of the original analysis. In the specific cases where the two analyses gave contrasting results (ie positive and negative) we apply qualitative adjustments to reflect the additional unit cost analysis. This applies to NPgN and NPgY.

Fault level reinforcement

Fast-track assessment

6.31. We benchmarked the unit cost of each individual fault level activity within the fault level reinforcement categories at a disaggregated level. We also carried out a unit cost assessment grouping activities by voltage, in order to account for boundary issues between asset replacement solutions and operational solutions to fault level issues. Each DNO was given a modelled allowance based on the version of the unit cost assessment in which they performed best. In order to account for a volume count that suggested a variation in interpretation, a qualitative adjustment was applied to ENWL.

Key comments on the fast-track assessment

6.32. It was suggested that fault level reinforcement should be assessed qualitatively based on DNO supporting evidence.

Revised approach for the slow-track assessment

6.33. The same analysis as fast-track was applied. In addition to applying a qualitative adjustment to account for ENWL's differing interpretation of volumes, a qualitative adjustment was also applied to SPMW to account for some significantly outlying unit costs.

Results

6.34. Table 6.1 details the total forecast reinforcement costs across all categories above as well as our overall modelled view. This is the total reinforcement costs of all the above categories. The ten slow-track DNOs forecast they would spend £1,669m. Our modelled view is £58.2m less at £1,611m.

Table 6.1: Reinforcement modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	103	108	4.7	4.5%
NPg	NPgN	82	79	- 2.7	-3.2%
	NPgY	100	92	- 8.0	-8.0%
WPD	WMID	187	172	- 15.0	-8.0%
	EMID	259	226	- 33.3	-12.9%
	SWALES	43	62	19.5	45.9%
	SWEST	80	81	0.6	0.8%
UKPN	LPN	338	284	- 54.2	-16.0%
	SPN	178	172	- 5.6	-3.1%
	EPN	284	333	48.8	17.2%
SPEN	SPD	133	132	- 0.7	-0.5%
	SPMW	155	150	- 5.2	-3.3%
SSEPD	SSEH	57	55	- 1.8	-3.2%
	SSES	239	205	- 33.5	-14.0%
Total		**2,238**	**2,152**	**- 86.4**	**-3.9%**
Total exc WPD		**1,669**	**1,611**	**- 58.2**	**-3.5%**

Transmission Connection Point (TCP) charges

Fast-track assessment

6.35. We carried out an initial review of expenditure on TCP charges with the support of DNV GL. As there was insufficient detail to analyse the plans effectively, we decided that these costs should be included in the n-1 modelling.

Key comments on the fast-track assessment

6.36. There were no significant comments raised on our fast-track assessment of TCP charges.

Revised approach for the slow-track assessment

6.37. Our consultants have carried out an engineering review of the DNOs' forecasts for TCP charges as part of our more detailed assessment for slow-track. We have based our modelled outcome on their assessment.

Results

6.38. We have made no reductions to the DNO forecasts for TCP charges.

Table 6.2: Transmission connection point charges total modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	6	6	-	0.0%
NPg	NPgN	7	7	-	0.0%
	NPgY				
WPD	WMID	2	2	-	0.0%
	EMID	1	1	-	0.0%
	SWALES				
	SWEST				
UKPN	LPN	41	41	-	0.0%
	SPN	22	22	-	0.0%
	EPN	14	14	-	0.0%
SPEN	SPD	8	8	-	0.0%
	SPMW				
SSEPD	SSEH	53	53	-	0.0%
	SSES	4	4	-	0.0%
Total		**159**	**159**	-	**0.0%**
Total exc WPD		**156**	**156**	-	**0.0%**

Connections

Fast-track assessment

6.39. We adopted a simple approach for the connections assessment given data issues for some of the DNOs. We accepted the DNOs' connection volumes for RIIO-ED1 and applied the median industry unit costs. Our analysis was carried out on a disaggregated voltage level due to the different mixes of projects forecast by DNOs. We were concerned that there would be difficulty in establishing unambiguous boundaries if we modelled volumes at each voltage level.

Key comments on the fast-track assessment

6.40. One DNO felt that although unit cost assessment was appropriate for HV and LV connections, it was not appropriate for EHV due to the wide spread of industry unit costs at this voltage level. It proposed that Ofgem remove schemes which appeared to be outliers and engage an expert to assess the justification for these.

Revised approach for the slow-track assessment

6.41. We applied qualitative adjustments to volumes and unit costs. Where relevant these were applied at the disaggregated voltage level.

6.42. Our volume assessment considered the justifications provided by the DNOs, along with the DPCR5 and RIIO-ED1 data. For some DNOs the volumes for RIIO-ED1 are significantly higher than their DPCR5 average. We assess the DNOs' efficient volumes by calculating their annual average volumes for 2013-14 and 2014-15 then apply these across the eight year RIIO-ED1 period.

6.43. The unit cost assessment is again based on using the average of the industry's RIIO-ED1 median and the company's own or industry DPCR5 median unit cost. This is applied to the DNOs' modelled volumes for the RIIO-ED1 period. For DUoS funded HV demand connections unit costs for all of the DNOs were set at their RIIO-ED1 forecast unit costs, because of the high degree of variability in unit costs across the DNOs. For example, the highest unit cost was £80,000 and the lowest was £1,600.

Results

6.44. Overall our assessment of efficient costs represents a reduction to the ten slow-track DNOs' total forecast costs of 18.7 per cent, from £217m to £176m.

Table 6.3: Connections modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	31	26	- 4.7	-15.4%
NPg	NPgN	21	7	- 13.7	-66.3%
	NPgY	6	6	0.6	10.7%
WPD	WMID	19	20	1.2	6.7%
	EMID	17	18	0.5	2.9%
	SWALES	9	8	- 0.7	-7.9%
	SWEST	9	11	1.9	22.3%
UKPN	LPN	13	10	- 2.8	-22.2%
	SPN	22	18	- 3.1	-14.4%
	EPN	47	45	- 1.4	-2.9%
SPEN	SPD	5	3	- 1.3	-27.7%
	SPMW	24	23	- 1.1	-4.5%
SSEPD	SSEH	30	21	- 8.7	-29.3%
	SSES	21	16	- 4.4	-21.5%
Total		**271**	**233**	**- 37.6**	**-13.9%**
Total exc WPD		**217**	**176**	**- 40.6**	**-18.7%**

7. Asset replacement, refurbishment and civils

Chapter Summary

Our approach to assessing key components of network investment costs – asset replacement, refurbishment and civil works. We describe our fast-track approach, the issues raised at fast-track, our slow-track approach and finally the results under these specific activity areas. We also detail our approach to assessing high value projects (HVPs).

Question 1: Do you agree with our approach to assessing asset replacement costs?
Question 2: Do you agree with our approach to assessing refurbishment costs?
Question 3: Do you agree with our approach to assessing civil works costs?
Question 4: Do you agree with our approach to assessing high value projects (HVPs)?

Overview

7.1. Asset replacement, refurbishment and civils costs comprise the majority of non-load-related network investment costs.[13] The remainder of non-load-related network investment cost (non-core costs) are discussed in Chapter 8.

Asset Replacement

Fast-track assessment

7.2. At fast-track, we applied a number of analytical techniques to assess asset replacement volumes, as follows:

- an age-based asset replacement model (survivor model) based on asset age profiles and the probability of assets of different ages failing
- run rate and trend analysis where asset replacement volumes were assessed as a proportion of the total asset base
- a review of the asset health and criticality information and supporting narrative.

7.3. Unit cost benchmarking and expert review was used to assess unit costs which were applied to the final volumes.

[13] Civils refer to civil engineering work associated with DNO network assets, including buildings and site works at substations.

Volume assessment

Age-based asset replacement model

7.4. At fast-track we used an aged-based asset replacement model based on survivor model principles to set volumes. The model was designed around the assumption that industry asset lives can either be maintained at the levels achieved in the past or longer lives can be achieved in the future through improved asset management. The model calculated the highest of the lives achieved across the industry that were implied from historical asset replacement volumes in DPCR5. This benchmark set of asset lives was then combined with each DNO's individual asset age profile to give a DNO modelled volume for each asset.

7.5. The main inputs to the model are the current age profile and life assumptions based on a normal distribution. The current age profile is the number of assets that remain in service from the years in which they were installed. The life assumptions or asset lives indicate the likelihood of asset failure based on age.

7.6. The model calculated implied asset lives from actual replacement using a normal distribution for the cumulative probability of failure. This is done by matching actual and forecast volumes against the calculated asset life.

7.7. At fast-track we used asset lives based on actual replacement volumes in the DPCR5 period (2010-11 to 2013-14).[14] The age profile relied on implied lives, ie the ages used are implied by the data rather than being based on expert opinion.

7.8. We assessed the DNO's forecast volume against the modelled volumes. If the DNO's forecast volumes were below the modelled volumes they received either the modelled volumes or their own volumes (following a qualitative review).

Non-modelled volumes

7.9. We used trend analysis to review the DNOs submitted forecast volumes for a number of asset categories not suitable for the age based model, eg where there were issues over the data or the spread of the implied asset lives was very large. In such cases we used replacement run rates based on submitted disposal volumes as a proportion of DNO assets in service. In most cases we applied the industry median benchmark to represent efficient replacement volumes. Due to the variable quality of the asset replacement data submitted by DNOs we applied an expert view of benchmark replacement volumes for some asset categories taking into account the industry median and other supporting information.

Qualitative adjustments

7.10. Such modelling has limitations and does not fully take account of all relevant factors. For example, the implied life approach makes no adjustments for the condition

[14] Age profile 4.

of the assets, only age. So it was important that we overlaid our quantitative assessment with a qualitative review.

7.11. Where a company provided robust evidence to support higher volumes than suggested by the model, we made appropriate adjustments. This work was supported by our technical consultants, DNV GL, who provided specialist input. The types of supporting evidence we considered for departures from modelled volumes were:

- business cases and other supporting narratives for named schemes and high value assets
- asset specific condition information
- relationships to health indices
- evidence of poor or worsening performance
- evidence of type faults, failure modes and safety issues, and
- reports from specialist external consultants.

7.12. We applied qualitative adjustments to modelled asset replacement volumes based on a technical assessment of the above. Where the evidence provided was not considered to be of a sufficient standard we placed more weight on the output of the model.

Unit cost assessment

7.13. We set our initial view of unit costs based on median unit cost analysis. We overlaid this assessment with a qualitative expert review of unit costs.

7.14. In determining unit costs we made use in some cases of blended actual and forecast unit costs. Within asset replacement there are instances where DNOs may dispose of an asset but then replace it with a similar but not identical asset. We grouped assets where we consider these substitutions take place and applied a blended unit cost to account for this aggregation.

Conversion of modelled asset disposal to asset addition volumes

7.15. Our volume assessment was derived from asset disposals. However, our expert view of unit costs was derived from asset additions. In order to ensure that we were combining consistent units to calculate overall expenditure we applied the ratio of submitted additions against disposals to give a view of modelled additions.

Key comments on the fast-track assessment

7.16. Following the fast-track assessment the DNOs noted that the our approach to reducing submitted volumes did not take into account the fact that DNOs may manage overall network health by varying the programme between asset classes.

7.17. The validity of using of run rates for asset replacement was questioned by one DNO and a number of DNOs suggested that we make greater use of the age-based modelling and the cost benefit analysis (CBA).

7.18. Regarding the details of the methodology, it was suggested that inappropriate combinations of unit costs were used for some asset replacement categories, for example where different time periods were used to calculate certain assets' unit costs. Overall, a clearer rationale for the selection of unit costs was requested.

7.19. One DNO argued that if an assessment of the health index secondary deliverables was not included as an explanatory variable some alternative was needed to account for DNOs' different positions in the asset replacement cycle.

Revised approach for the slow-track assessment

7.20. The principles and foundation of our approach at fast-track remain the same at slow-track. We continue to use the age-based survivor model, run rate analysis and qualitative assessment to determine our efficient view of volumes. Similarly, we use median unit cost analysis and expert review to determine our efficient view of unit costs. However, we make some important changes to the detail under this broad approach.

7.21. The key changes are as follows:

- following data cleansing, a much greater proportion of assets are subjected to the age-based model to assess volumes, with a smaller proportion subjected to run rate analysis
- both the volume and unit cost assessments are subject to greater qualitative review by Ofgem staff and our external expert consultants
- we run the age-based model using two age profiles rather than one with the results of both factored into our final volume assessment to ensure the modelling is based on both historical and forecast data
- for the unit costs assessment we no longer substitute assets, combine unit costs for some asset replacement categories or use blended unit costs. Instead each asset is considered on an individual, line-by-line basis (reflecting the greater depth of our qualitative review at slow-track)
- we make greater use of the health index data in our volume assessment.

Volume assessment

Age-based model

7.22. At slow-track a much larger proportion of assets are subjected to the age-based model than at fast-track. The model itself uses two sets of disposal values rather than one to infer asset lives. We use the aggregate age profile across all DNOs in order to reduce volatility in the implied lives due to the different DNOs' lumpy age profiles. The first is based on actual replacement volumes in the DPCR5 period (2010-11 to 2013-14)[15] and the second is based on the forecast replacement volumes for the last year of DPCR5 and all of RIIO-ED1 (2014-15 to 2022-23)[16]. The two implied lives give different estimates for replacement volumes. This is due to a combination of the change in asset lives and each DNO's age-based profile. We believe that both profiles offer valuable information and could not find sufficient objective reasons to choose one over the other, so both are used in our assessment.

[15] Age profile 4.
[16] Age profile 6.

7.23. We assessed each DNO's forecast volume against the modelled volumes. Similar to fast-track, where a DNO's forecast volumes are below our modelled volumes, the DNO received its own volumes. Where a DNO's forecast volumes are above our modelled volumes, the DNO either receives their own volumes, the average between the two modelled volumes or the average of the lowest modelled volume and its own forecast volumes (see Table 7.1). The final volumes received depend on the outcome of a line-by-line qualitative assessment.

Table 7.1: Asset volumes use in assessment

Scenario	Volumes use
1. DNO forecast volumes below both profiles modelled volumes	DNO volumes
2. DNO forecast volumes above either or both profiles modelled volumes	Following further review of each of the DNO's supporting evidence one of the following: a) DNO volumes b) the average between the two age profiles c) the average of the lowest modelled volume and the DNO's proposed volume

7.24. The critical difference at slow-track is the level of qualitative review that overlaid this initial quantitative volume assessment before settling on our efficient view of volumes. This is considerably greater for the slow-track assessment.

7.25. Where the DNO's forecasts are above either of the modelled volumes (ie scenario two in Table 7.1), three key questions are considered:

1. Has the DNO proposed using a substitute asset, eg plastic underground cables for paper underground cables?
2. Has the DNO provided additional evidence as to why the volumes are higher, eg a higher level of deterioration than age would indicate?
3. Are there complementary assets which have been allowed, eg LV poles for LV conductor?

7.26. For substitution of an asset, we considered the following questions:

- Has the DNO indicated lower disposal volumes than replacement volumes (indicating that it is disposing of assets elsewhere)? If the disposals are lower than replacement volumes is the aggregate modelling volume for the substitutes greater than the DNO's proposed replacement volumes?
- If aggregate volumes are not sufficient are there other reasons to increase volumes?
- If proposed volumes are accepted has sufficient evidence (eg, a CBA) been supplied to support any higher unit costs?

7.27. If the asset class does not have readily identifiable substitutes and the DNO's proposed volumes are higher than indicated by the modelling we undertook the following:

- in most cases a review of the run rate and qualitative evidence by our engineering consultants
- an assessment of evidence provided by the DNO supporting the higher volumes
- a comparison of whether the asset life provided by the DNO is significantly different from the all DNO average life (ie we are less willing to accept a greater volume if the DNO proposed a significantly shorter life than on average)

- a check to determine whether there are complementary assets, ie LV poles and OHL conductors.

7.28. Following this review, if we were satisfied the DNO could justify the volumes, we allow the submitted volumes.

7.29. If we were not satisfied, where both age profiles provided volumes lower than the DNO submitted volumes, we set the volumes as the average between the two. Where one age profile is above the DNO's proposed volume, the average of the lowest modelled volume and the DNO's proposed volume is taken.

7.30. We also had some concerns that the models overestimate the volume for some asset classes which had low volumes. Where this occurred for low value assets (eg unit cost below £30,000), we accept the DNO's forecast. For higher value assets (eg 132kV transformers), we cross-checked with the health indices and refurbishment data to determine the needs case and applied an adjustment where the health indices supported doing this.

7.31. Overall, we assume that the DNOs would have built in some uncertainty into their asset forecasts and therefore we do not consider it appropriate to base our volume allowance on an estimate higher than the DNO's submitted volumes. While this approach is slightly different from those adopted in other areas we consider that it is a pragmatic approach given the difference in age profiles and the DNOs' ability to trade-off between refurbishment and replacement.

Non-modelled volumes

7.32. In our slow-track assessment, we continue to use trend analysis and run rates to review the DNO submitted forecast volumes for a number of asset categories where there are no age profiles. This is more limited than at fast-track. For the non-modelled volumes we adopt the same approach as fast-track.

Unit cost assessment

7.33. We follow broadly the same approach in slow-track as at fast-track in setting unit costs. Using the updated submissions, we reviewed evidence and calculated an expert view of unit costs based upon inputs from technical consultants and industry historical and forecast asset replacement costs. Overall, the technical consultant review is conducted in greater depth at slow-track and covered a broader range of assets.

7.34. The depth of our assessment is such (all 102 assets considered line-by-line) that we no longer make use of blended unit costs.

Results

7.35. The ten slow-track DNOs forecast that they would spend £3,331m on asset replacement in RIIO-ED1. Our efficient view of these costs is lower at £2,972m, representing a difference of £359.2m (10.8 per cent).

Table 7.2: Asset replacement modelled costs (2012-13 prices)

DNO Group	DNO	ED1 total forecast (£m)	ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	365	344	- 20.6	-5.6%
NPg	NPGN	270	258	- 12.3	-4.6%
	NPgY	346	301	- 44.9	-13.0%
WPD	WMID	420	433	13.4	3.2%
	EMID	349	375	25.3	7.2%
	SWALES	247	247	0.2	0.1%
	SWEST	373	360	- 13.3	-3.6%
UKPN	LPN	292	243	- 48.9	-16.8%
	SPN	281	232	- 48.9	-17.4%
	EPN	434	331	- 102.6	-23.7%
SP	SPD	241	235	- 6.1	-2.5%
	SPMW	429	387	- 41.6	-9.7%
SSE	SSEH	205	185	- 19.8	-9.7%
	SSES	470	457	- 13.6	-2.9%
Total		**4,720**	**4,386**	**- 333.6**	**-7.1%**
Total exc WPD		**3,331**	**2,972**	**- 359.2**	**-10.8%**

Refurbishment

Fast-track assessment

7.36. To assess the efficient workload for asset refurbishment we modelled an efficient view of refurbishment volumes by benchmarking the DNO's submitted volumes against the industry median refurbishment volumes as a proportion of the DNOs' asset bases. The workload adjustment was expressed in monetary terms by multiplying the volume adjustment by our efficient view of unit costs. To assess unit cost efficiency we reviewed information from the DNOs and our consultants and used this to form a view of appropriate unit costs for each asset category. This was then multiplied by our view of volumes to determine efficient modelled costs for each DNO.

Key comments on the fast-track assessment

7.37. The validity of using of run rates for refurbishment was questioned by one DNO, who felt that greater use of survivor modelling in tandem with CBAs was more appropriate. It was also suggested that a consistent approach should be adopted for refurbishment, rather than a mixture of mean, median and expert views of run rates.

7.38. It was also felt that insufficient consideration of the trade-offs between refurbishment and replacement had been made during fast-track and that Ofgem's modelling should be a starting point for further investigation, rather than the result. Concerns were raised by the DNOs during the fast-track process that refurbishment did not align with the work that DNOs were carrying out in asset replacement. For example, in a particular period asset replacement may be offset by the refurbishment of an asset. In order to align these we looked at both making changes to the unit cost and to the volumes.

Revised approach for the slow-track assessment

7.39. A similar approach for the assessment of refurbishment was taken forward at the slow-track process to the fast-track. Expert unit costs were chosen using DPCR5 or RIIO-

ED1 data and consultants reviewed the unit costs for all asset categories. Run rate and trend analysis was then used against the proportion of the DNOs asset base. At fast-track 25 asset categories were excluded from analysis based upon consultant advice and the same approach was taken used in slow-track. These volumes were given to the DNOs.

7.40. In order to achieve the alignment between asset replacement and refurbishment we made changes to the refurbishment unit costs for the areas that align with asset replacement. We divided the DNOs' view of unit cost for refurbishment by their asset replacement unit cost. We then took the mean of these results across all DNOs and multiplied it by the asset replacement expert view of unit cost to give a unit cost for refurbishment. We used the mean unit costs for each DNO from the combination of both DPCR5 and RIIO-ED1 to take account of any differences in approach between the two price control periods. For the remaining assets that do not align with asset replacement our consultants provided unit cost based on DNO data and their expert knowledge.

7.41. A criticism of our approach in fast-track was that we did not take account of the possible trade-offs between asset replacement and refurbishment volumes. The concern raised is that some DNOs may be offsetting (prolonging the life of the asset) replacement with refurbishment. In that respect we would expect to see a higher number of assets being refurbished than replaced for those DNOs in the RIIO-ED1 period. Our view is that the combination of DNO submitted volumes for replacement and refurbishment should fall under our asset replacement modelled view. We relaxed this to if the DNO submitted volumes fell under 110 per cent of our modelled view the refurbishment volumes would be given. The modelled view used was the average view asset replacement modelled volumes using age profile 4 (implied lives) and age profile 6 (maximum of implied lives or forecast). As in asset replacement where a DNO has identified refurbishment of an asset that is agreed in their secondary deliverables for health and criticality we have given the DNO the volumes requested.

Results

7.42. As detailed in Table 7.3, the ten slow-track DNOs forecast that they would spend £586m on refurbishment works in RIIO-ED1. Our efficient view of these costs is lower at £451m, representing a difference of £135m (23.1 per cent).

Table 7.3: Refurbishment modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	109	90	- 18.7	-17.2%
NPg	NPgN	61	36	- 25.8	-42.1%
	NPgY	78	53	- 25.0	-31.9%
WPD	WMID	29	32	2.7	9.5%
	EMID	25	27	2.1	8.5%
	SWALES	20	22	1.5	7.3%
	SWEST	27	32	5.1	19.3%
UKPN	LPN	15	15	0.3	2.3%
	SPN	24	22	- 1.9	-7.9%
	EPN	31	28	- 2.6	-8.6%
SPEN	SPD	50	44	- 6.0	-12.0%
	SPMW	95	49	- 45.7	-48.2%
SSEPD	SSEH	28	28	- 0.8	-3.0%
	SSES	95	86	- 8.8	-9.4%
Total		**686**	**563**	**- 123.7**	**-18.0%**
Total exc WPD		**586**	**451**	**- 135.1**	**-23.1%**

Civil works

Fast-track approach

7.43. Civil works costs are reported under two main categories:

1. **Civil works driven by the condition of civil items**: under this category, DNOs report a breakdown of works carried out at indoor and outdoor substations as well as cable tunnels, cable bridges and street furniture. The detail of works carried out at each substation is recorded by voltage level (eg roofs, doors, enclosures and surrounds etc, at LV, HV, EHV and 132kV).
2. **Civil works driven by plant asset replacement:** under this category DNOs report the number of items where civil works has been undertaken as a result of the replacement of an asset. The categories of civil works here are new builds, plinths and groundworks, buildings, and enclosures and surrounds. The work for each of these is recorded by voltage level. Other items reported also include cable tunnels and cable bridges.

7.44. For the volume assessment at fast-track, for each detailed cost area we applied the industry median run rate as a proportion of the total asset base. For unit costs, we applied the industry median unit costs using RIIO-ED1 data.

Key issues from fast-track

7.45. Some concerns were raised about inconsistency in reporting as some DNOs reported volumes as the number of sites while other as the number of interventions. Additionally concerns were raised for the unit comparison for certain asset categories. Some DNOs claimed that because of the differences between the networks, the comparisons were not like-for-like.

Slow-track approach

7.46. For our slow-track assessment we use broadly the same methodology as fast-track. To improve the quality of data used in our analysis we amended the business plan data table (BPDT) guidance and cost commentary to help capture the correct data. We also issued supplementary questions to verify the data quality and worked together with our technical consultants to provide qualitative adjustments where there was a justifiable case.

Results

7.47. As detailed in Table 7.4, the ten slow-track DNOs forecast that they would spend £554m on civil works in RIIO-ED1. Our efficient view of these costs is lower at £520m representing a difference of £34m (10.9 per cent).

Table 7.4: Civils modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	76	84	7.9	10.5%
NPg	NPgN	38	28	- 10.2	-27.0%
	NPgY	67	49	- 17.8	-26.6%
WPD	WMID	63	36	- 27.0	-43.1%
	EMID	55	54	- 1.2	-2.2%
	SWALES	24	21	- 2.6	-11.1%
	SWEST	44	28	- 15.3	-35.1%
UKPN	LPN	69	39	- 29.2	-42.6%
	SPN	43	61	17.9	41.3%
	EPN	84	88	3.1	3.7%
SPEN	SPD	48	47	- 1.5	-3.2%
	SPMW	76	55	- 21.7	-28.4%
SSEPD	SSEH	14	22	7.4	51.6%
	SSES	38	48	9.6	25.1%
Total		**739**	**658**	**- 80.5**	**-10.9%**
Total exc WPD		**554**	**520**	**- 34.3**	**-6.2%**

High Value Projects (HVPs)

Fast-track assessment

7.48. External consultants assessed the HVP scheme papers submitted by DNOs. A number of scheme papers did not provide sufficient detail to enable to us to adequately assess the efficient costs of carrying out the work. Therefore we used the approach taken in our cost efficiency assessment of asset replacement and of primary network reinforcement, combined with the qualitative assessment from our technical consultants.

7.49. In several cases DNOs submitted HVP costs covering projects that were also included in their DPCR5 business plans. We made an adjustment for the feasibility of these projects being completed over the RIIO-ED1 period. We did this by looking at the ratio of the expected expenditure on these projects against the DPCR5 final settlement allowance and factored this into our adjustments for forecast costs. We ensured that this modelled view would not impact on the final assessment of the DPCR5 HVP re-opener mechanism.

Key comments on the fast-track assessment

7.50. The main concern was that asbestos management costs should not be included in the unit cost data.

Revised approach for the slow-track assessment

7.51. The submitted scheme papers were again assessed by our technical consultants. Where the information provided was insufficient, supplementary questions were raised. In addition, as was the case at fast-track, the forecast costs were compared with our disaggregated analysis. For the HVP that started in DPCR5, we used the same approach as in our fast-track assessment.

Results

7.52. Our technical consultants, DNV GL, reached a view on the HVPs by conducting an initial review to assess if there was clear, prima facie justification for the project and the scope for alternative smart grids solutions. If needs case for the project was justified, the review concentrated on a unit cost assessment. This assessment considered our expert view of unit cost of comparable assets undertaken for the asset replacement model (described above) and the cost of similar projects that have been carried out in the past, the details of which came from a database of projects held by the consultants. Where the proposed unit costs were unjustifiably high adjustments were made.

7.53. Three DNO groups (five DNOs) submitted a total of seven HVPs, totalling £236m. It is estimated that £182m of this will be incurred in the RIIO-ED1 period. Following a review of these projects and their associated costs, our view of efficient costs is £172m, a difference of £10m (6 per cent). Based on our analysis and a technical assessment, three projects receive the full submitted costs. The remaining four receive an allocation lower than their submitted costs. The details are presented in Table 7.5.

Table 7.5: High value projects costs (2012-13 prices)

Type	DNO Group	Project cost (£m)	DPCR5 cost (£m)	RIIO-ED1 costs (£m)	Expert view of scheme (£m)	RIIO-ED1 expert costs (£m)	% Change
Load related	LPN	32	5	26	28	23	-10.0%
Load related	LPN	44	7	37	43	37	-2.0%
Load related	SSES	29	0	29	25	25	-13.0%
Load related	NPgY	39	28	11	39	11	0.0%
Non load related	LPN	26	0	26	26	26	0.0%
Non load related	SPN	37	6	31	33	28	-11.0%
Both	EPN	30	8	22	30	22	0.0%
Total		**236**	**54**	**182**	**224**	**172**	**-6%**

8. Non-core expenditure

Chapter Summary

Our approach to non-core non-load-related expenditure, which comprises 12 categories, followed by the slow-track results.

Question 1: Do you agree with our slow-track approach for assessing:
- operational IT&T costs
- diversions costs
- ESQCR costs
- legal and safety costs
- quality of service (QoS) costs
- flooding costs
- BT21C costs
- environmental costs
- black start costs
- rising and lateral mains (RLM) costs?

Overview

8.1. The non-core non-load-related expenditure comprises 12 categories as follows:

- operational it & telecoms
- diversions
- ESQCR
- legal and safety
- quality of supply (QOS)
- flooding
- BT21C
- losses and environment
- high impact low probability (HILP)[17]
- critical national infrastructure (CNI)
- black start
- rising and lateral mains (RLMs).

8.2. Our approach at both fast-track and slow-track to each is considered in turn.

[17] No expenditure was put forward by the DNOs at fast-track or slow-track.

Operational IT and Telecoms

Fast-track assessment

8.3. At fast-track we adopted a purely quantitative assessment that applied the lower of the annual average annual spend in DPCR5 and forecast for RIIO-ED1, and applied this to the eight years of RIIO-ED1.

Key comments on the fast-track assessment

8.4. DNOs sought a qualitative review to overlay any quantitative assessment of operational IT&T costs. They were concerned that they were being constrained to historical spending levels. Given the cyclical nature of these costs companies that have spent relatively little in DPCR5 may need additional expenditure in RIIO-ED1.

Revised approach for the slow-track assessment

8.5. A mixture of a quantitative and qualitative approach is taken to assess operational and non-operational IT&T, with a 25 per cent weighting given to the quantitative and 75 per cent weighting to the qualitative assessment. Due to the depth of the qualitative assessment and the fact that DNOs advocated such an assessment, we place greater emphasis on the results from this review. We also recognise that there is merit in the quantitative assessment in these areas and believe it is appropriate that this is accounted for in our allowance setting.

8.6. In our quantitative assessment, operational IT&T is combined with the non-operational capex costs. We think this is a sensible approach as it deals with any boundary issues for reporting of capex IT&T costs. The operational expenditure (opex) element of IT&T that is captured under BSCs is assessed separately (see Chapter 10).

8.7. The quantitative assessment is for costs only (volumes do not apply). We apply an industry median unit cost, calculated using 13 years of actual and forecast data and MEAV as a cost driver. Using the full 13 years of data smooths the lumpy nature of the capex expenditure. It is reasonable to expect that the scale of the network, as captured in MEAV, drives the capex IT. However, we recognise that there are limitations to the explanatory power of MEAV on IT&T costs and we place greater weight on the qualitative assessment.

8.8. We employed consultants (DNV GL) to undertake a qualitative assessment of the DNOs' IT&T expenditure as part of the slow-track assessment. This involved a review of all DNOs' IT&T strategies. It collectively reviewed the costs for operational IT&T, non–operational capex IT&T and business support IT&T (opex).

8.9. It was based on a detailed evaluation of each DNO's IT&T strategy and the related RIIO-ED1 expenditure to justify replacement and innovation costs. The assessment looked at historical expenditure but this was not used not make adjustments. It focused on answering four main questions:

- does the IT Strategy directly align with the objectives and outputs of the business case?

- has the IT Strategy been constructed using best practice techniques and can it therefore be expected to produce a robust plan that will successfully support the business case?
- does the IT Strategy demonstrate a best practice approach to implementation that is grounded in reality?
- how do the long-term costs of running IT services compare and are they efficient, reasonable and justified?

8.10. Following an initial review, our consultants discussed initial findings with the DNOs and requested supplementary information. The assessment determined the adequacy of IT strategies in terms of costs, benefits and outputs. It identified qualitative adjustments for operational IT&T, non-operational IT&T and business support IT&T costs on a DNO basis. The results were also reviewed on an ownership group level and cross checked with Ofgem's quantitative analysis. The qualitative assessment results were then combined with the Ofgem quantitative assessment results. Finally, the costs were then reallocated to operational IT&T and non-op capex IT&T based on the ratio of submitted expenditure in these two areas.

Results

8.11. Over the RIIO-ED1 period the DNOs are forecasting to spend on average 38 per cent more on annual operational IT&T than in DPCR5. The common reasons cited for this is to improve IT capability and to improve customer service. The significant increase in IT cost and the various reasons stated for the increase led us to give more weight to the qualitative assessment carried out by the consultants.

8.12. The ten slow-track DNOs submitted £365m in operational IT&T costs for RIIO-ED1 and our view of efficient costs is lower at £337m, a difference of £28m (7.8 per cent). Our results combine quantitative analysis (25 per cent weighting) and qualitative analysis (75 per cent weighting).

8.13. Our overall view reduces five of the slow-track DNOs forecast costs and gives three DNOs an increase. Both NPg companies receive their forecast costs. The greatest reductions in costs are for ENWL and UKPN. Both companies' costs are assessed as being high under both the quantitative analysis and qualitative consultant's analysis.

Table 8.1: Operational IT&T modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	66	46	- 20.0	-30.4%
NPg	NPgN	23	23	-	0.0%
	NPgY	42	42	-	0.0%
WPD	WMID	24	24	0.0	0.1%
	EMID	26	27	1.1	4.3%
	SWALES	24	22	- 1.5	-6.1%
	SWEST	24	23	- 1.0	-4.1%
UKPN	LPN	49	40	- 9.4	-19.1%
	SPN	37	32	- 4.9	-13.2%
	EPN	47	45	- 1.8	-3.9%
SPEN	SPD	21	22	1.2	5.7%
	SPMW	33	39	5.6	17.0%
SSEPD	SSEH	18	18	- 0.5	-2.8%
	SSES	30	31	1.5	5.0%
Total		**463**	**433**	**- 29.6**	**-6.4%**
Total exc WPD		**365**	**337**	**- 28.3**	**-7.8%**

8.14. The results of the quantitative modelling alone, which was based only on unit cost adjustments (not volumes), is that eight of the ten slow-track DNOs' IT&T costs are assessed as less efficient than our modelled costs. Only SPD and SSES are found to be more efficient. The results of the qualitative review are in line with the quantitative analysis for these two DNOs.

8.15. Looking at the results of the qualitative assessment in isolation our consultants recommend reductions to ENWL and all three of UKPN DNOs forecast costs (see Table 8.2). The qualitative review recommends allowing all other ten DNOs their forecast costs.

8.16. Our consultants are aware that ENWL needs to make changes to its IT estate and this will come at a cost. However, they consider the cost too high. They suggest reductions can be made in contract and energy management, costs to refresh the control room and costs for the BT 21st century (BT21C) refresh.

8.17. DNV GL notes that UKPN licensees' overall expenditure is amongst the highest. Although the business plan provides narrative on the cost, they are of the view that there is insufficient information to provide credible evidence for such high expenditure. In particular DNV GL notes that the associated IT costs of asset replacement are too high.

Table 8.2 Qualitative assessment of operational IT&T

Group	DNO	Submitted (£m)	Qualitative view (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	65.6	43.4	-22.2	-34%
UKPN	LPN	49.0	36.0	-13.0	-27%
	SPN	36.7	30.0	-6.4	-17%
	EPN	46.8	43.6	-3.2	-7%

8.18. For NPg we have decided to award the both DNOs their submitted cost. That is, to reverse the reduction in costs our quantitative model suggest. In our strategy decision[18] we encouraged DNOs to consider the impact of investment in RIIO-ED1 on future price controls. We allowed DNOs to propose investments in RIIO-ED1 that only deliver a positive net present value benefit in a subsequent price control. NPg is the only DNO to propose investment during RIIO-ED1 in 'smart enablers' that deliver benefits during the RIIO-ED2 period. It requested £83m across a number of activity areas. This investment is largely in bringing forward communications and IT equipment to enable the quick deployment of smart grids solutions as required.

8.19. We have worked with our consultants to assess the submitted CBA, the engineering basis for the work, and the justification for investing in advance of need. We consider that it is in the interest of consumers for NPg to be allowed the funding in full for this investment in smart grids enablers. It is likely to deliver significant benefits to consumers through avoided reinforcement costs in subsequent price controls. At the RIIO-ED2 price control review NPg will need to demonstrate it has invested efficiently to deliver the promised benefits for consumers. If it is unable to do so, we will recover at least part of the allowed expenditure on behalf of consumers when setting NPg's RIIO-ED2 allowances.

Diversions

Fast-track assessment

8.20. At fast-track we concluded that the breakdown of industry volumes for diversions was not sufficiently comparable across DNOs and we applied the volumes as submitted by each DNOs. Run rate analysis of diversion volumes revealed that on the whole all DNO forecasts were relatively stable due to difficulty in forecasting trends in diversionary activity. For this reason we excluded any efficiency benchmarking relating to volumes.

8.21. Efficient unit costs were taken as the industry median calculated by a simple cost:volume ratio using eight year RIIO-ED1 forecasts. Due to the project based nature of diversions work, the forecast data was viewed as more reliable than historical data. This industry median unit cost was applied to the accepted volumes. Data on diversions is collected at four different voltage levels (LV, HV, EHV and 132kV), and a median unit cost was calculated and applied at each level.

Key comments on the fast-track assessment

8.22. There were a limited number of comments from DNOs on the approach to assessing diversions at fast-track.

Revised approach for the slow-track assessment

8.23. With minimal changes in the DNO submitted data from the fast-track to the slow-track assessment and no substantive issues raised, we adopted the same approach at slow-track.

[18] https://www.ofgem.gov.uk/publications-and-updates/strategy-decision-riio-ed1-overview

Results

8.24. Our industry level view of diversions costs is broadly in line with the forecast costs. The ten slow-track DNOs forecast £376m of diversion costs over the RIIO-ED1 period and our view of efficient costs is £376m (Table 8.3).

Table 8.3: Diversions modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	27	30	2.6	9.4%
NPg	NPgN	24	23	-0.8	-3.4%
	NPgY	32	33	1.4	4.4%
WPD	WMID	70	71	1.4	2.1%
	EMID	68	67	-1.2	-1.7%
	SWALES	29	32	3.3	11.5%
	SWEST	61	61	-0.5	-0.7%
UKPN	LPN	31	29	-2.2	-7.0%
	SPN	58	57	-1.1	-1.8%
	EPN	111	106	-5.0	-4.5%
SPEN	SPD	11	11	-0.5	-4.9%
	SPMW	23	23	-0.1	-0.3%
SSEPD	SSEH	4	4	1.0	27.8%
	SSES	55	60	4.3	7.7%
Total		**605**	**607**	**2.7**	**0.4%**
Total exc WPD		**376**	**376**	**-0.4**	**-0.1%**

Diversions – rail electrification

8.25. At fast-track only the four WPD licensees submitted ex ante costs for rail electrification diversions. Given that a key principle of our fast-track assessment was to consider submitted plans in the round, the fact that we fast-tracked the four WPD licensees meant that we allowed the submitted ex ante rail electrification costs. We put in a licence condition to allow costs to be claimed back if they were not incurred.

8.26. At slow-track both NPgN and NPgY submitted ex ante rail electrification costs totalling £61m which were not in their fast-track submissions. We do not include an ex ante allowance for slow-track as we consider that they are adequately dealt with through an uncertainty mechanism of the type proposed by SSEPD.[19]

Electricity Safety, Quality and Continuity Regulations (ESQCR)

Fast-track assessment

8.27. ESQCR costs are broken down into seven methods for meeting ESQCR requirements: shrouding; diversions; reconductoring; rebuild; undergrounding;

[19] We have not penalised NPgN and NPgY for submitting these costs as they have not been included in our efficiency assessment of submitted costs.

derogation and other. Costs in each of the seven categories are then split by four voltage levels (LV, HV, EHV and 132kV).

8.28. For our fast-track assessment we did not to make any adjustments to the submitted volumes due to the safety related importance of ESQCR. With regards to unit costs we calculated the average unit cost per DNO for each method at each voltage level using 13 years of data (DPCR5 and RIIO-ED1). We used these to calculate a median unit cost and applied this to the submitted volumes. DNOs were given the minimum of submitted and Ofgem modelled costs. Where a DNO had completed the agreed ESQCR programme but continued to report business as usual safety clearance costs in the ESQCR tab (rather than in legal and safety) the costs were not permitted.

Key comments on the fast-track assessment

8.29. We received limited comments on the methodology for assessing ESQCR costs, other than disallowing wrongly reported costs.

8.30. It transpired that WPD reported LV overhead line ground clearance costs under the Legal and Safety (under the "other" category) and not in ESQCR. We explored the possibility of transferring the forecast costs and volumes to the ESQCR reporting table. The analysis results did not show significant difference and so the costs remained as reported.

Revised approach for the slow-track assessment

8.31. We again verified the submitted volumes with the HSE and these were accepted. For unit costs, the same approach as fast-track is adopted. Unlike fast-track, where a DNO has completed the agreed ESQCR programme but reported the business as usual safety clearance costs in the ESQCR reporting table (rather than in legal and safety), we allow these costs in our slow-track assessment. This reflects the importance we place on ensuring that DNOs operate safe networks. We expect that when DNOs report ESQCR and legal and safety costs during the RIIO-ED1 price control period that they adhere strictly to the Regulatory Instructions and Guidance (RIGs) to ensure consistency of reporting.

Results

8.32. Six of the ten slow-track DNOs submitted ESQCR costs totalling £187m and our view is in line with this at £186m, a less than one per cent reduction in total forecast costs.

Table 8.4: ESQCR modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	3	3	-	0.0%
NPg	NPgN				
	NPgY				
WPD	WMID				
	EMID				
	SWALES				
	SWEST	15	15	- 0.8	-5.2%
UKPN	LPN				
	SPN	27	27	- 0.2	-0.8%
	EPN	45	44	- 0.6	-1.3%
SPEN	SPD	48	48	-	0.0%
	SPMW	61	61	-	0.0%
SSEPD	SSEH	3	3	-	0.0%
	SSES				
Total		**202**	**201**	**- 1.6**	**-0.8%**
Total exc WPD		**187**	**186**	**- 0.8**	**-0.4%**

Legal and Safety

Fast-track assessment

8.33. Legal and safety costs are broken down into six categories: site security; asbestos management; safety climbing fixtures; fire protection, earthing upgrades and other. Site security at substations is further broken down by three voltage levels (HV, EHV and 132kV), and asbestos management is further broken down into two categories (substations and meter positions). Under the other category DNOs are free to suggest other legal and safety related activity.

8.34. For the fast-track assessment, we accepted the volumes as submitted. To assess unit costs for all categories except other, we calculated a median unit cost at the most disaggregated level of reporting. This was based on eight years of RIIO-ED1 data. We gave the minimum of submitted and modelled costs. For the other category we undertook a qualitative assessment.

Key comments on the fast-track assessment

8.35. No significant comments were raised with our approach to assessing legal and safety costs.

Revised approach for the slow-track assessment

8.36. At slow-track we use the same methodology as in our fast-track assessment, except that we use 13 years of data to calculate the median unit costs. This is consistent with our approach to ESQCR costs. We apply a positive adjustment to ENWL's safety climbing costs following a qualitative review of their justification.

Results

8.37. The ten slow-track DNOs forecast they will spend £330m on legal and safety activity over the RIIO-ED1 period; we believe the efficient total cost to be £293m, a difference of £38m (11.5 per cent).

Table 8.5: Legal and Safety modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	40	29	- 10.6	-26.7%
NPg	NPgN	24	18	- 6.2	-25.4%
	NPgY	51	42	- 9.5	-18.6%
WPD	WMID	25	22	- 3.3	-13.0%
	EMID	26	22	- 4.6	-17.3%
	SWALES	11	11	- 0.2	-1.5%
	SWEST	21	21	- 0.4	-1.7%
UKPN	LPN	41	40	- 0.6	-1.5%
	SPN	34	32	- 2.7	-7.9%
	EPN	48	47	- 1.5	-3.1%
SPEN	SPD	25	23	- 1.6	-6.5%
	SPMW	36	36	-	0.0%
SSEPD	SSEH	5	4	- 1.1	-21.7%
	SSES	26	22	- 4.2	-15.9%
Total		**414**	**368**	**- 46.3**	**-11.2%**
Total exc WPD		**330**	**293**	**- 38.0**	**-11.5%**

Quality of Supply

8.38. As was the case for fast-track we do not award ex ante allowances for QoS at slow-track. DNOs receive financial incentives if they perform well against CI and CML targets set under the Interruptions Incentives Scheme (IIS). We do not believe it is appropriate to also set ex ante allowances in this area.

Flooding

Fast-track assessment

8.39. Flooding is broken down into several sections: flood mitigation schemes (fluvial and coastal) at HV, EHV, 132kV, and 275/400kV; flood mitigation schemes (pluvial); flooding site surveys (fluvial and coastal); and flooding site surveys (pluvial).

8.40. Each category was assessed separately to give an industry median unit cost based on RIIO-ED1 data, with each DNOs' unit cost determined by a simple division: RIIO-ED1 forecast costs/RIIO-ED1 forecast volumes.

8.41. For the volume adjustment, rather than adjusting DNO costs on a volume of work basis, the volume adjustments were made based on an assessment of their risk points at each substation for each flood mitigation scheme.

8.42. Similar to the approach in DPCR5, we took the total risk on the network before investment (flood likelihood at each substation (ie 1/100, 1/200, 1/1000) multiplied by the number of customers supplied by that substation) and the total risk after investment (designed protection level multiplied by the number of customers supplied by that substation). The difference between these risk levels was calculated to achieve a risk delta (ie total reduction in risk points). The total reduction in risk points was then calculated as a percentage of the original risk. This was then divided by the industry average to give a proportion of risk reduced for each DNO, relative to the industry average. This proportion gave the total volume reduction for each DNO.

8.43. The unit cost adjustment for each category was calculated by taking the DNO's total forecast costs and subtracting its submitted volumes multiplied by the industry median unit cost. Those DNOs with a higher unit cost than the median received a reduction in their submitted costs; those DNOs with a lower unit cost than the median received an increase in their submitted costs.

8.44. If this value of the unit cost adjustment was lower than the volume related adjustment suggested by the risk points (ie if we were taking a smaller proportion off through unit costs than through volumes), then costs were adjusted by both the unit cost and the volume adjustment. If the unit cost reduction was already taking off more than the volume reduction indicates, then no further volume reduction was made.

Key comments on the fast-track assessment

8.45. Concern was raised that we made two unit cost adjustments, as there was a unit cost adjustment inherent in the risk-based volume adjustment assessment.

8.46. It was also argued that the volume assessment did not provide any credit for those DNOs protecting the existing level of risk. For example, if there was no change in the risk score for a particular site but flood mitigation work was undertaken to ensure there was no increase in flood risk, a DNO was not given credit for maintaining the flood risk level.

Revised approach for the slow-track assessment

8.47. We accept that our volume assessment at fast-track also had a unit cost adjustment incorporated in it. Assessment of flood mitigation costs at slow-track is based solely on a similar approach to "volume" assessment in fast-track.

8.48. We calculate the risk delta for each DNO (risk points before intervention minus risk points after intervention). A key difference from fast-track to slow-track is that we are now giving credit where DNOs are providing protection up to the current unprotected level of risk. This is in line with the approach taken at DPCR5 and recognises that it may not be economic or feasible to protect to a higher level of risk.

8.49. The risk delta is then used to determine the cost of a risk point reduction for each DNO (risk delta divided by forecast costs). DNOs are given the lower of their cost per risk point reduction or the industry lower quartile cost per risk point reduction. This cost per risk reduction is then multiplied by the risk delta to give an efficient view of costs. We chose to benchmark based on lower quartile and not the stricter industry median; while we want to ensure costs are efficient, we also want to ensure that any reductions in costs are not to such a level that flood mitigation work could be put at risk. Equally, given the different flood mitigation strategies proposed by the DNOs we feel that to uplift those DNOs with a lower cost per risk point than the lower quartile would result in an inappropriately generous cost allowance. We have accepted the workload put forward by

DNOs, so in the round we believe that this is a fair and pragmatic assessment of flood mitigation costs.

Results

8.50. Total submitted costs for flood resilience by the ten slow-track DNOs are £88m and our view is £86m, a difference of 2.7 per cent (£2m).

Table 8.6: Flooding modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	11	11	-	0.0%
NPg	NPgN	17	15	- 2.4	-13.8%
	NPgY	23	23	- 0.0	-0.2%
WPD	WMID	1	1	-	0.0%
	EMID	5	3	- 1.8	-36.5%
	SWALES	8	3	- 5.0	-66.0%
	SWEST	1	1	-	0.0%
UKPN	LPN	4	4	0.0	0.0%
	SPN	4	4	-	0.0%
	EPN	8	8	-	0.0%
SPEN	SPD	1	1	-	0.0%
	SPMW	1	1	-	0.0%
SSEPD	SSEH	1	1	-	0.0%
	SSES	20	20	-	0.0%
Total		**103**	**94**	**- 9.2**	**-9.0%**
Total exc WPD		**88**	**86**	**- 2.4**	**-2.7%**

BT21C[20]

Fast-track assessment

8.51. BT21C is broken down into two main categories: protection communication circuits and protection operational measures.

8.52. No volume adjustments were made, only a unit cost adjustment. For both categories, where a DNO incurred expenditure in DPCR5, its DPCR5 annual average unit cost was applied to the RIIO-ED1 period. Where a DNO did not incur costs in DPCR5, the RIIO-ED1 industry median was applied to the RIIO-ED1 period.

8.53. The modelled costs were calculated by multiplying the selected unit cost by the submitted volumes.

[20] BT21CN refers to the roll out of BT's next generation communications network which replaces Public Switched Telephone Network (PSTN) with a Digital Internet Protocol (IP). Whilst changing the communications protocol used on the existing network assets, it also accelerates the replacement of copper communications circuits with non-metallic optical fibre.

Key comments on the fast-track assessment

8.54. Three main issues were raised with the assessment of BT21C costs at fast-track. The first concerned the unit of volume adopted. It was suggested the length of overhead and underground pilot wires was more appropriate than the number of BT circuits. Secondly, it was argued that if the number of BT circuits were to be used, then evidence of the existence of these circuits should be submitted to Ofgem. Thirdly it was suggested that the analysis should reflect that costs will differ depending on the solution adopted. This is particularly important when the least expensive option is not appropriate for a DNO.

Revised approach for the slow-track assessment

8.55. For the slow-track assessment we sought further evidence on the BT21C costs from DNOs. We asked for the detail on the length of overhead and underground pilot wires used to replace BT21C circuits, further detail on the type of solutions adopted and the justification for choosing those solutions.

8.56. We do not have confidence in the data provided on the length of overhead and underground pilot wires to use it in our assessment. Therefore, our volume metric remains the number of BT circuits. We are satisfied with the evidence provided from DNOs (ie a list of all BT circuit reference numbers) that these volumes are justified. No volume adjustments are made.

8.57. For our unit cost assessment, we calculate an industry median unit cost using 13 years' of actual and forecast data. Thirteen years' of DNO data provides us with a larger and dataset that is more reflective of costs in RIIO-ED1, as well as historical information. The unit costs are then multiplied by the submitted volumes to set modelled costs.

8.58. We reviewed the additional data on the cost of different solutions to BT21C. We also considered making a qualitative adjustment for those DNOs where an aggregate BT21C unit cost assessment could be penalising them unfairly (ie there are justifiable reasons for adopting more expensive solutions). The data received allowed us to complete a unit cost comparison by type of solution for only a limited number of solutions. Those DNOs with high aggregate unit costs (who therefore received a reduction) were also significantly more expensive for the comparable solutions types (eg microwave radio and fibre optic cable) than comparator DNOs. We concluded that this suggests cost inefficiencies across all BT21C solutions for those DNOs and it is therefore inappropriate to make a qualitative adjustment based on the cost of different solutions.

8.59. A qualitative adjustment was made to SPMW's modelled costs to account for a greater length of pilot wire per BT circuit being required, due to the interconnectivity of its network.

Results

8.60. Eight of the 14 DNOs submit RIIO-ED1 costs for BT21C totalling £95m. We do not believe these costs to be efficient and apply a £22m (23 per cent) reduction to DNO forecast costs.

Table 8.7: BT21C modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL				
NPg	NPgN				
	NPgY				
WPD	WMID	6	2	- 3.4	-58.1%
	EMID	9	3	- 6.4	-71.7%
	SWALES				
	SWEST				
UKPN	LPN				
	SPN	16	10	- 6.0	-36.3%
	EPN	25	13	- 11.1	-45.2%
SPEN	SPD	5	4	- 1.4	-27.4%
	SPMW	28	35	6.7	23.6%
SSEPD	SSEH	2	2	-	0.0%
	SSES	4	4	-	0.0%
Total		**95**	**73**	**- 21.6**	**-22.7%**
Total exc WPD		**80**	**68**	**- 11.8**	**-14.7%**

Losses and other environmental

Fast-track assessment

8.61. Environmental costs comprise costs related to schemes to reduce losses and for the management of the eight sub-categories of activity that make up the other environmental category:

- visual amenity
- oil pollution mitigation scheme - cables
- oil pollution mitigation scheme - operational sites
- oil pollution mitigation scheme - non-operational sites
- SF6 emitted mitigation schemes
- noise pollution
- contaminated land clean up
- environmental civil sanction.

Losses

8.62. At fast-track we undertook a qualitative assessment based on the DNOs' losses strategies. While we focused on the narratives, we also analysed some of the CBAs provided. Our assessment concluded that most companies had addressed most or all of the key areas in our strategy decision, but we highlighted the need for more robust CBA justification in a number of cases. [21]

[21] https://www.ofgem.gov.uk/publications-and-updates/strategy-decision-riio-ed1-overview

Other environmental

8.63. Our fast-track assessment was based on a qualitative assessment of forecast costs. As a result of this, some DNOs were allocated what they asked for. When we were dissatisfied with the qualitative results for a DNO it received the lower of the submitted and industry median unit cost. This unit cost was applied to the volumes as submitted. This median was based on using eight years of RIIO-ED1 forecast data and MEAV as a cost driver. The assessment was done at an aggregate level (ie all environmental cost categories were aggregated before the median cost was calculated).

Key comments on the fast-track assessment

8.64. There was limited feedback on the assessment undertaken. We felt that an approach more bespoke to the individual categories that comprise the ex ante environmental costs would be appropriate.

Revised approach for the slow-track assessment

Losses

8.65. At the slow-track, we have looked in more detail at the measures proposed by each DNO, with their associated costs and benefits. We assessed the proposed measures to reduce losses and explored these through questions to the companies. We asked DNOs to identify all losses-reducing activities across their strategies and sought specific quantification of proposals where proposed measures and costs were not specified. We have made use of DNO narratives, supporting information provided during the assessment process and CBAs.

8.66. We also sought confirmation of how proposed measures, particularly low loss transformers, compared with legal minimum requirements for existing or impending EU legislation related to asset specifications.

8.67. It is important to note that the costs reported in this section and the adjustments described in Table 8.8 below refer only to CV12 costs.[22] The benefits of loss reduction measures are greater than reported here. For instance, under general asset replacement cycles DNOs are replacing old transformers with low loss transformers and this is captured under asset replacement costs and not under environmental costs.

8.68. Where DNOs have appropriately justified accelerating asset replacement or higher unit costs to deliver incremental losses benefits, we have allowed the associated higher volumes or unit costs. Low loss transformer volumes have been allowed for ENWL and SPEN. Positive unit cost adjustments were made to SSEPD's transformer replacement costs and NPg LV and HV cable costs.

[22] These are the costs reported in the CV12 table in the business plan data tables (BPDTs) submitted by the DNOs. CV12 losses refer to the replacement of assets for which that replacement was driven mainly for environmental reasons (ie losses reduction). Asset replacement reported elsewhere (in CV3) may also have environmental benefits but the primary reason for replacement is not environmental-related.

Table 8.8: Summary of slow-track approach to losses

Environmental category	Approach
Losses reduction schemes	Volumes allowed where appropriately justified. Unit costs: the minimum of submitted or modelled where modelled costs use the expert view of the relevant asset type. This was overlaid by a qualitative assessment where unit costs are allowed when they are appropriately justified by losses reduction and are above minimum legal requirements. For ENWL, a qualitative adjustment was made to allow the 'theft in conveyance' prior to benchmarking. For SSES the expenditure on losses was not appropriately justified and therefore not allowed.

Environmental excluding losses

8.69. At slow-track the overarching approach for environmental activity is to allow the submitted volumes of work where a qualitative assessment supported it, and to assess whether the costs are reasonable.

8.70. Our quantitative modelling of unit costs is overlaid and sense checked by a qualitative assessment bespoke to each environmental category. Where we set industry median unit costs, we use 13 years of actual and forecast data. Many of the categories have limited data and so a longer time period provides better information which is more reflective of RIIO-ED1 as well as historical data. We chose 13 years for all categories to ensure consistency across the environmental assessment. We apply the minimum of modelled or submitted as we feel that while the qualitative assessment gives us confidence to allow forecast costs in some cases (and to allow volumes in others) it does not provide justification to allow more than the DNOs requested.

8.71. Table 8.9 below summarises our slow-track assessment for each of the nine categories.

Table 8.9: Summary of slow-track approach to other environmental costs

Environmental category	Approach
Visual amenity (excluding AONB)	Volumes allowed where justified. Unit costs: the minimum of submitted or modelled where modelled costs uses the expert view of underground cable costs.
Oil Pollution Mitigation Scheme - Cables	Volumes allowed where justified. Unit costs: the minimum of submitted or modelled where modelled costs use the industry median based on 13 years' of DNO data.
Oil Pollution Mitigation Scheme - Operational Sites	
Oil Pollution Mitigation Scheme - Non Operational Sites	

Noise Pollution	
Contaminated Land Clean Up	For contaminated land clean up an adjustment was made to allow ENWL what it asked for, due to the strong justification of the schemes.
SF6 Emitted Mitigation Schemes	Qualitative review and costs accepted as submitted for all DNOs.
Environmental Civil Sanction	Qualitative review and costs accepted as submitted for all DNOs.

Results

8.72. The ten slow-track DNOs forecast they would spend £98m on environmental activity in RIIO-ED1; we assessed the efficient level of expenditure to be £72m and our modelled costs are £26m (26.5 per cent) lower than the DNO forecast. Our modelled costs are lower than submitted costs for all ten slow-track DNOs.

Table 8.10: Environmental modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	16	13	- 2.8	-17.8%
NPg	NPgN	1	1	- 0.2	-24.2%
	NPgY	1	1	- 0.2	-15.9%
WPD	WMID	4	4	-	0.0%
	EMID	5	5	-	0.0%
	SWALES	2	2	- 0.1	-2.5%
	SWEST	2	2	- 0.1	-3.5%
UKPN	LPN	4	3	- 1.4	-34.4%
	SPN	3	3	- 0.1	-2.4%
	EPN	10	9	- 1.2	-11.6%
SPEN	SPD	18	16	- 2.4	-13.2%
	SPMW	16	14	- 2.0	-12.0%
SSEPD	SSEH	10	3	- 7.3	-69.5%
	SSES	18	10	- 8.5	-46.9%
Total		**111**	**85**	**- 26.0**	**-23.5%**
Total exc WPD		**98**	**72**	**- 25.9**	**-26.5%**

Critical national infrastructure (CNI)

8.73. Two DNOs submitted expenditure relating to CNI; £13m for NPgY and £2m for SPMW. The sites that these projects relate to have been confirmed as CNI by the Department of Energy and Climate Change (DECC) and we therefore allow the forecast costs. The same approach was adopted in fast-track.

Black start

Fast-track assessment

8.74. Black start is broken down into two main categories: black start resilience (BSR) at substations and BSR - securing of existing telecommunications infrastructure. These two categories are broken down further. BSR at substations by voltage (EHV and 132kV) and by battery type (SCADA or Protection). BSR – securing of existing telecommunications infrastructure is broken down by landlines and internal telephony, mobile and voice communications, and SCADA infrastructure. This resulted in seven sub-categories of black start, all of which were subject to a separate cost and volume assessment.

8.75. For all areas, the industry median was taken as the unit cost using eight years of RIIO-ED1 data, as only forecast data was available. This was multiplied by submitted volumes to calculate the unit cost adjustment for each DNO.

8.76. For volumes, we took the lower of submitted and modelled volumes, where the modelled volumes were the industry median percentage of all sites worked on (submitted volumes divided by total number of substations). This was multiplied by the submitted unit cost to give the volume adjustment (where DNOs had been disallowed volumes through our modelling).

Key comments on the fast-track assessment

8.77. The main concern raised with the fast-track assessment for black start costs was with the volumes. DNOs believed that the volumes should be based on only the number of primary substations (as it is only primary substations that are black start resilience related). DNOs expressed concerns with using a ratchet (ie lower of submitted and modelled costs or volumes) at a disaggregated level.

Revised approach for the slow-track assessment

8.78. Similar to fast-track, unit costs are assessed for each of the seven sub-categories and the same approach is adopted. Forecast RIIO-ED1 data is used as there are no historical black start costs.

8.79. For volumes we make some changes. Volumes of batteries are based on the number of unprotected primary substations multiplied by the industry average number of batteries per substation. The volumes for the internal telephony, mobile and voice communications and SCADA infrastructure can be no greater than the number of unprotected primary substations.

Results

8.80. The ten slow-track DNOs submitted £44m for blackstart resilience. Our modelled costs are £38m, a £6m (13.9 per cent) decrease on forecast costs.

Table 8.11: Black start modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	7	8	0.4	4.9%
NPg	NPgN	4	3	- 1.6	-37.3%
	NPgY	6	5	- 1.7	-27.4%
WPD	WMID	3	4	0.2	6.6%
	EMID	7	8	1.4	22.1%
	SWALES	2	3	0.9	52.2%
	SWEST	4	4	0.7	19.3%
UKPN	LPN	2	2	- 0.1	-4.4%
	SPN	3	4	0.7	22.4%
	EPN	4	6	1.1	24.1%
SPEN	SPD	2	2	0.1	5.6%
	SPMW	7	4	- 3.4	-45.3%
SSEPD	SSEH	4	4	- 0.5	-10.5%
	SSES	2	1	- 1.1	-45.4%
Total		**59**	**56**	**- 2.8**	**-4.8%**
Total exc WPD		**44**	**38**	**- 6.1**	**-13.9%**

Rising and lateral mains (RLMs)

Fast-track assessment

8.81. The volume of RLM activity was taken as the 13 year industry average volumes.

8.82. Three different industry median unit costs were calculated using forecast RIIO-ED1 data and three different cost drivers - length of cable, number of customers and number of properties. The lowest unit cost was used in line with the DPCR5 re-opener.

Key comments on the fast-track assessment

8.83. DNOs objected to using industry averages to determine volumes as the volumes are suggested to be unique to a DNO.

Revised approach for the slow-track assessment

8.84. Following a qualitative assessment of volumes and a review of DNO run rates, the submitted volumes for RLM for each DNO are accepted. We accept that the volumes do not lend themselves to benchmarking, as different DNOs will justifiably need to do more RLM work than others and many of the factors that drive the workload are outside the DNOs' control. No volume adjustments are made.

8.85. In line with the fast-track approach we calculate the unit costs based on RIIO-ED1 data, but unlike the fast-track the unit cost is calculated for all categories using customer numbers as the consistent driver. This consistency removes any risk of cherry-picking at a very disaggregated level. Sensitivity testing revealed that choosing a different volume driver (length of cable or number of properties) does not make significant differences to the results.

Results

8.86. Our modelled costs are largely in line with DNO forecast costs.

Table 8.12: RLM modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	15	15	0.0	0.0%
NPg	NPgN	3	3	- 0.0	-0.8%
	NPgY	4	4	- 0.0	-0.6%
WPD	WMID				
	EMID				
	SWALES				
	SWEST				
UKPN	LPN				
	SPN	16	16	-	0.0%
	EPN	10	9	- 0.4	-3.9%
SPEN	SPD	81	81	0.0	0.0%
	SPMW	39	39	0.1	0.3%
SSEPD	SSEH	3	3	0.0	0.1%
	SSES	7	7	0.0	0.1%
Total		**178**	**177**	**- 0.3**	**-0.2%**
Total exc WPD		**178**	**177**	**- 0.3**	**-0.2%**

Summary of non-core cost results

8.87. In total, the ten slow-track DNOs estimated that they will spend £1,746m on non-core related activities in RIIO-ED1. Our assessments of the individual activities suggest this should be £1,632m and our modelled costs are £114m (6.5 per cent) lower than DNO forecast costs.

Table 8.13: Non-core modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	184	154	- 30.4	-16.5%
NPg	NPgN	97	86	- 11.2	-11.5%
	NPgY	159	149	- 10.0	-6.3%
WPD	WMID	134	129	- 5.0	-3.7%
	EMID	145	134	- 11.4	-7.8%
	SWALES	75	73	- 2.5	-3.3%
	SWEST	129	127	- 2.0	-1.5%
UKPN	LPN	131	117	- 13.6	-10.4%
	SPN	199	185	- 14.1	-7.1%
	EPN	307	287	- 20.5	-6.7%
SPEN	SPD	211	207	- 4.6	-2.2%
	SPMW	245	252	7.0	2.8%
SSEPD	SSEH	50	41	- 8.4	-16.8%
	SSES	163	155	- 8.0	-4.9%
Total		**2,229**	**2,094**	**- 134.8**	**-6.0%**
Total exc WPD		**1,746**	**1,632**	**- 114.0**	**-6.5%**

9. Network Operating Costs

Chapter Summary

Our approach to assessing network operating costs (NOCs). It reviews our fast-track approach, the issues raised at fast-track, our approach at slow-track and the results. It also reviews our approach to setting ex ante allowances for smart meter costs and for improved resilience.

Question 1: Do you agree with our approach to assessing troublecall and occurrences not incentivised (ONIs) costs?
Question 2: Do you agree with our approach to assessing the costs of tree cutting (ENATs 43-8)?
Question 3: Do you agree with our approach to assessing the costs of severe weather – atypical, inspections and maintenance, NOCs other, and tree cutting (ETR 132 activity)?
Question 4: Do you agree with our approach to assessing smart meter costs?

Overview

9.1. Network operating costs (NOCs) include the following activity areas:

- troublecall
- occurrences not incentivised (ONIs)
- severe weather - atypical
- inspections and maintenance
- tree cutting
- NOCs other.

9.2. For both the fast-track and slow-track assessments a range of different approaches have been taken to assess these individual activity areas.

9.3. For fast-track we used regression analysis in our assessment of tree cutting (ENATs 43-8 activity), troublecall and ONIs. Our regressions estimated the parameters of cost functions using historical expenditure and historical cost drivers for 2010-11 to 2012-13.

9.4. The following NOCs activities were not regressed for the fast-track assessment: severe weather - atypical; inspections and maintenance; tree cutting (ETR 132 activity), and NOCs other.

Troublecall and ONIs

Fast-track assessment, key comments and revised slow-track assessment

9.5. For both the fast-track and slow-track assessment a range of different approaches were used for the analysis of troublecall and ONIs.

9.6. The efficient volume assessment for the fast-track assessment of several areas of troublecall and ONIs was derived using the average of our modelled view of efficient volumes (a benchmark based on the industry median fault rate), DPCR5 actual volumes and RIIO-ED1 forecast volumes.

9.7. The table below summarises our approach for each voltage level and fault type, both at fast-track and slow-track, and our rationale for the slow-track approach.

Table 9.1: Summary of cost assessment approach for troublecall and ONIs

Voltage level and fault category	Summary of fast-track approach	Revised approach for-slow-track	Rationale for change
LV/HV Overhead faults	Regressed using LV/HV overhead lines	N/A	N/A
LV/HV plant and equipment	Regressed using fault volume for LV/HV plant and equipment	No longer regressed but assessed using ratio benchmarking analysis. Assessment uses industry median unit costs. Efficient volumes assessed taking the lower of DPCR5 actual or RIIO-ED1 submitted fault rates.	We have decided to move away from regression analysis because the DNO historical costs are not reflective of the submitted RIIO-ED1 forecast costs.
LV underground faults	Unit costs for faults assessed using MEAV Volumes assessed by applying average model volumes (based on median run rates as percentage of asset base), DPCR5 actuals and RIIO-ED1 forecasts.	Industry median unit costs still being used but we have considered the length of underground cable replaced and have made a qualitative adjustment to take account of this. Efficient volumes assessed taking the lower of DPCR5 actual or RIIO-ED1 submitted.	A DNO highlighted that our analysis failed to take into consideration that its higher unit costs are driven by the greater length of cable it installs, due to faults compared to other DNOs. We have taken into account that one DNO group has a fault replacement strategy that is different to other DNOs which entails it carrying out work in excess of the minimum repair required for sections of the underground cable that have a fault history.
HV underground faults	Unit costs for faults assessed using MEAV Volumes assessed by	No change from fast-track assessment for unit costs but for slow-track efficient volumes	N/A

	applying average model volumes (based on median run rates as percentage of asset base), DPCR5 actuals and RIIO-ED1 forecasts	are assessed taking the lower of DPCR5 actual or RIIO-ED1 submitted.	
LV/HV switching faults Submarine cable faults EHV and 132kV faults Pressure assisted cables	Volume assessment applied average model volumes (based on median run rates as percentage of asset base), DPCR5 actuals and RIIO-ED1 forecasts. Unit costs for these fault types assessed using industry median	No change from fast-track assessment apart from efficient volumes assessed taking the lower of DPCR5 actual or RIIO-ED1 submitted fault rates.	N/A
ONIs	Regressed using ONIs fault volume	No longer regressed but assessed using ratio benchmarking analysis. We have assessed volumes and unit costs at a more disaggregated level. Efficient volumes are assessed taking the lower of DPCR5 actual or RIIO-ED1 submitted.	We have decided to move away from regression analysis because the DNO historical costs are not reflective of the submitted RIIO-ED1 forecast costs. Two companies recommended changes to our assessment to a more disaggregated level of analysis to take account of reporting disparities between DNOs. We have changed our approach to take this into account.

Qualitative Adjustments

9.8. For LV and HV underground faults we recognise that there is a definitional boundary between asset replacement and troublecall which resulted in material differences in the unit cost of underground fault repair costs in the troublecall analysis at fast-track. Those DNOs that undertake proactive replacement of these assets enter the replacement costs in the relevant asset replacement table of the business plan data templates (BPDTs). Those that adopt a reactive replacement strategy enter these costs as troublecall costs.[23] The four WPD DNOs, unlike the other ten DNOs, adopt a reactive replacement strategy. As such the cost per fault is typically higher for the WPD DNOs as the length of cable used to repair each fault is greater.

[23] DNOs reporting this as asset replacement would place costs and volumes in the CV3 table in the BPDTs but those reporting in troublecall would place the costs in CV15a.

9.9. To account for this in our troublecall analysis we made an adjustment to WPD for LV and HV underground faults. We calculated the average length of cable installed for repairing a fault for the other ten DNOs. We then multiplied that by WPD's fault rates to determine the number of faults that should be assessed for WPD under troublecall. The troublecall benchmark unit costs were then applied to these faults. For the additional length of cable that WPD install when repairing a fault, we apply the unit cost that is calculated by the asset replacement model. This approach does not adversely affect the efficient volumes for the other DNOs in the asset replacement model as these volumes are calculated using the age-based model rather than run rate analysis.

9.10. For UKPN and SPD LV underground CONSAC cable faults, we have made a qualitative adjustment to our modelled volumes where our analysis indicated inconsistency in DNOs' data reporting.

9.11. For SSEPD we have made a qualitative adjustment for the improvement in fault rates used by SSEPD to justify its CONSAC cable replacement program.

9.12. SSEPD's LV switching volumes are high and we have used our implied fault rate (this is the minimum of DNO volumes and industry median fault volume), as the basis for our qualitative adjustment.

9.13. We also made a qualitative adjustment to SSEPD's HV overhead line volumes in respect of the justification given for its asset replacement allowance for the undergrounding of 500km of overhead lines impacted by trees.

9.14. For ONIs, we have made a number of qualitative adjustments where the volumes were high. This applies to the following DNOs: NPgN, SPD, SPMW and EPN. We have based our qualitative analysis on the average historical run rates and the output of our customer number analysis.

Results

Troublecall

9.15. The ten slow-track DNOs collectively forecast £1,572m for troublecall and our modelled costs are £1,556m, a reduction of £16m (one per cent).

Table 9.2: Troublecall modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	162	167	4.9	3.0%
NPg	NPgN	150	129	- 20.9	-14.0%
	NPgY	226	219	- 6.3	-2.8%
WPD	WMID	175	157	- 18.2	-10.4%
	EMID	217	166	- 51.1	-23.5%
	SWALES	80	84	3.8	4.8%
	SWEST	151	145	- 5.8	-3.9%
UKPN	LPN	138	127	- 11.2	-8.1%
	SPN	151	142	- 8.5	-5.6%
	EPN	227	226	- 0.8	-0.3%
SPEN	SPD	140	144	3.3	2.4%
	SPMW	115	122	7.0	6.1%
SSEPD	SSEH	98	87	- 11.4	-11.6%
	SSES	164	192	28.1	17.2%
Total		**2,195**	**2,108**	**- 87.0**	**-4.0%**
Total exc WPD		**1,572**	**1,556**	**- 15.7**	**-1.0%**

ONIs

9.16. The ten slow-track DNOs collectively forecast £427m for ONIs and our modelled costs are £404m, a reduction of £23m (5.3 per cent). Nearly all DNOs are facing reduced allowance.

Table 9.3: ONIs modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	36	27	- 8.5	-23.7%
NPg	NPgN	35	27	- 7.5	-21.6%
	NPgY	72	63	- 9.5	-13.2%
WPD	WMID	31	30	- 1.0	-3.2%
	EMID	22	22	0.3	1.4%
	SWALES	14	11	- 3.0	-21.3%
	SWEST	20	16	- 4.4	-21.9%
UKPN	LPN	41	41	- 0.0	0.0%
	SPN	38	41	2.7	7.2%
	EPN	67	66	- 0.8	-1.2%
SPEN	SPD	35	34	- 1.0	-2.9%
	SPMW	38	35	- 3.2	-8.5%
SSEPD	SSEH	10	9	- 1.0	-10.7%
	SSES	55	61	6.2	11.3%
Total		**515**	**484**	**- 30.9**	**-6.0%**
Total exc WPD		**427**	**404**	**- 22.7**	**-5.3%**

Tree Cutting (ENATs 43-8)

Fast-track assessment

9.17. For tree cutting, we applied a regression analysis to ENATs 43-8 activity only, with ETR 132 activity subject to a separate assessment, described later in this chapter. We used spans cut as the driver for the regression. We applied a scaling adjustment but did not apply a workload adjustment. The time period used was 2010-11 to 2012-13.

Key comments on fast-track assessment

9.18. Some DNOs felt that the historical data available for tree cutting was not sufficiently representative of their work programmes to be used as the time period for the regression.

Revised approach for slow-track assessment

9.19. Having considered DNOs' views and given the fact that DCPR5 volumes for tree cutting were particularly back loaded to later years of the price control, we have decided to change the time period used for the regression to the eight years of RIIO-ED1 .

Results

9.20. The slow-track DNOs have collectively forecast £625m for tree cutting and our modelling allowed £612m, a reduction of £14m (2.2 per cent). The overall assessment results are in line with the fact that DNO forecasts for the RIIO-ED1 years included efficiencies compared to their historical tree cutting costs.

Table 9.4: Tree cutting modelled costs (2012-13 prices)*

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	28	37	8.4	29.8%
NPg	NPgN	32	34	2.8	9.0%
	NPgY	42	39	- 3.4	-8.1%
WPD	WMID	61	64	2.3	3.8%
	EMID	48	49	1.6	3.4%
	SWALES	59	53	- 6.0	-10.2%
	SWEST	83	88	5.3	6.4%
UKPN	LPN	0	0	-	0.0%
	SPN	66	59	- 6.2	-9.4%
	EPN	127	135	8.5	6.7%
SPEN	SPD	62	56	- 6.7	-10.8%
	SPMW	91	94	3.7	4.1%
SSEPD	SSEH	53	64	11.2	21.2%
	SSES	125	93	- 32.0	-25.7%
Total		**876**	**866**	**- 10.4**	**-1.2%**
Total exc WPD		**625**	**612**	**- 13.6**	**-2.2%**

*The results table includes ETR 132 activity.

Non-regressed areas of NOCs

Fast-track assessment, key comments and revised slow-track assessment

9.21. Assessment of the following areas was not based on a regression analysis at either fast-track or slow-track: severe weather - atypical; inspections and maintenance; NOCs other; tree cutting (ETR 132 activity only).

9.22. Our estimate of efficient workloads was carried out in a number of ways depending on the activity area being assessed. In the table below, for each area we have summarised the fast-track approach, revised approach for slow-track and our rationale for any changes.

Table 9.5: Summary of cost assessment approach for severe weather, inspections and maintenance, NOCs other and tree cutting ETR 132

Non-regressed activity area	Summary of fast-track approach	Revised approach for-slow-track	Rationale for change
Severe Weather – Atypical	Unit cost assessment only, using the minimum of the RIIO-ED1 forecast and roll forward of DPCR5	No change from fast-track assessment	N/A
Inspections & Maintenance	Volumes assessment using MEAV. Unit cost assessment using industry median as benchmark	Slight change to the calculation of MEAV for LPN	Change to MEAV necessary due to LPN's lack of overhead lines
NOCs other	For substation electricity, unit cost assessment carried out using industry median as benchmark. For dismantlement and remote location generation, the lower of the industry median change in annual spend (from DPCR5 to RIIO-ED1) or the company's submitted unit costs was applied.	No change from fast-track assessment	N/A
Tree Cutting - ETR 132	Unit cost assessment carried out using industry median as benchmark. NPg excluded from assessment due to its significantly different approach to reporting costs and volumes in this area.	No change from fast-track assessment	N/A

Results

9.23. For severe weather 1-20 allowances nine of the ten slow-track DNOs forecast costs totalling £78m. Our modelled view is £76m. Only NPgY submitted costs higher than our modelled costs (of £1.3m).

Table 9.6: Severe weather 1-20 modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	2	2	-	0.0%
NPg	NPgN	20	20	-	0.0%
	NPgY	18	17	- 1.3	-7.0%
WPD	WMID	13	13	-	0.0%
	EMID	13	13	-	0.0%
	SWALES	6	6	-	0.0%
	SWEST	10	10	-	0.0%
UKPN	LPN				
	SPN	6	6	-	0.0%
	EPN	7	7	-	0.0%
SPEN	SPD	4	4	-	0.0%
	SPMW	4	4	-	0.0%
SSEPD	SSEH	8	8	-	0.0%
	SSES	8	8	-	0.0%
Total		**119**	**118**	**- 1.3**	**-1.1%**
Total exc WPD		**78**	**76**	**- 1.3**	**-1.7%**

9.24. For inspections and maintenance, the ten slow-track DNOs have collectively forecast £752m. Our modelled costs are slightly lower at £744m.

Table 9.7: Inspection and maintenance modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	65	65	0.2	0.3%
NPg	NPgN	47	45	- 2.0	-4.2%
	NPgY	66	64	- 1.6	-2.4%
WPD	WMID	70	70	- 0.2	-0.3%
	EMID	63	75	11.4	18.0%
	SWALES	36	42	5.9	16.2%
	SWEST	50	60	9.3	18.5%
UKPN	LPN	113	106	- 7.1	-6.3%
	SPN	70	69	- 1.3	-1.9%
	EPN	116	112	- 3.8	-3.3%
SPEN	SPD	53	59	6.1	11.5%
	SPMW	67	75	7.3	10.9%
SSEPD	SSEH	32	40	7.8	24.3%
	SSES	124	109	- 14.3	-11.6%
Total		**972**	**990**	**17.8**	**1.8%**
Total exc WPD		**752**	**744**	**- 8.7**	**-1.2%**

9.25. For NOCs other, the ten slow-track DNOs have collectively forecast £220m. We reduce costs by £27m with our modelled costs at £193m.

Table 9.8: NOCs other modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	15	15	- 0.1	-0.6%
NPg	NPgN	7	8	0.2	3.1%
	NPgY	14	14	0.2	1.7%
WPD	WMID	20	19	- 1.3	-6.4%
	EMID	24	22	- 2.0	-8.4%
	SWALES	9	8	- 1.4	-15.5%
	SWEST	14	15	0.4	2.7%
UKPN	LPN	23	20	- 2.7	-11.6%
	SPN	19	16	- 3.8	-19.8%
	EPN	36	35	- 1.5	-4.1%
SPEN	SPD	17	16	- 1.5	-8.5%
	SPMW	19	10	- 8.5	-45.1%
SSEPD	SSEH	61	52	- 9.6	-15.6%
	SSES	8	8	-	0.0%
Total		**287**	**256**	**- 31.5**	**-11.0%**
Total exc WPD		**220**	**193**	**- 27.2**	**-12.3%**

Ex ante call out smart meter costs

9.26. There are four cost categories that comprise the DNO operational smart meter costs as follows:

- **on-site**: subject to a smart meter volume driver. A small proportion of costs are ex ante costs. The reminder subject to an uncertainty mechanism
- **indirect IT and data services for smart meter roll out**: subject to smart meter volume driver. A small proportion of costs are ex ante costs. The reminder subject to an uncertainty mechanism
- **ongoing smart meter IT and data services up to 2021-22:** subject to pass through (discussed in Chapter 11)
- **ongoing smart meter IT and data services post 2021-22**: not subject to pass through (discuss in Chapter 11).

9.27. Our assessment in this section refers only to the ex ante element of the first two bullets above.

Fast-track assessment

9.28. On-site and indirect IT costs subject to a smart meter volume driver were assessed together. For volume adjustments, we stated in our strategy decision that we would provide an ex ante allowance based on a two per cent call out rate. We therefore gave the minimum of the two per cent or the DNO's submitted volumes. For unit costs, we benchmarked the DNOs' submitted costs against the industry median over RIIO-ED1.

Key comments on the fast-track assessment

9.29. No comments were raised with our approach to assessing the call out smart meter costs.

Revised approach for the slow-track assessment

9.30. For our slow-track assessment we retained our fast-track volume adjustment methodology. For the unit cost analysis, we changed our approach and benchmarked the DNOs submitted unit costs against the industry lower quartile. The reason for our change of approach was the variability of the submitted costs and the lack of reliable historical data. Additionally we included a qualitative adjustment for LPN, to take into account the extra costs related to the significant number of multi-storey properties in London compared to the rest of the UK.

Results

9.31. For the call out smart meter costs the ten slow-track DNOs have collectively forecast £127m. Our modelled costs are higher at £131m.

Table 9.9: Smart meter call out modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	12	13	1.0	8.4%
NPg	NPgN	12	10	- 2.1	-17.4%
	NPgY	17	14	- 2.9	-17.4%
WPD	WMID	10	15	5.3	56.0%
	EMID	10	16	5.8	56.0%
	SWALES	5	7	2.3	48.9%
	SWEST	6	10	3.3	51.5%
UKPN	LPN	20	12	- 7.6	-38.7%
	SPN	14	14	0.1	0.9%
	EPN	23	22	- 0.8	-3.6%
SPEN	SPD	8	14	5.6	66.8%
	SPMW	6	9	3.5	59.3%
SSEPD	SSEH	3	5	1.2	35.6%
	SSES	13	18	5.5	43.1%
Total		**158**	**178**	**20.2**	**13%**
Total exc WPD		**127**	**131**	**3.5**	**2.8%**

Improved resilience

9.32. SSEH requested an ex ante allowance to improve resilience for worst served customers (WSC). This was not submitted in the fast-track business plan. It submitted six CBAs to justify its proposal. We asked our economic consultants (CEPA) to review the CBAs and the related schemes. Our consultants were of the view that the benefits did not justify the costs. We then sought the views of our technical consultants (DNV GL) to review the schemes. Based on this and on our disaggregated analysis, we further reviewed the submitted breakdown costs for each scheme.

9.33. Using our expert view unit costs and comparing costs of similar projects that have been carried out in the past, the details of which came from a database of projects held by the consultants, we reached our efficient view of these costs. From the £25m submitted, we applied £12m (a 51 per cent reduction) for these WSC schemes.

9.34. We expect SSEH to deliver the same level of benefits as identified in the CBAs for our revised cost.

Table 9.10: Improved resilience modelled costs (2012-13 prices)

	Submitted (£m)	Ofgem View (£m)	Adjustments (£m)	Adjustments (%)
WSC schemes	25.2	12.5	-12.7	-51%

10. Closely Associated Indirects, Business Support and Non-op Capex

Chapter Summary

Details of our approach to assessing indirect costs , both closely associated indirect (CAI) costs and business support costs (BSCs), and non-operational capex costs. For each area, we describe our fast-track approach, the issues raised at fast-track, and our slow-track approach. We provide the results for these specific activities.

Question 1: Do you agree with our overall assessment of closely associated indirect (CAI) costs?
Question 2: Do you agree with our approach to assessing:
- the eight aggregated categories of CAI costs
- vehicles and transport (for both CAI costs and non-operational capex)
- operational training and workforce renewal
- assessing streetwork costs?

Question 3: Do you agree with our approach to assessing business support costs (BSCs)? Please consider the four aggregated areas and IT&T costs separately.
Question 4: Do you agree with our approach to assessing non-operational capex costs? Please consider each of the two categories of IT&T and property and small tools, equipment, plant and machinery (STEPM) separately.

Indirect costs overview

10.1. The direct costs of carrying out work on a DNO's network are captured in network investment costs and network operating costs (NOCs). DNOs also incur indirect costs. These include costs that support this direct activity, known as closely associated indirect (CAI) costs, and costs that support the running of a DNO's business known as business support costs (BSCs).

10.2. Some activities within CAI costs and BSCs are carried out at a group level rather than by individual DNOs. Each company has its own methodology for allocating such costs between its DNOs and other companies within the same group. At fast-track we considered whether companies using different drivers to allocate these costs might distort our totex and disaggregated activity analysis. Following sensitivity testing applying common allocation drivers for all groups at fast-track, we concluded that it was appropriate to continue to use the companies' own allocations for the purposes of our cost benchmarking. The same approach is taken at the slow-track assessment.

Closely associated indirects (CAI) costs

Fast-track assessment

10.3. CAI costs comprise the following 10 categories:

- network design and engineering
- project management

- system mapping – cartographical
- engineering management and clerical support (EMCS)
- stores
- network policy
- control centre
- contact centre
- vehicles and transport
- operational training including workforce renewal.

10.4. We also report streetworks costs in this section.

10.5. For the fast-track assessment a combination of regression, ratio analysis and run rate analysis was used to assess the costs of different CAI categories. Table 10.1 summarises the approach to assessing CAI costs at fast-track.

Table 10.1: Summary of fast-track CAI assessment

CAI category	Main approach	Details
Network design, project management, and system mapping	Regression	The three categories were aggregated and regressed[24] using three years of historical data and weighted MEAV[25] as the cost driver. No workload adjustment was applied. A scalar was applied when modelled costs were greater than forecast costs.
EMCS, stores, and network policy	Regression	As above.
Wayleaves	Run rate analysis	Wayleaves were stripped out of EMCS costs. Lower of submitted and modelled costs. Modelled costs were based on applying individual DNO average annual actual spend on wayleave payment (2010-11 to 2012-13) to the eight years of RIIO-ED1.
Control Centre	Regression	This was regressed using three years of historical data. Faults including ONIs and employees were used as the cost drivers. A workload adjustment and a scalar were applied.
Call Centre	Regression	This was regressed using three years of historical data. Faults including ONIs was used as the cost driver. A workload adjustment was applied but no scalar.

[24] The regression approach is pooled OLS as described in Appendix 2.Appendix 2 - Approach to econometric benchmarking

[25] This cost driver was MEAV weighted by asset replacement and refurbishment expenditure over the first three years of DPCR5. The weighted MEAV was broken down by overhead, underground, plant and other types of assets.

Vehicles and transport	Run rate analysis	CAI vehicle and transport costs were assessed together with non-operational capex vehicles and transport. Modelled annual costs were taken as the lower of DPCR5 annual average and RIIO-ED1 annual average expenditure.
Operational training including workforce renewal	EU skills and National Skills Academy model and ratio analysis	Operational training costs were separated into two categories (a) workforce renewal costs (b) non workforce renewal cost. These were assessed separately using ratio benchmarking at group level over the eight years of RIIO-ED1. Workforce renewal costs were benchmarked against the total number of leavers, while non-workforce renewal costs were benchmarked against the current workforce total. In calculating the number of leavers we normalised for differences in DNO's assumed rate of non-retirement leavers.
Streetworks	Bespoke ratio analysis	Costs were adjusted in line with the efficiency assessment of each disaggregated activity where streetwork costs were embedded. The minimum of forecast costs and modelled costs was taken.

Key comments on the fast-track assessment

10.6. The majority of the comments received following the fast-track assessment concerned the regressed categories of CAI costs, which make up the majority of CAI costs. The main concerns were as follows:

- choice of cost drivers: weighted MEAV was criticised, with traditional MEAV preferred. There was also support to use costs drivers that reflect both network scale (ie MEAV) and workload on the network. For workload, suggestions included peak demand, units distributed and direct efficient expenditure.

- perceived lack of rigour of the statistical results in particular the relatively low R-squared.

- level of aggregation of CAI categories: some DNO supported higher aggregation of the CAI categories to alleviate any reporting issues across categories, while others supported disaggregation to allow more intuitive cost drivers to be used.

- use of a qualitative adjustment (scalar): using a ratchet to reduce the modelled costs (which were all higher than forecast costs) to total industry forecast costs was not supported.

10.7. For the non-regressed areas, using run rate analysis for vehicles and transport was criticised. This was on the basis that those DNOs that invested heavily in DPCR5 would be rewarded in the assessment and those with relatively low levels of expenditure in DPCR5 were penalised, where the typical cycle of spend was greater than five years.

10.8. A similar criticism was levelled at the run rate approach for wayleaves where it was argued that future activity would not necessarily be the same as past activity, particularly given the projected increase in wayleave activity in RIIO-ED1.

Revised approach for the slow-track assessment

10.9. Despite the concerns noted above, DNOs have responded positively to our call for further efficiency savings in CAI costs. Five of the ten DNOs that resubmitted their business plans for slow-track reduced CAI costs from their fast-track submission. There was an overall reduction of £114m, with SPMW reducing costs by £86m. Review of the business plans explains that this is due to a number of factors, but in the main due to improved efficiency.

10.10. We considered the comments raised and have made appropriate changes to our slow-track approach. Table 10.2 summarises the approach to assessing CAI costs at slow-track.

Table 10.2: Summary of slow-track CAI assessment

Category	Main approach	Details
Network design, project management, system mapping, EMCS, stores, network policy, control centre and call centre	Regression	The eight categories are aggregated and regressed[26] using eight years of forecast data, and MEAV and the value of asset additions to the network as cost drivers. No workload adjustments or scalars are applied.
Wayleaves	Ratio analysis	Unit costs are assessed using network length as the cost driver and applying the industry median calculated with 13 years of data. Thirteen years give a more reliable dataset as there are differences in the wayleave activity from DPCR5 to RIIO-ED1.
Vehicles and transport	Ratio analysis	Vehicle and transport CAI costs are assessed together with non-operational capex vehicles and transport. Unit costs are assessed using MEAV as the cost driver and applying the industry median calculated with 13 years of data.
Operational training and workforce renewal	EU skills and National Skills Academy model and ratio analysis	As per fast-track, with inconsistencies in FTE numbers corrected so that related parties are included for all DNOs. An additional

[26] The regression approach is pooled OLS as described in Appendix 2.

		normalisation in calculating number of leavers to take account of differences in assumed retirement age is applied (although the effect is insignificant).
Streetworks	Bespoke	Existing streetwork costs are adjusted in line with the efficiency assessment of each disaggregated activity where streetwork costs are embedded. New streetworks costs are stripped out of the relevant embedded activity and subjected to a bespoke assessment.

Regressed areas

10.11. For the slow-track assessment we group eight of the CAI activities together (all excluding vehicles and transport, operational training including workforce renewal and streetworks). We think that this is a sensible approach, as it addresses any boundary issues for reporting CAI costs and with the low R-squared that arises for more disaggregated regressions. Furthermore it deals with some of the movements within CAI categories from fast-track to slow-track submissions.

10.12. In revising our approach to regressions, we set a three-stage test as follows: a) the cost drivers must make economic and/or engineering sense; b) the results must pass key statistical tests; and c) the results must pass a sense check. We considered and tested a large range of regressions using different cost drivers and periods and narrowed this down based on meeting these criteria.

10.13. The regression uses eight years of RIIO-ED1 forecast data, and MEAV and the efficient value of asset additions as cost drivers.

10.14. The significant industry wide reduction in DPCR5 annual costs and RIIO-ED1 annual costs raised the question of whether we should use only historical data (2010-11 to 2013-14) to estimate the parameters in the model, focus only on forecast data (RIIO-ED1) or a combination of both. A model based on DPCR5 data is likely to provide most DNOs with a greater allowance than they have submitted. Models that combine the two periods did not pass our statistical tests due to the structural break in the data. Therefore we use eight years of forecast data in the regression. The use of eight years of data also avoids the need to use a scalar, which was criticised in the fast-track assessment.

10.15. We recognise that theoretical correctness is a critical first step to the modelling process; that is the identification of appropriate cost drivers. We built upon work we have done with engineers as well as lengthy discussions with the DNOs to determine appropriate explanatory cost drivers. Both the scale of a network and the workload on that network are widely accepted to drive the CAI costs. All other things being equal, the larger the network, the more work that would be required to maintain that network, and the more direct work you do on a network, the more indirect costs will be incurred (for example, design costs and project management costs). MEAV and asset additions are proxies for scale and workload, respectively, and have been used as the explanatory variables in the regression. MEAV has been widely supported as a driver. Asset additions reflect both load and non-load-related activity and as such do not favour replacement over reinforcement or vice versa. Finally, as we took the decision to benchmark based on forecast data, it was even more important that we chose cost drivers which reflect the relative future workloads of the DNOs. We believe the choice of these cost drivers pass the first test specified above.

10.16. We ran the regression at the DNO level rather than group level. We do not believe that there is sufficient evidence of shared costs for these CAI categories to justify a group level analysis. We sought data from the DNOs to allow us to make a more informed judgement on the level of shared costs, but the interpretation of this from the DNOs varied and therefore it was not robust enough to use. We also found that the group level regressions did not give plausible results.

10.17. There is no single metric or method to assess the statistical performance of models mechanistically, but we are satisfied with the regression using the above explanatory variables and eight years of forecast data. The R-squared is high at 86 per cent and the coefficients on each of the variables make sense. The regressions meet the key statistical tests for pooling, functional form and heteroskedasticity (see Appendix 8).

10.18. Following a sense check of the results we consider our model provides too harsh a reduction of forecast costs for the three UKPN licensees. The UKPN and WPD groups are relatively similar in terms of scale and we would therefore expect our model to produce similar results in CAI costs, which are largely driven by scale. Yet the gap in modelled allowance between the two groups is wider than we would expect. We make an adjustment to the UKPN group costs to reflect this and this is reapportioned to the UKPN DNOs (LPN, EPN and SPN) based on the proportion of their submitted forecasts. This positive adjustment does not change the overall ranking on CAI costs. UKPN remains the most inefficient company group. Our modelled costs are seven per cent lower than its submitted CAI costs.

10.19. Further detail of this qualitative adjustment and of our overall approach to the regressed CAI costs can be found in Appendix 8.

Vehicles and Transport

10.20. We are analysing CAI vehicles and transport costs with non-operational capex vehicle and transport costs to avoid any bias in our modelling between those DNOs that lease and those DNOs that buy vehicles. We use ratio analysis taking the industry median costs based on 13 years of data and use MEAV as the cost driver. We believe the scale of the network is a key driver of vehicles costs. Using 13 years of data smooths the lumpy nature of vehicles costs. The modelled costs are then reallocated to CAI and non-op capex based on the ratio of submitted expenditure in these two areas.

Wayleaves

10.21. Following more detailed review of the qualitative evidence submitted at slow-track for wayleaves we accept that the historical activity for wayleaves may not always reflect future activity. We have moved to using ratio analysis for our slow-track assessment. The ratio analysis calculates unit costs using network length as a cost driver and 13 years of data. We believe using 13 years of data will take into account forecast increases in wayleave costs due to proactive land agents seeking payments.

Operational Training and Workforce Renewal

10.22. No significant issues were raised relating to the fast-track approach. However, inconsistencies were identified in the FTE numbers input to our model with related parties for some DNOs included in the analysis. The approach at slow-track does not change from fast-track, except for a correction for these inconsistencies. Related party FTEs are now included for all DNOs. We also apply an additional normalisation in calculating number of leavers to take account of differences in assumed retirement age. The effect of this additional normalisation is insignificant.

Streetworks

10.23. Streetwork costs are embedded in the relevant cost activity tables. For our slow-track analysis streetwork costs fall into two groups: existing streetwork costs and new streetwork costs. Existing streetwork costs comprise those costs associated with notification penalties, inspections, inspection penalties, congestion charges and set up costs. New streetwork costs comprise permits, permit penalties, condition costs, and lane rentals. Streetwork administration costs are assessed as part of EMCS costs.

10.24. Existing streetwork costs remain embedded in the relevant activity and are therefore subject to the overall assessment of that activity.

10.25. New streetwork costs are stripped out of the relevant activity and subjected to the assessment detailed in Table 10.3.

Table 10.3: New streetwork costs slow-track assessment

Category	Approach
Permit and permit penalties	Eight of the 14 DNOs submitted permit costs. As permit volumes and costs are specific to particular local authorities and highway authorities, they do not lend themselves well to industry benchmarking. Volumes are taken as the lower of the DNO average annual actuals or the DNO RIIO forecast Unit costs are taken as the lower of DNO average annual actuals or RIIO forecast. Our efficient view takes into account that in limited cases incurring a permit penalty may be the most cost effective solution.
Permit condition costs	These are costs of conditions placed on permits such as night-time working. Only SSES and LPN forecast costs. Other DNOs did not submit such costs noting that meeting permit conditions is achieved as standard as work should always be done in a manner that is the safest and causes the least inconvenience to the public. The forecast costs are not sufficiently justified and we do not allow any costs for permit conditions.
Lane rentals	There is only one lane rental scheme, the TfL scheme, that has been in operation for over 12 months to July 2013 and therefore only this scheme satisfies our criteria for setting ex ante allowances (TfL implemented its scheme on 11th June 2012). Only two DNOs have costs under this scheme – LPN and SSES. Volumes: the lower of actual annual average volumes (2011-11 to 2013-14) and RIIO-ED1 volumes. Unit costs: SSES unit costs are significantly higher than

	LPNs with no clear justification. The LPN unit cost is applied to both DNOs. The LPN unit cost is based on the lower of actual annual average unit costs (2011-11 to 2013-14) and RIIO-ED1 unit costs.

Results

10.26. Table 10.4 details the results of the assessment of CAI costs. The ten slow-track DNOs submitted £3,349m in CAI and our modelling allows £3,400m, an increase of £51m (1.5 per cent). These results are in line with the fact that DNO forecasts for the RIIO-ED1 years included considerable efficiencies compared to their historical CAI costs.

Table 10.4: CAI modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	325	380	54.8	16.9%
NPg	NPgN	231	234	3.7	1.6%
	NPgY	270	300	29.6	10.9%
WPD	WMID	401	393	-8.3	-2.1%
	EMID	399	420	21.4	5.4%
	SWALES	225	227	2.4	1.1%
	SWEST	329	305	-23.2	-7.0%
UKPN	LPN	334	325	-8.4	-2.5%
	SPN	378	337	-40.6	-10.7%
	EPN	510	508	-2.0	-0.4%
SPEN	SPD	273	296	22.4	8.2%
	SPMW	297	297	-0.2	-0.1%
SSEPD	SSEH	251	231	-19.3	-7.7%
	SSES	480	490	10.7	2.2%
Total		**4,702**	**4,746**	**43.2**	**0.9%**
Total exc WPD		**3,349**	**3,400**	**50.8**	**1.5%**

Business Support Costs (BSCs)

10.27. BSCs comprise the following five categories:

- finance and regulation
- HR and non-operational training
- IT & telecoms
- property management
- CEO and group management.

Fast-track assessment

Ratio benchmarking

10.28. For our fast-track assessment of BSCs we used ratio benchmarking of costs for aggregated business support activities (ie all five categories assessed together) using a composite scale metric. We carried out the benchmarking at group level and benchmarked the RIIO-ED1 cost ratios against the median value to give efficient cost baselines for each group. These efficient cost baselines were allocated to individual DNOs within a group in proportion to their submitted forecasts. The main fast-track analysis included a fixed cost normalisation based on the number of DNOs in the group.

Construction of composite size metric

10.29. We constructed a composite driver the same way as described in RIIO-T1 and GD1 final proposals.[27] We identified an appropriate activity size metric for each business support activity and then weighted the drivers based on the contribution of the activity to overall costs. The relevant drivers are specified in Table 10.6 below. We also conducted sensitivity analysis using an alternative set of size metrics. The choice of metrics made little difference to our overall rankings of the companies in respect to their business support costs and reinforced our confidence in the suitability of the selected size metrics.

Table 10.6: Business support drivers

Business support Activity	**Size metric used**	**Alternate size metric**
Finance and regulation split into three components		
Finance	Revenue	MEAV
Procurement	Total spend	MEAV
Insurance	Excluded from benchmarking	Excluded from benchmarking
HR & non-op training	Employees	Employees
IT & telecoms	IT end-users	IT end-users
Property management	Revenue	Network length
CEO & group management	Revenue	MEAV

Monte Carlo Assessment

10.30. Our view of business support efficiency was arrived at by using Monte Carlo simulation. This involved applying the benchmarking methodology described above a number of times with varying input parameters in order to produce a range of results for each DNO group. Our final view, for input into the totex models, was the average of all results in the range and was based on one thousand simulations with varying composite size.

Assessment of narrative justification

10.31. Where DNOs looked inefficient based on our quantitative assessment we reviewed the DNO narratives to see whether justification was provided for high BSCs. None of the companies that we assessed as being inefficient based on our quantitative assessment provided sufficient justification to materially affect our view of their efficiency.

Key comments on the fast-track assessment

10.32. Some DNOs felt that the business support modelling was too complex and that there were a number of errors in the model. There were different views and suggestions made with the main ones as follows:

---

[27] https://www.ofgem.gov.uk/publications-and-updates/riio-gd1-final-proposals-%E2%80%93-overview
https://www.ofgem.gov.uk/publications-and-updates/riio-t1-final-proposals-national-grid-electricity-transmission-and-national-grid-gas-%E2%80%93-overview

- Ofgem should use activity level regressions consistent with other areas of the fast-track assessment
- property and IT should be based on an expert view
- a static model should be used rather than the Monte Carlo analysis
- insurance costs should be included in the business support modelling
- group level regressions should be used
- fixed costs should not be modelled at an individual DNO level but more appropriately at group level.

Revised approach for the slow-track assessment

10.33. For the slow-track assessment we comprehensively reviewed many possible approaches for assessing BSCs. Based on the economic literature, supporting materials and previous Ofgem practices we considered and tested the following alternatives:

- aggregated and disaggregated assessment
- DNO and group level assessment
- ratio benchmarking, regression analysis, Monte Carlo simulation and combination of these
- assessment with and without fixed cost normalisation (with improved fixed cost estimation that takes account of economies of scale)
- a range of possible drivers and documented cost driver selection process
- inclusion or exclusion of insurance costs in the assessment
- different time frames: actuals (2010-11 to 2013-14), DPCR5 (2010-11 to 2014-15), RIIO-ED1 forecasts (2015-16 to 2022-23) and all 13 years (2010-11 to 2022-23).

10.34. In deciding on the criteria for the final assessment approach we considered a number of factors including the appropriateness of the assumptions, the economic rationale, performance against the statistical tests, sensitivities, the level of complexity, expert views and a final sense check of results.

Ratio benchmarking

10.35. The slow-track approach adopts ratio benchmarking at an ownership group level for four aggregated BSC categories (finance and regulation including insurance, HR and non-operational training, property management, and CEO and group management). Business support IT&T costs are subject to a separate assessment. This was assessed through a combination of ratio analysis at ownership group level and expert review. It is the same expert review as described in Chapter 8 for operational IT&T and non-operational capex IT&T.

10.36. The assessment does not include fixed cost normalisation. A group level assessment is undertaken which accounts to some degree for the sharing of costs across DNOs within a group. It also addresses the problem of significant differences in allocation methodologies across ownership groups, which made the DNO level data less comparable. The measure used as a comparator in the ratio benchmarking is the industry median ratio for 2010-11 to 2022-2023.

Cost driver

10.37. The driver used for ratio benchmarking is MEAV, which describes the general business activity and the capital invested. Based on methodological selection process and our tests, MEAV is considered the most appropriate driver to describe the aggregated BSCs and the business support IT&T costs. Other drivers such as those used in the fast-track analysis, were rejected for three key reasons: the lack of economic rationale; their endogenous nature; and significant changes were made to them by DNOs between the fast-track and the slow-track submissions, reducing our confidence in them.

Results

10.38. The ten slow-track DNOs collectively forecast £1,728m in BSCs and our modelling allows £1,904m, an increase of £176m (10.2 per cent). As for CAI costs, the overall assessment results are in line with the fact that DNO forecasts for the RIIO-ED1 years included considerable efficiencies compared to their historical BSCs.

10.39. ENWL incur a minor reduction to costs in our modelling (less than two per cent of forecast costs) and the other DNOs in NPg, UKPN, SPEN and SSEPD ownership groups have modelled costs eight per cent to 18 per cent above their RIIO-ED1 forecast costs.

Table 10.7: Business support modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	237	235	- 2.2	-0.9%
NPg	NPgN	133	157	23.9	17.9%
	NPgY	153	180	27.3	17.9%
WPD	WMID	207	204	- 3.1	-1.5%
	EMID	214	211	- 3.3	-1.5%
	SWALES	112	110	- 1.7	-1.5%
	SWEST	178	176	- 2.7	-1.5%
UKPN	LPN	168	181	13.0	7.7%
	SPN	172	185	13.3	7.8%
	EPN	221	238	17.2	7.8%
SPEN	SPD	153	169	16.3	10.6%
	SPMW	127	141	13.5	10.6%
SSEPD	SSEH	144	165	21.0	14.6%
	SSES	220	254	33.2	15.0%
Total		**2,439**	**2,604**	**165.6**	**6.8%**
Total exc WPD		**1,728**	**1,904**	**176.4**	**10.2%**

Non-op Capex

10.40. Non-operational capex costs comprise the following four activities:

- property
- IT&T
- small tools, equipment, plant and machinery (STEPM)
- vehicles and transport.

Fast-track assessment

10.41. For the fast-track assessment, both the areas of property and IT&T were assessed using the business support assessment model.

10.42. For STEPM we benchmarked against DNOs' MEAV, taking the lower of the industry median benchmark or DNO submitted forecast.

10.43. For vehicles, we took the lower of the DPCR5 annual average for total vehicles expenditure and the average annual forecast for RIIO-ED1.

Key comments on the fast-track assessment

10.44. The comments received centred on overlaying the quantitative assessment of both property and IT&T with a qualitative assessment making use of expert consultants if appropriate. The same comments applied to non-operational capex vehicles as to CAIs vehicles; that run rate analysis was inappropriate. For STEPM, there were concerns from one DNO in particular that the lower modelled costs would mean that they would not be able to meet their output commitments.

Revised approach for the slow-track assessment

IT&T

10.45. The assessment of non-operational capex IT&T is combined with the assessment of operational IT&T. This is described in the operational IT&T section in Chapter 8.

Property

10.46. For property, we no longer include non-operational capex property costs in the BSCs assessment. We sought greater transparency of these costs and concluded that capex expenditure should not be captured within the opex assessment of business support.

10.47. We conduct ratio analysis using MEAV as a cost driver and 13 years of data (to smooth lumpy expenditure). We also undertook a qualitative assessment of the forecast costs, seeking further information from DNOs that our models suggests are inefficient. Combining the two we chose to allow the lower of forecast costs and modelled costs. The unit costs used in the model are the lower quartile industry costs. We choose lower quartile over median as a review of the qualitative evidence supported a more lenient approach. Conversely, we do not feel it is appropriate to allow more than the submitted capital expenditure programmes put forward by the DNOs.

Small tools equipment, plant and machinery (STEPM)

10.48. We use ratio analysis using MEAV as a cost driver and 13 years of data (to smooth lumpy expenditure) to set our modelled unit costs. We apply the minimum of our modelled and DNO forecast costs. Similar to property, we do not feel it is appropriate to uplift the capital expenditure programmes put forward by the DNOs.

Vehicles and transport

10.49. The assessment of non-op capex vehicles is combined with the assessment of CAI vehicles and transport. This is described in paragraph 10.19 above.

Results

10.50. Table 10.8 details the results of our assessment of non-operational capex costs. The ten slow-track DNOs have forecast that they will spend £629m on non-operational capex in RIIO-ED1. On average we consider that costs can be reduced by 2.5 per cent to £614m.

Table 10.8: Non-operational capex modelled costs (2012-13 prices)

DNO Group	DNO	RIIO-ED1 submitted (£m)	RIIO-ED1 modelled costs (£m)	Difference (£m)	Difference (%)
ENWL	ENWL	39	47	8.7	22.4%
NPg	NPgN	57	54	- 3.7	-6.4%
	NPgY	68	74	6.3	9.3%
WPD	WMID	91	83	- 7.3	-8.0%
	EMID	84	90	6.3	7.6%
	SWALES	47	38	- 9.4	-19.9%
	SWEST	79	57	- 21.4	-27.2%
UKPN	LPN	60	54	- 6.1	-10.2%
	SPN	70	62	- 7.8	-11.2%
	EPN	96	94	- 2.2	-2.3%
SPEN	SPD	53	53	- 0.6	-1.1%
	SPMW	51	47	- 3.3	-6.5%
SSEPD	SSEH	47	47	0.2	0.3%
	SSES	88	81	- 7.1	-8.1%
Total		**930**	**882**	**- 47.5**	**-5.1%**
Total exc WPD		**629**	**614**	**- 15.7**	**-2.5%**

11. Smart grids and smart meter benefits

Chapter Summary

Our approach to assessing the benefits to DNOs of using smart grids and smart metering data. It reviews our fast-track approach, the issues raised at fast-track, our approach at slow-track and the results. It also reviews our approach to setting ex ante allowances for smart meter IT costs.

Overview

11.1. By 2016 consumers will have contributed up to £450m in Low Carbon Networks Fund (LCNF), Network Innovation Competition (NIC) and Network Innovation Allowance funding. Our assessment indicates that potential savings estimated by DNOs from the roll-out of their LCNF projects amount to around £2bn over the RIIO-ED1 period for particular scenarios for the take-up of low carbon technologies. The smart meter roll-out will deliver significant benefits directly to consumers as well as cost savings to DNOs. The DNOs' cost savings should be passed on to consumers who are investing in the roll-out.

11.2. We have drawn on evidence from the DNOs' business plans, the Energy Networks Association (ENA) assessment of smart metering benefits, the Smart grids Forum smart grids modelling work, the DECC smart metering impact assessment and expected trends in efficiency gains due to innovation. This evidence indicates significant benefits should be achieved over the period.

Smart grids and smart meter benefits

Fast-track assessment

11.3. We undertook a qualitative assessment of smart grids and innovation in the DNOs' business plans. This included assessing the overall strategy for the deployment of smart grids solutions and the degree of integration of the strategy into the business plan to deliver specific benefits to customers. We scrutinised the narratives to understand each DNO's strategy for using innovation and smart grids solutions to realise cost efficiencies. We also assessed the justification for the claimed benefits including where the benefits had been reflected in the business plan. The assessment included using the DNOs' Transform models as a reference point for an appropriate level of benefits from smart and innovative techniques. We compared this against the benefits included in the DNOs' business plan data tables.

11.4. There are four cost categories relating to the roll out of smart meters and use of smart metering data as follows:

- on-site/physical - subject to smart meter volume driver
- indirect IT and data services for smart meter roll out - subject to smart meter volume driver
- ongoing smart meter IT and data services up to 2021/22 - subject to pass through
- ongoing smart meter IT and data services post 2021/22 - not subject to pass through.

11.5. The first two are discussed in Chapter 9.

11.6. For our assessment of ongoing smart meter IT and data services, we considered the DNOs' strategies for use of smart metering data to improve performance on outputs and cost efficiency. We assessed the benefits of the strategy compared with the DNOs' estimated costs of the systems required to collect and process the data.

11.7. Our assessment of LCT related reinforcement cost was designed specifically to avoid discrimination between using smart grids techniques and conventional reinforcement. We recognise that there may be trade-offs between investing in a small number of relatively expensive assets or a large number of relatively cheap interventions. We do not want to incentivise a particular approach when it is not most efficient or in the best interests of consumers. We have not applied a ratchet to the volume or unit cost assessment for LCT related reinforcement so we do not penalise a particular, efficient investment strategy.

Key comments on the fast-track assessment

11.8. There were no comments received in response to the consultation on our fast-track approach to assessing the benefits of smart grids or smart metering data.

Revised approach for the slow-track assessment

11.9. For the slow-track companies we have made an adjustment to totex to account for the benefits of smart metering and smart grids which DNOs have not incorporated into their business plans for RIIO-ED1.

11.10. At fast-track we reviewed the DNOs' strategies for using smart grids during the price control on a qualitative basis. For slow-track we have looked in more detail at the savings the DNOs propose to deliver for consumers. While we recognise that some of the DNOs' strategies appear high quality, the test is the level of benefits included in the DNOs' requested allowances.

Assessing benefits included in DNOs' business plans

11.11. We asked all DNOs to identify the cost savings resulting from smart grids against the corresponding high level cost area. We asked for further information of the solutions being deployed and the savings associated with them. To ensure comparability we asked all DNOs to identify which of these solutions they have included in their business plans and whether they are considered as a conventional (business as usual) solution, a smart solution, or only being trialled and therefore the savings are not embedded in the plan.

11.12. Any solution included in the smart solution set in the Transform model we treated as smart. Any solution which at least one DNO included as a 'business as usual' solution we excluded from our assessment, except in four instances. We have treated dynamic network automation and enhanced automatic voltage control as smart as they are part of the Transform model smart solution set. Network meshing is also a smart solution in the Transform model. A portion of UKPN's network is already meshed and it would not be equitable to discount these smart benefits from our assessment for UKPN or for other DNOs. WPD identifies energy efficiency as business-as-usual. It has explained that it uses energy efficiency for its own buildings. In the context of smart solutions, energy efficiency refers to contracting with consumers to install energy efficiency measures in order to reduce peak network load. No DNO is currently doing this as business-as-usual according to the DNOs' submissions and supplementary question responses.

11.13. Where no DNO identified a solution as business as usual, we have categorised this solution as smart in our assessment. There are three exceptions. We do not consider that chromatic analysis of insulating oil, ecoplugs, or tap change acoustic monitoring should be treated as 'smart' for the purposes of our assessment. In order to ensure consistency across DNOs we have had to limit the extent to which novel or innovative solutions are counted as smart. It is not clear that these solutions fully represent the smart approach to operating networks.

11.14. The final list of solutions the DNOs collectively identified as smart is shown in Table 11.1. Not all DNOs included all these solutions in their business plans.

Table 11.1: List of smart solutions

DSM/DSR
Dynamic line ratings
Dynamic network automation and associated advanced load modelling
Dynamic transformer ratings
Energy efficiency
Enhanced automatic voltage control
Fault current limiter
Installation of power line carrier system for data comms
Intelligent control devices (EVs)
Network meshing
Phase shifting transformer
STATCOM
Switched capacitors
Voltage gradient approach to LV fault finding

11.15. For each DNO we calculated the savings from the solutions identified in Table 11.1. We included only those solutions that each DNO identified as being embedded in their business plan. Therefore, we did not include savings claimed from solutions that are only included in the business plan for trial as the associated potential savings have not been embedded in the requested allowances. In some cases we were unable to identify and confirm where in the business plan the claimed benefits have been reflected, even following supplementary questions. In these cases we have excluded those claimed benefits. We also asked each DNO to identify the benefits embedded in its plan from the use of smart metering data. The total benefits for each DNO from smart grids and smart metering that we have included in our assessment are shown in Table 11.2.

Table 11.2: Total savings from smart grids and smart metering data in each DNO's business plan

	Savings included in business plan (£m)
ENWL	36.1
NPGN	12.8
NPGY	23.3
WMID	27.5
EMID	60.3
SWALES	2.8
SWEST	18.5
LPN	52.1
SPN	44.5
EPN	51.8
SPD	20.5
SPMW	18.9
SSEH	14.7
SSES	20.8
Total	**404.7**

Identifying the total savings possible during RIIO-ED1

11.16. We do not consider that the £405m savings from the use of smart grids and smart meter data in the DNOs' business plans is sufficient. We do not believe that any DNO has taken account of the full potential of smart grids, including the use of smart metering data. The evidence indicates that further savings are possible across a range of cost areas. We discuss this further below in relation to the use of smart metering data, avoided or delayed increases in network capacity, and other smart grids benefits. Our figures below are based on potential savings across all 14 DNOs.

Smart metering data

11.17. We have also used the latest DECC impact assessment for the roll-out of smart meters as evidence of the savings from the use of smart metering data that DNOs should be achieving through RIIO-ED1. The impact assessment identifies around £190m of savings accruing to DNOs over the RIIO-ED1 price control period.[28] This is generally supported by the ENA's 2013 study on network benefits of smart metering.

11.18. In light of the available evidence that significant benefits to DNOs are achievable on the back of the smart meter roll-out DNOs should have reflected these savings in their plans.

---

[28] We have used the undiscounted value of benefits, rebased to 2012-13 prices. Therefore this figure will not match up directly with those published in the DECC impact assessment.

Network capacity

11.19. A significant proportion of the total savings of using smart grids will be achieved through avoiding or delaying work to increase the capacity of the network (reinforcement). On average the DNOs have forecast savings of around 14 per cent of reinforcement cost from the use of smart grids. The best tool currently available to analyse the potential savings is a model (the Transform model)[29] which DNOs developed under the Smart grids Forum. The DNOs' own models using their own data indicate that on average 23 to 25 per cent of reinforcement cost can be avoided at a GB level using smart solutions. On this basis a total of £653m of savings could have been included across all the DNOs' plans. While the frontier DNO (SSEH) in this area included 20 per cent savings, we believe even it is not making full use of smart grids during RIIO-ED1.

Other smart grids savings

11.20. We consider that significant savings should be possible across the business. Most DNOs have not fully considered benefits of smart grids in cost areas other than reinforcement. Only £14.5m of savings have been justified by one DNO (ENWL) in other areas. Applying ENWL's identified benefits across all DNOs indicates significant possible savings of more than £200m. This can be seen by calculating ENWL's savings as a percentage of network operating costs and applying this percentage to all DNOs' requested network operation allowance. We are not convinced that any DNO has fully considered the benefits of smart solutions across its business. Therefore we consider savings in excess of this should be achievable.

11.21. We acknowledge that there is uncertainty as to the level of the savings that are achievable and that there is some risk of double counting savings identified elsewhere. We judge that total savings of £137m should have been included in the DNOs' business plans. This represents around 20 per cent of the savings we believe to be achievable through avoided or delayed network reinforcement.

11.22. We consider that significant additional savings will be possible during the RIIO-ED1 period as the understanding of smart grids solutions and benefits evolves. DNOs should experience an increase in efficiency in comparison to previous price controls due to the embedding of innovation in standard business practices. Additional savings could be at least a further one per cent of totex. These savings are less certain than those identified above and may suffer from double-counting of benefits considered elsewhere. We have therefore not deducted them from the ex ante allowances. The DNOs will be incentivised to derive these benefits, which they will share with consumers via the efficiency incentive. Our incentives should drive DNOs to use innovation, smart metering data and smart solutions to deliver their outputs more effectively and efficiently.

11.23. In our analysis we have considered only those benefits that impact directly on DNOs' costs. Further benefits of smart metering will accrue directly to consumers. For example, significant benefits are forecast to be delivered through reduction in losses. Table 11.3 shows the total benefits we consider should have been included in DNOs' business plans.

---

[29] More information on the Transform model can be found in the publications on the SGF web page: https://www.ofgem.gov.uk/electricity/distribution-networks/forums-seminars-and-working-groups/decc-and-ofgem-smart-grid-forum

Table 11.3: Total potential savings

	Total potential savings (£m)
ENWL	73
NPGN	50
NPGY	68
WMID	73
EMID	78
SWALES	41
SWEST	57
LPN	68
SPN	68
EPN	101
SPD	62
SPMW	67
SSEH	44
SSES	94
Total	**943**

Results

Calculating the totex adjustment for each DNO

11.24. Combining the analysis above we believe the industry could have reasonably included £943m savings from smart grids and smart metering in its business plans. We note that there may be trade-offs between the different areas of savings considered above. By combining them into a single figure we are allowing DNOs to determine how they achieve these savings. This single figure of savings is calculated as a percentage of the industry's submitted totex, excluding RPEs.

11.25. The total savings each DNO should have included in its business plan is calculated by multiplying this percentage by our modelled view of efficient totex for each DNO. The savings shown in table 11.2 for each DNO are deducted from this value. We have reduced each DNO's totex by the remaining value of savings DNOs should have included in their business plans. The process of netting-off the savings already embedded ensures we do not double-count the benefits DNOs have already identified. It also gives the best performing DNOs on this measure credit for the savings they have identified. Table 11.4 shows the total potential savings, the savings already embedded in the business plan, and the final totex adjustment for each DNO. On average this is a cut of 2.2 per cent of totex after the UQ is applied, before interpolation with the DNOs' forecasts. This is equivalent to a total reduction of £396m to our view of efficient totex.

Table 11.4: Totex adjustment for smart grids and smart metering data savings

	Totex adjustment (£m)
ENWL	-36
NPGN	-37
NPGY	-44
LPN	-16
SPN	-23
EPN	-49
SPD	-42
SPMW	-47
SSEH	-29
SSES	-73
Total	**-396**

11.26. By calculating the total savings as a percentage of requested totex and applying the same percentage to our benchmark totex, in aggregate the total saving reduces by the same proportion that totex is reduced in our general cost assessment process. We consider this is appropriate for the following reasons:

- A portion of the benefits we consider should have been included in the DNOs' business plans are derived from considering benefits as a percentage of expenditure. It is reasonable to scale the total potential savings down in line with the scaling of totex during the cost assessment process.
- During the comparative cost assessment process, the DNOs' allowances are reduced in aggregate. A portion of this reduction in the benchmarking will be due to the savings included by the best performing DNOs. The cost assessment process can be seen to embed additional savings to an extent in some areas of DNOs' allowances. This effect is likely to be small as there are many other reasons for comparative efficiency.
- Even though we gave the DNOs the opportunity to identify all the savings from smart grids and smart metering in their plans, there is some risk that they have done so incorrectly. Therefore there is a small risk of double counting savings that DNOs have already embedded in their costs. This is likely to have a very low level of materiality as we believe the DNOs have identified the savings appropriately.

Applying the totex adjustment to disaggregated cost areas

11.27. We have allocated the total net smart grids savings to the disaggregated activity level costs for each DNO. The allocation is done on the basis of the proportion of estimated savings in each of the high level areas. Each high level area relates to certain activity level costs, as shown in Table 11.5 below. Within each high level area, the benefits are allocated on a pro-rata basis

11.28. For example, if the other smart grids savings made up 50 per cent of the total benefits across all DNOs then 50 per cent would be allocated across DNOs' costs areas excluding reinforcement categories.[30]

---

[30] The allocation of savings across cost areas in the tables throughout the draft determination documents

Table 11.5: Allocation of smart grids benefit areas to cost assessment categories

Smart grids benefit areas	Allocated to Ofgem's cost assessment categories
Reinforcement	Connections Reinforcement TCP Load-related share of CAI Load-related share of business support Load-related share of non-op capex
Other smart grids savings	Across all other cost areas excluding those above
Smart meters	Across all cost areas

11.29. The reinforcement savings have been allocated across all load-related capex and the load-related share of indirects. We have excluded high value projects from this allocation as these costs have been subjected to separate detailed assessment by our engineering consultants. The consultants reviewed the extent to which DNOs have adequately considered the opportunity for such savings in terms of both the need case and the costs of the schemes.

11.30. The load-related share of CAI, business support, and non-op capex is calculated according to the following equation:

$$Load - related\ share\ of\ indirects = \frac{(reinforcement + connections + TCP)}{totex - CAI - business\ support - non - op\ capex}$$

11.31. We applied the higher of the DNOs' own or the industry average load-related share of indirects to ensure that a reasonable proportion of such savings are allocated to indirect costs. We expect where DNOs are able to reduce the level of activity or unit costs as a result of smart grids savings this will also have an impact on associated indirects.

11.32. There are a number of alternative approaches; one could be to allocate the benefits based on the DNOs total reinforcement (eg reinforcement, connections and TCP) relative to the industry average, and likewise for the other smart grids savings category. This would add another level of complexity to the allocation and it is not always clear how the DNOs' have allocated their benefits across the cost assessment categories. We consider that the allocation based on the high level smart grids benefit cost areas is a pragmatic solution.

Assessment of smart meter IT costs and data services

11.33. As part of our slow-track assessment of smart meter IT costs and data services, we calculated the median IT spend up to 2021 across DNO groups. The median was

---

diverges slightly from the description here. Following the finalisation of all elements of cost assessment, the allocation has not been recalculated. We expect this to have a minor impact on the allocation across cost areas. This does not affect the value of totex. We will consider updating the allocation of savings for final determinations.

£10.3m. Where a DNO group proposed spending above £10.3m on smart meter IT, we have reduced its smart metering IT costs to the level of the lowest DNO group (£6.9m). However, in 2021-22 we will conduct a review of each DNO group's (including WPD) spend on smart meter IT to ensure that they are efficient. DNOs will be able to make a case for higher spend than that allowed under this assessment where they can identify that these will be offset by benefits to customers in other areas. Our assessment of smart meter IT and data costs from 2021-22 remains the same as our fast-track assessment.

12. Real price effects (RPEs) and ongoing efficiency

Chapter Summary

Detail of our approach to accounting for RPEs and ongoing efficiency in our cost assessment, detailing the key changes from fast-track.

Question 1: Do you agree with our approach to assessing ongoing efficiency?

Overview

Real price effects

12.1. DNOs' allowances are indexed by the Retail Prices Index (RPI) as part of the price control framework. We expect some of the costs faced by DNOs during RIIO-ED1 to change over the period at a different rate than the RPI measure of economy-wide inflation. These differences in cost changes are known as real price effects (RPEs). Our cost allowances for DNOs include the forecast impact of RPEs.

Ongoing efficiency

12.2. We expect even the frontier DNO to make productivity improvements over the price control period, for example by employing new technologies. These improvements are captured by the ongoing efficiency assumption. This assumption represents the potential reduction in input volumes that can be achieved whilst delivering the same outputs.

Real price effects

Fast-track assessment

12.3. We set common assumptions for the path of input prices for all DNOs. We rolled forward the long term historical real average growth in input price indices for all forecast years where no relevant short term forecast was available. We chose representative indices based on those used at previous price controls. A short-term forecast was calculated for labour as this is the only input type where reliable, independent data is widely available.

12.4. The input indices were weighted together using a notional structure of a DNO. The notional structure was the average structure of all DNOs as submitted in their business plans. We used a notional structure to ensure we did not reward potentially inefficient company structures.

12.5. Our RPE forecast was included in the cost assessment to set our view of efficient cost allowances. Our forecast RPE indices were applied to each disaggregated cost area and to our high level forecast of totex. We constructed a totex RPE forecast by weighting together the RPEs in different cost areas. We used the average industry weighting.

Key comments on the fast-track assessment

12.6. There were no comments received in response to the consultation specifically on our fast-track methodology for forecasting RPEs. British Gas raised concerns that the fast-tracking of WPD may set a precedent for the RPE submissions of slow-track companies. We have been clear that our assessment of WPD's business plan was taken in the round.

12.7. In response to our open letter consultation on the revised business plans,[31] British Gas raised concerns over the setting of ex ante allowances for real price effects. It proposed a more suitable approach could be indexation, an uncertainty mechanism which increases or decreases the DNOs' allowances during the price control period according to the movement in pre-determined indices. In its response to the open letter consultation, the Prospect union stated that they expect skill shortages to lead to real wage increases for specialist staff. It also stated that the DNOs operate in a national labour market and that it expects pay of engineers to follow national trends during the RIIO-ED1 price control period.

12.8. In ENWL's resubmission for slow-track assessment, its consultant noted that at fast-track we used the Office of Budget Responsibility's (OBR) medium term wage growth forecast whereas at RIIO-GD1 and T1 we used a forecast from HM Treasury. It also noted that the RPE growth forecast at fast-track was markedly different in some cost areas from the forecast at RIIO-GD1 and T1. While our general methodology for forecasting RPEs at fast-track was based on that used at RIIO-GD1 and T1, we did make a number of changes. We used the OBR forecast for wage growth as this was the most recently available forecast. Some of the indices we used to derive our RPE forecast were different to those used at RIIO-GD1 and T1 because the inputs the different sectors use are different. Our fast-track assessment was conducted after the RPE assumptions were made for the previous RIIO price controls. Therefore, we had additional data that we incorporated into our assessment of historical and forecast RPEs.

12.9. SPEN and SSEPD referenced the same consultant's report for RPEs. This report uses a different methodology. Some of the key differences highlighted in this report are the use of nominal rather than real average growth rates from which forecasts of RPI are subtracted each year and the use of particular historical periods to extrapolate the short and medium term forecasts. Our use of real average growth rates is consistent with previous price controls. Given the uncertainty over how prices will move in the future, our approach uses the long term historical average growth rates rather than choosing particular historical periods for extrapolation.

[31] Open letter consultation on revised RIIO-ED1 business plans: https://www.ofgem.gov.uk/publications-and-updates/open-letter-consultation-revised-riio-ed1-business-plans

Revised approach for the slow-track assessment

General methodology

12.10. Our methodology is based on that used at RIIO-GD1 and T1 with a number of changes.[32] We calculate a forecast for RPEs in three stages:

1. We construct an input price trend relative to RPI for a range of costs relevant to the inputs purchased by the DNOs.
2. We weight together these input price trends based on the assumed proportions of the inputs in cost areas broadly split between capex and opex.
3. We convert these assumptions into monetary allowances. This is done by taking the RPE assumptions and multiplying them by the DNOs' allowances.

12.11. We forecast RPEs for the following inputs:

- general labour (capex and opex)
- specialist labour (capex and opex)
- materials (capex and opex)
- plant and equipment
- transport
- other.

12.12. Our approach to forecasting RPEs at slow-track uses the following methodology:

- We use actual input price index data for 2013-14 as the RPE assumption for that year.[33]
- Where we have a suitable short term forecast we use this to derive our RPE assumptions for years 2014-2016. We only use a short term forecast for labour RPEs.
- We use the historical real growth in price indices as our RPE assumptions for the medium term to 2022-23. We use input price index data up to and including 2013-14 in the long term historical average real growth rate to reflect the latest available information.
- We have made an adjustment to account for the step-change in RPI in 2010 relative to underlying price inflation.

12.13. These are discussed in more detail below.

[32] For more information on our approach at RIIO-GD1 and T1, see the RIIO-T1/GD1 initial proposals – real price effects and ongoing efficiency appendix: https://www.ofgem.gov.uk/ofgem-publications/48211/riiot1andgd1initialproposalsrealeffects.pdf

[33] In the DNOs' resubmissions, we assessed 2013-14 costs as 'actuals' rather than forecasts. The costs for 2013-14 include RPEs. No RPE assumptions were made for this year in DNOs' plans

Input price indices[34]

12.14. We considered a wide range of indices to construct our forecast for RPEs including those used at DPCR5, RIIO-GD1 and T1, fast-track, and by the DNOs. Table 12.1 lists the indices we used for slow-track, the time series over which we calculated the long term average growth, the value of the growth rate, and the growth rate in 2013-14.

Table 12.1: Input price indices

Source	**Index**	**Historical series**	**Historical average real growth rate (applied 2014-15 to 2022-23)**[35]	**Real growth rate in 2013-14**[36]
General labour				
ONS	LNKY AEI private sector including bonus	1990-2000	Average real growth rate of combined index = 0.7 per cent per year	N/A
ONS	K54V AWE private sector including bonus	2000-2014		-1.1 per cent
Specialist labour				
BEAMA	Electrical labour	1987-2014	1.6 per cent per year	-0.6 per cent
BCIS	70/1 Labour and supervision in civil engineering	1987-2014	1.1 per cent per year	-1.1 per cent
Materials capex				
BCIS	3/58 Copper pipes and accessories	1991-2014	1.7 per cent per year	-5.4 per cent
BCIS	3/59 Aluminium pipes and accessories	1991-2014	0.3 per cent per year	-2.8 per cent
BCIS	3/S3 Structural steelwork materials: civil engineering work	1991-2014	1.5 per cent per year	-3.8 per cent
Materials opex				
BCIS	FOCOS RCI infrastructure: materials	1990-2014	1.6 per cent per year	-2.6 per cent
Plant and equipment				
ONS	K389 Machinery and equipment output PPI	1996-2014	-1.2 per cent per year	-0.4 per cent
ONS	K5W6 Machinery and equipment input PPI	1996-2013	Average real growth rate of combined index = -1.4 per cent per year	Growth rate of combined index = - 2.6 per cent
ONS	MB4U Machinery and equipment input PPI	2013-2014		

[34] All numbers shown in this section represent the values of the indices without the adjustment for the RPI step-change being applied. The final RPE forecasts which include the adjustment are shown in the results section below.
[35] We use a short term forecast for years 2014-15 and 2015-16 for general labour and specialist labour. The historical average real growth rate is applied for years 2016-17 to 2022-23 for these inputs.
[36] The growth rates shown here and for the historical average growth rate are calculated before taking account of the step-change in the RPI measure of inflation discussed below. The values for real growth we used in calculating our forecast of RPEs include an adjustment for this.

BCIS	70/2 Plant and road vehicles: providing and maintaining	1987-2014	-0.2 per cent per year	-1.5 per cent

12.15. Where we use multiple indices for constructing an RPE for a particular input we use an un-weighted average.

12.16. We have not forecast RPEs for transport and other inputs. They represent a small proportion of DNOs' costs and we assume they move in line with economy-wide inflation.

12.17. All forecast costs in the DNOs' business plans and in our proposed allowances are relative to 2012-13 prices. This includes our RPE forecast. The RPE assumptions for the RIIO-ED1 period include the impact of the movement in prices since 2012-13 as the growth in price indices is cumulative. For Draft Determinations we have used actual input price data for financial year 2013-14 in setting our forecast. This data indicates where prices have moved to since 2012-13. Our forecast then uses this price level relative to 2012-13 as its starting point. This methodology ensures our RPE assumptions for all years are relative to 2012-13 prices for consistency with the other elements of the cost allowances.

12.18. We included index data up to 2013-14 as it is appropriate to make use of the latest available information in our cost assessment. Our methodology does not involve selecting historical periods that we believe to be representative of the future. We consider it more appropriate to use the longest possible data series for calculating the historical averages and applying these for all forecast years where we do not have an appropriate forecast.

General labour

12.19. Our RPE for 2013-14 is calculated from the outturn data from the Office of National Statistics (ONS) for RPI and average weekly earnings (AWE) of the private sector economy including bonuses.

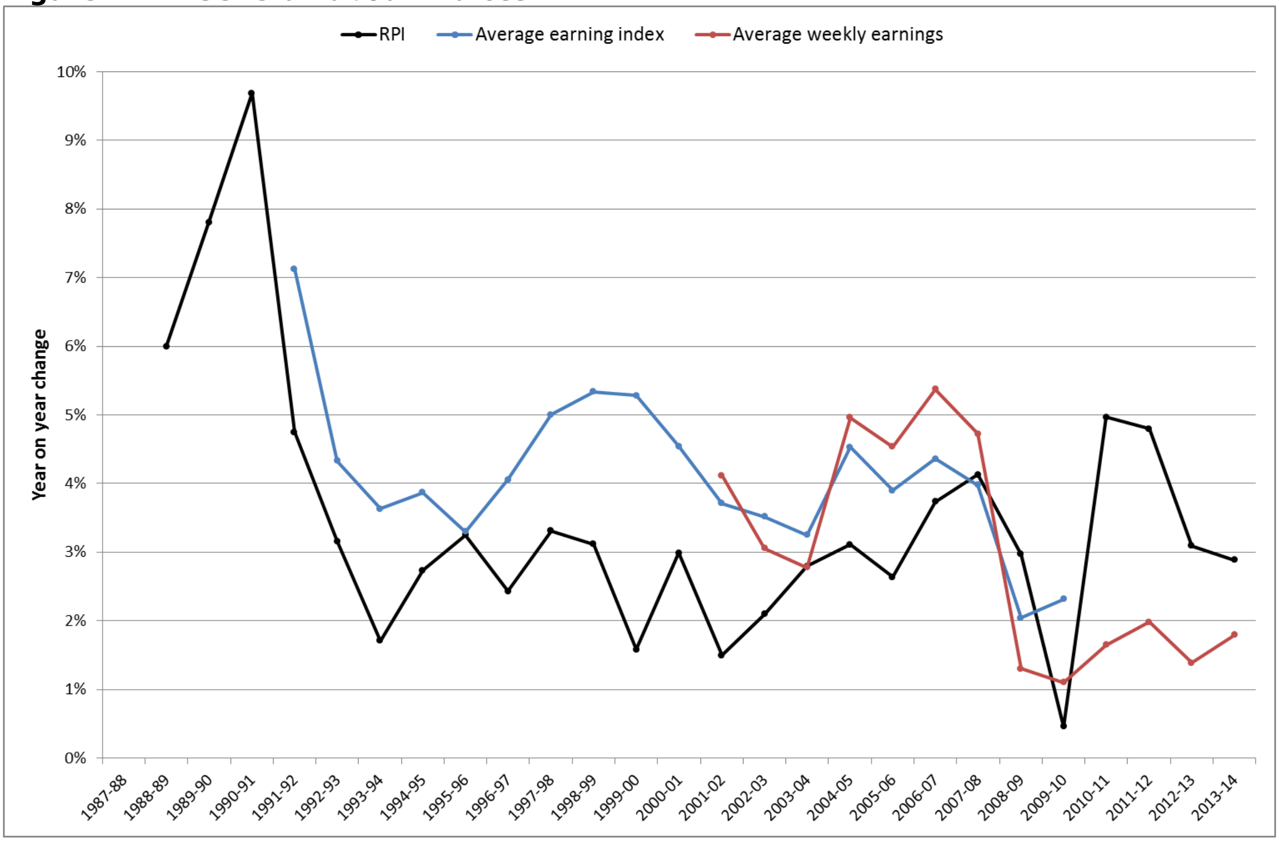
12.20. Our forecast for 2014-15 and 2015-16 uses the HM Treasury consensus forecast for average weekly earnings growth for the whole economy and for RPI growth. This is an update to the forecast used at RIIO-GD1 and T1. Historically there has been no systematic difference between private sector and whole economy wage growth, and therefore in the longer-term we would expect this relationship to hold. We used the HM Treasury forecast because it was published more recently than alternatives.

12.21. It is appropriate to use a forecast rather than return immediately to the historical average growth rate where we have a robust forecast. A short term forecast better reflects the short term impacts on input prices than the long term average growth rate. As the HM Treasury forecast we are using is only for two years, we are confident that the forecast growth rates are a good estimate of the actual growth wages will experience.

12.22. We applied a long term forecast for general labour RPEs for 2016-17 to 2022-23. This RPE was derived from rolling forward the historical average real growth rate calculated over the time series identified in Table 12.1. We used the ONS Average Earnings Index (AEI) of the private sector including bonuses up to 2000-01. From 2001-02 to 2013-14 we used the ONS index for AWE of the private sector including bonuses. We combined these indices to provide a longer historical time series over which to calculate the average real growth rate. We consider it appropriate to switch to the AWE index from the first year it is available.

12.23. These indices were used for RIIO-GD1 and T1 and we do not consider that the DNOs' inputs warrant the use of a different index for the electricity distribution sector. Figure 12.1 shows the two indices.

Figure 12.1: General labour indices

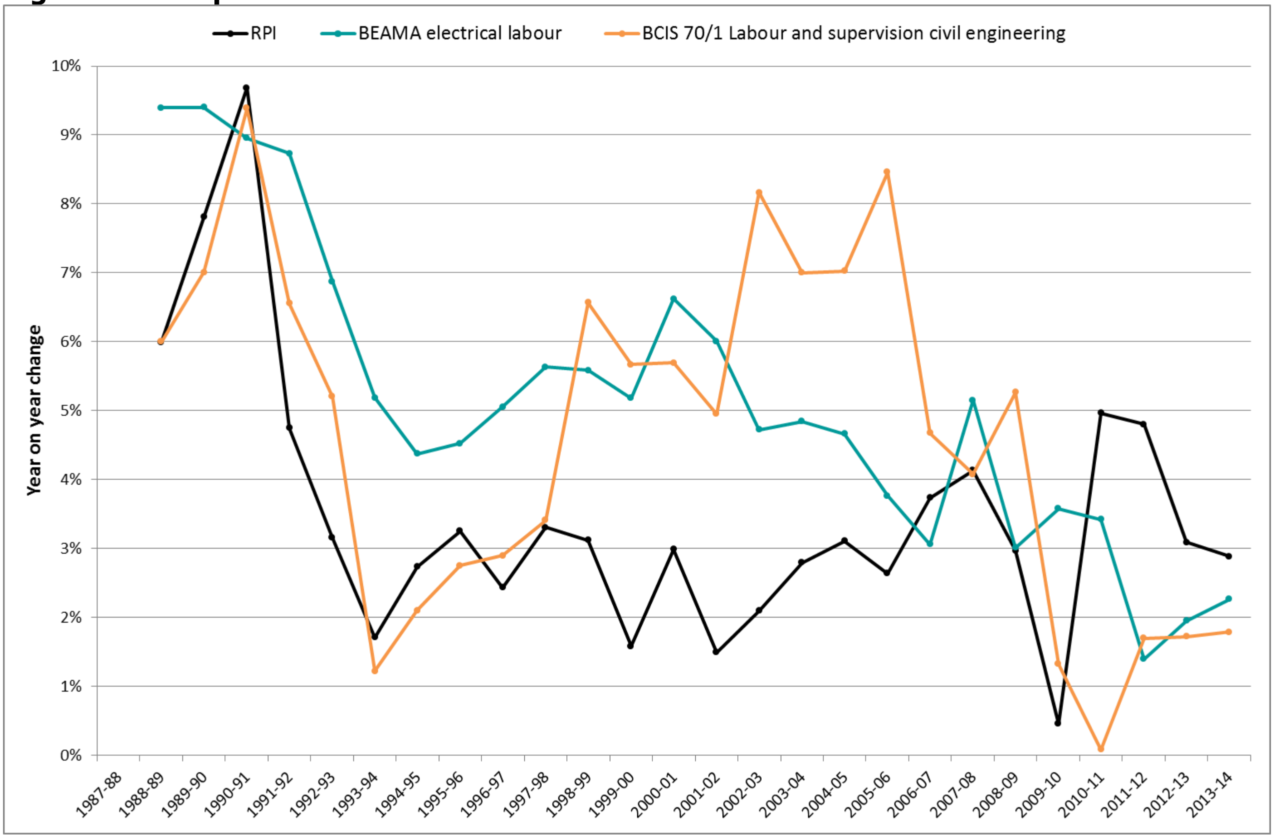


12.24. Figure 12.1 shows that both series used in our assessment of RPEs follow the same broad pattern between 2001-02 and 2009-10.

Specialist labour

12.25. We have assessed a number of indices to determine which best represent the specialist labour inputs of DNOs. Figure 12.2 shows the indices we used for the specialist labour RPE. We have not used the AWE construction and transport/storage indices we used for RIIO-GD1 and T1 because a substantial proportion of the time series has been during the recent economic downturn that began in 2008-09. We do not believe an average growth rate calculated from these series would accurately represent the long term growth in the costs of these inputs.

Figure 12.2: Specialist labour indices



12.26. Our RPE for 2013-14 is calculated from the outturn data from the ONS for RPI and for the indices mentioned above from BEAMA and BCIS.

12.27. There is no relevant forecast for specialist labour inputs. We consider that a general labour forecast is a good proxy for movements in specialist labour prices in the short term. As for the general labour RPE, our forecast for 2014-15 and 2015-16 uses the HM Treasury consensus forecast for average weekly earnings growth for the whole economy and for RPI growth.

12.28. We applied a long term forecast for specialist labour RPEs for years 2016-17 to 2022-23. This RPE was derived from rolling forward the un-weighted average of the historical average real growth rates for the BEAMA and BCIS indices. These historical averages were calculated over the time series identified in table 12.1.

Materials (capex)

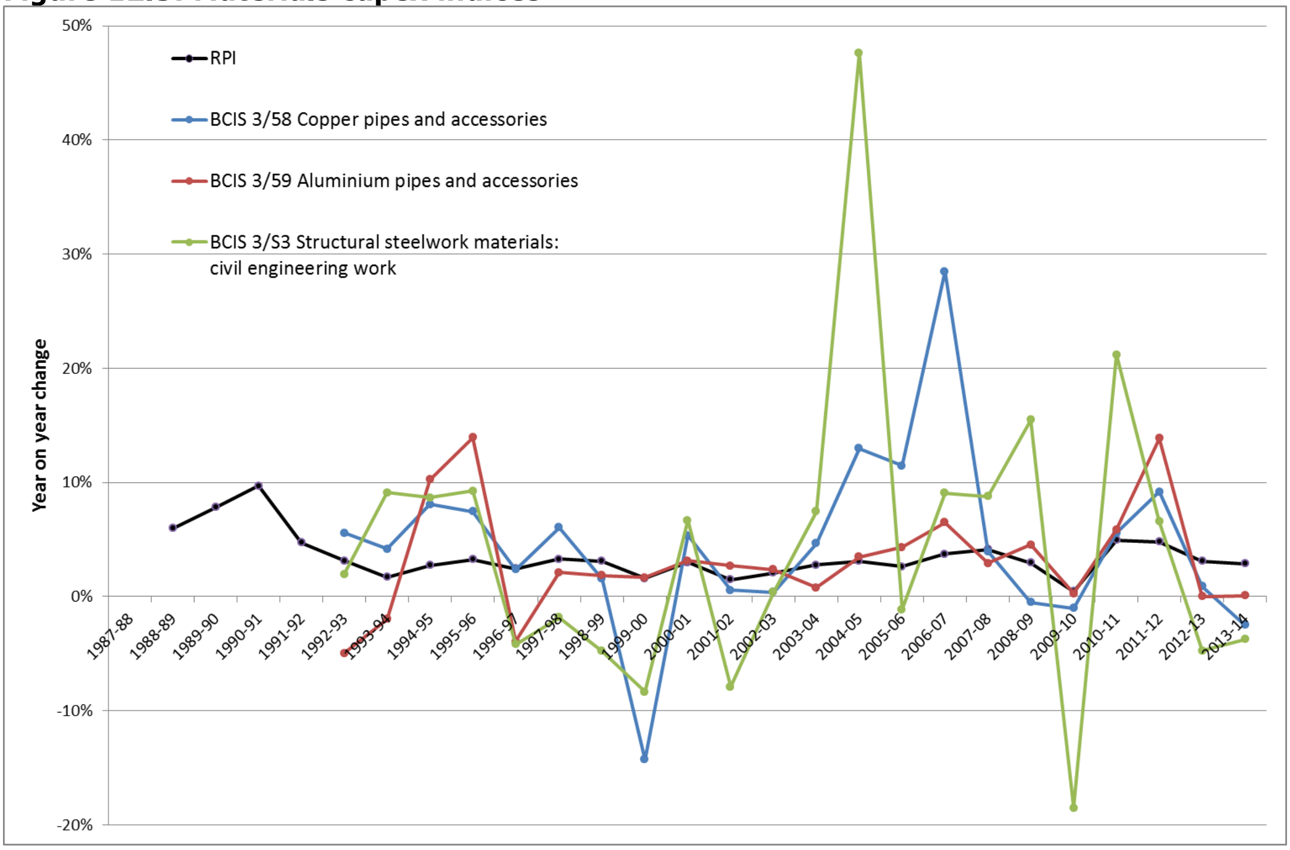
12.29. There are a number of indices available that could reflect the changes in cost of the materials DNOs purchase. We used indices that we consider represent the inputs used by DNOs. This has been influenced by the evidence provided by DNOs in their resubmissions.

12.30. Our RIIO-ED1 slow-track forecast is comprised of the following indices from BCIS:

- PAFI copper piping and accessories
- PAFI structural steelwork for civil engineering
- PAFI aluminium piping and accessories

12.31. For RIIO-T1 and GD1 we used the PAFI copper piping and PAFI structural steelwork for civil engineering indices. Figure 12.3 shows the indices we used in our forecast.

Figure 12.3: Materials capex indices



12.32. These indices are different to those used in our fast-track forecast. We changed the indices for two reasons. Firstly, we further considered the evidence provided by DNOs. Secondly, we recognised that there was a wide differential between the materials capex and materials opex RPEs in our fast-track forecast. This differential was not seen at RIIO-GD1 and T1. We did not consider this wide differential to be appropriate given the range of potential indices.

12.33. Our RPE for 2013-14 is calculated from the outturn data from the ONS for RPI and an un-weighted average of the outturn data for the three PAFI indices we have used.

12.34. For all forecast years, 2014-15 to 2022-23, we applied the un-weighted average of the historical average real growth rates of the three PAFI indices. These historical averages were calculated over the time series identified in table 12.1.

Materials (opex)

12.35. We used the BCIS FOCOS RCI infrastructure materials index to forecast our RPE for opex materials. This is the same index as at RIIO-GD1 and T1. We do not consider that the inputs DNOs purchase warrant the use of a different index for the electricity distribution sector.

12.36. Our RPE for 2013-14 is calculated from the outturn data from the ONS for RPI and the outturn data for the RCI infrastructure materials index. For all forecast years, 2014-15 to 2022-23, we applied the historical average real growth rate of this index. The historical average was calculated over the time series identified in table 12.1.

Plant and equipment

12.37. There are a number of indices available that could reflect the changes in cost of the materials DNOs purchase. We used the same indices as at RIIO-GD1 and T1. We do not consider that the inputs DNOs purchase warrant the use of a different index for the electricity distribution sector.

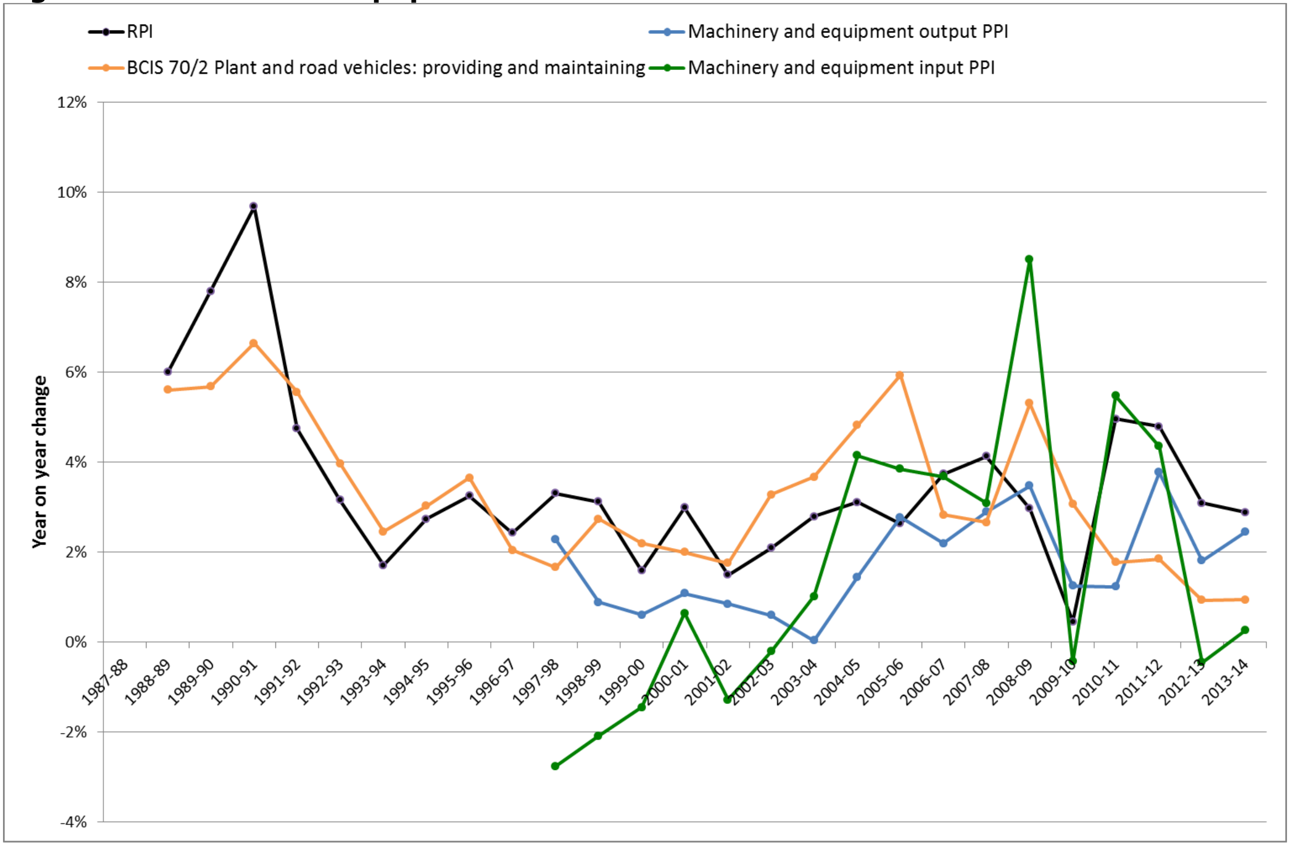
12.38. The indices we used are as follows:

- BCIS PAFI plant and road vehicles
- ONS machinery and equipment output PPI
- ONS machinery and equipment input PPI.

12.39. Our RPE for 2013-14 is calculated from the outturn data from the ONS for RPI and the un-weighted average of the outturn data for the indices listed above. For all forecast years, 2014-15 to 2022-23, we applied the un-weighted average historical average real growth rates of these indices. The historical averages were calculated over the time series identified in table 12.1.

12.40. Figure 12.4 shows the indices we used in our forecast.

Figure 12.4: Plant and equipment indices



Adjustment for RPI step-change

12.41. Price control allowances are up-rated by RPI each year. As recognised in our assessment of cost of equity, RPI experienced a step change relative to underlying cost inflation in the economy.[37]

12.42. In rolling forward the historical average real growth rates into the future, we are assuming that the gap in growth between economy wide inflation and inflation for DNO inputs in the future will be consistent with the gap in the past. As RPI experienced the step-change in 2010, this will no longer be the case.

12.43. If no adjustment is made to RPEs, DNOs receive an additional RPE in the RPI up-rating. To account for this, and to ensure the gap between DNO input price inflation and economy wide inflation is consistent in the future with that in the past, we applied an adjustment to our RPE assumption.

12.44. The adjustment is a two stage process:

- Adjust historical RPI for 2010-11 to 2013-14. This adjustment removes the increase in RPI experienced in 2010. The same adjustment must be made to the forecast for RPI used in calculating the real short term labour forecast.
- Adjust the year on year RPE growth for years 2015-16 to 2022-23 to remove the additional 0.4 per cent per year growth in RPI DNOs will receive through RPI indexation.

12.45. In order to calculate the historical average real growth in input price indices, all years considered must be on the same basis. We include years beyond 2010 in this calculation. For the years 2010-11 to 2013-14 as RPI growth is higher than growth in economy-wide inflation, the RPE growth will appear lower than it should. To counteract this, we reduced RPI growth by 0.4 per cent per year for 2010-11 to 2013-14. This has the effect of increasing RPEs for these years.

12.46. Our forecast of labour RPEs includes a short term forecast for 2014-15 and 2015-16. This relies on a forecast of RPI and of nominal wage growth. The same adjustment is made to forecast RPI for 2014-15 and 2015-16.

12.47. For 2014-15 to 2022-23 we applied a reduction of 0.4 per cent per year to our RPE forecast. In these years, the DNOs receive an additional 0.4 per cent RPE through the indexation of allowances to RPI. Therefore, to ensure there is no double-counting we removed this additional growth from our forecast growth in RPEs.

12.48. As we assume transport and other inputs move in line with economy-wide inflation, we applied a reduction of 0.4 per cent per year to each year from 2012-13 to

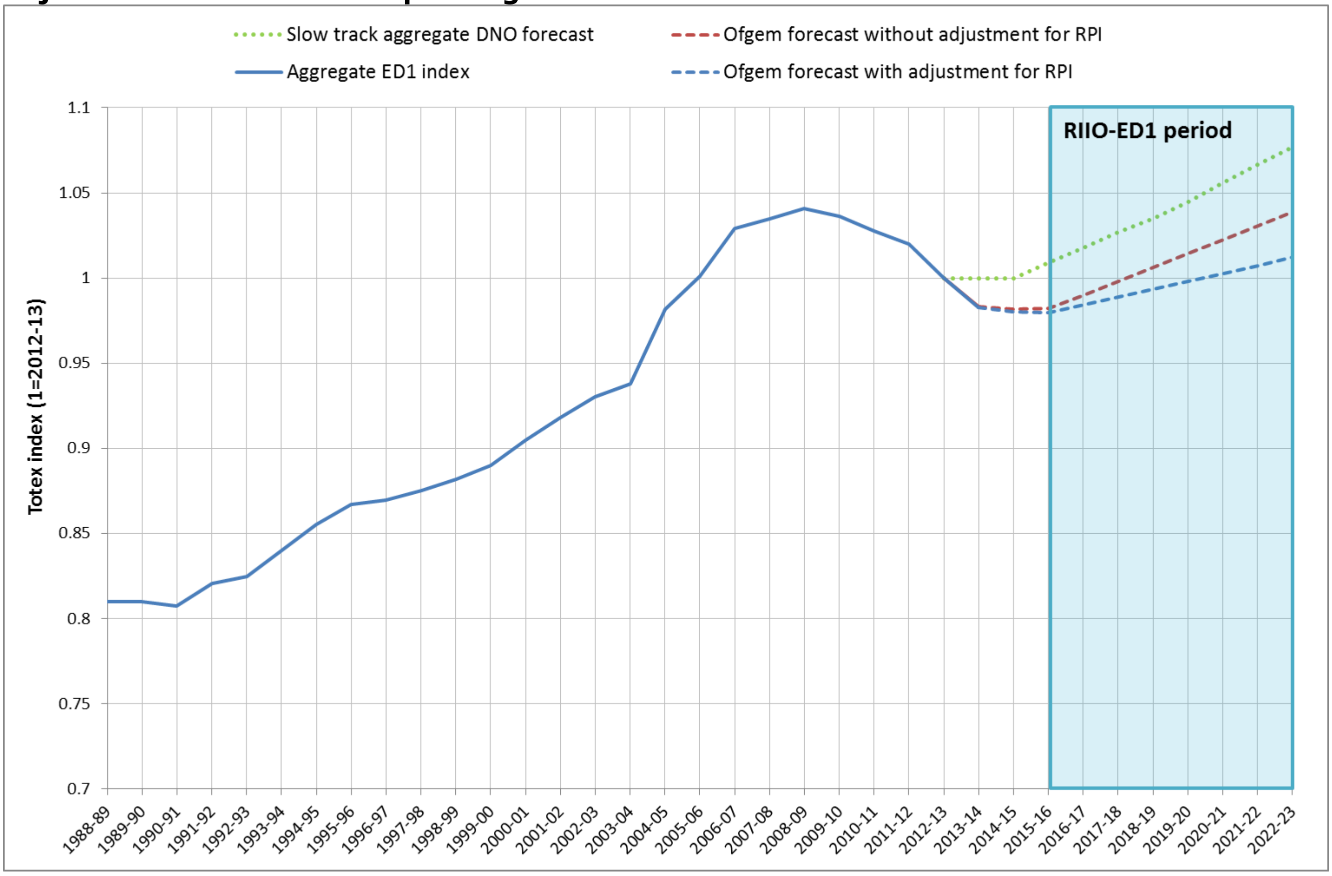
---

[37] During 2010 the Office of National Statistics changed the way it calculates price increases for some items that make up the RPI measure of economy-wide inflation. This led to an increase in RPI relative to underlying cost inflation. In our 17 February 2014 decision on equity market return methodology, we identified a need to adjust the cost of equity to account for this step-change in RPI. For more information see our decision document: https://www.ofgem.gov.uk/ofgem-publications/86366/decisiononequitymarketreturnmethodology.pdf. It is consistent to apply an equivalent adjustment to RPEs.

2022-23 to counteract the increase in RPI relative to price inflation by 0.4 per cent per year.

12.49. Figure 12.5 shows the historical and forecast movement in our aggregate RPE with and without the adjustment for the RPI step change.

Figure 12.5: Historical and forecast movement in RPEs with and without the adjustment for the RPI step change



12.50. The result of this two stage adjustment is to ensure DNOs receive the same level of protection from input price growth and consumers do not have to pay for the increase in the value of RPI. This adjustment is consistent with our approach to the calculation of the cost of equity.

Weighting inputs

12.51. The inputs discussed above are weighted into six cost areas using a notional structure of a DNO. The notional structure is the average structure of all DNOs as submitted in their business plans.[38] We use a notional structure to ensure we do not reward potentially inefficient company structures. The weightings we used are shown in table 12.2.

[38] WPD did not provide weightings and are therefore excluded.

Table 12.2: Notional DNO structure – weightings of inputs into cost areas

	Load-related capex	Non-load-related capex - asset replacement	Non-load-related capex - other	Faults	Tree cutting	Controllable opex
General Labour (capex)	35%	36%	37%	19%	N/A	N/A
General Labour (opex)	N/A	N/A	N/A	33%	85%	59%
Specialist Labour (capex)	17%	24%	20%	15%	N/A	N/A
Specialist Labour (opex)	N/A	N/A	N/A	5%	4%	15%
Materials (capex)	37%	29%	30%	9%	N/A	N/A
Materials (opex)	N/A	N/A	N/A	7%	4%	9%
Equipment/Plant	6%	7%	8%	6%	2%	5%
Transport	2%	2%	2%	3%	3%	4%
Other	3%	3%	3%	3%	2%	9%

12.52. The weighted RPEs for these six cost areas are applied to the disaggregated cost allowances.

12.53. We construct a totex RPE forecast to apply to the top down totex allowance. This is created by weighting together the RPE indices for the six cost areas. The weightings we use are the industry average contribution to totex of each of the cost areas in totex. Table 12.3 shows the weightings we used.

Table 12.3: Cost area weighting for the totex RPE

	Percentage of totex
Load-related capex	11%
Non-load-related capex - asset replacement	33%
Non-load-related capex - other	6%
Faults	12%
Tree cutting	4%
Controllable opex	35%

Results

12.54. All numbers shown here include the impact of the adjustment for the RPI step-change discussed above. Table 12.4 shows the RPE forecast in each year up to 2022-23 for each of the inputs. Table 12.5 shows the RPE forecast in each year up to 2022-23 for each of the six cost areas and for the totex RPE. Table 12.6 shows the total value of the RPE forecast over the RIIO-ED1 period for each DNO.

Table 12.4: RPE forecast for each input

	2013-14	2014-15	2015-16	2016-17 to 2022-23
General Labour (capex)	-1.1%	-0.6%	-0.2%	0.4%
General Labour (opex)	-1.1%	-0.6%	-0.2%	0.4%
Specialist Labour (capex)	-0.9%	-0.6%	-0.2%	1.0%
Specialist Labour (opex)	-0.9%	-0.6%	-0.2%	1.0%
Materials (capex)	-4.9%	0.8%	0.8%	0.8%
Materials (opex)	-2.6%	1.3%	1.3%	1.3%
Plant and equipment	-1.7%	-1.3%	-1.3%	-1.3%
Transport	-0.4%	-0.4%	-0.4%	-0.4%
Other	-0.4%	-0.4%	-0.4%	-0.4%

Table 12.5: RPE forecast for each cost area

	2013-14	2014-15	2015-16	2016-17 to 2022-23
Load-related capex	-2.5%	-0.1%	0.1%	0.5%
Non-load-related capex - asset replacement	-2.1%	-0.2%	0.0%	0.5%
Non-load-related capex - other	-2.2%	-0.2%	0.0%	0.5%
Faults	-1.5%	-0.3%	-0.1%	0.5%
Tree cutting	-1.1%	-0.5%	-0.2%	0.4%
Controllable opex	-1.1%	-0.4%	-0.2%	0.4%
Totex	**-1.7%**	**-0.3%**	**-0.1%**	**0.5%**

Table 12.6: Value of DNO and our RPE forecasts over RIIO-ED1

	DNO forecast of RPEs for RIIO-ED1 (£m)	Ofgem forecast of RPEs for RIIO-ED1 (£m)	Difference (£m)
ENWL	82.5	-7.8	90.3
NPGN	62.5	-5.9	68.4
NPGY	84.9	-8	92.9
LPN	77.5	-7.8	85.3
SPN	75.2	-7.7	82.9
EPN	112.4	-11.1	123.5
SPD	67.9	-6.9	74.8
SPMW	86.7	-8.2	94.9
SSEH	40.1	-4.4	44.5
SSES	82.2	-10.4	92.6

12.55. A large portion of the difference between the RPEs shown in table 12.6 and those forecast by the DNOs is caused by the drop in the totex RPE between 2010-11 and 2013-14. This can be seen in figure 12.5. We cross-checked the indices we are using with a selection of others used for DPCR5 and in DNOs' submissions. All sets of indices show a reduction in these years. This is not a consequence of our choice of indices but reflects the use of more recent data.

The uncertainty inherent in forecasting RPEs

12.56. We consider our methodology to be the most suitable way of incorporating RPEs into the ex ante cost allowance. However, as shown in figure 12.5 there has been a change in the trajectory of our input price indices in aggregate since 2010-11 and for some indices since 2004-05. This indicates that there may be increased uncertainty in the forecast of RPEs and casts doubt over the use of an ex ante forecast for an eight year control.

12.57. At the DPCR5 price control review we considered alternative mechanisms. We reached the conclusion that an ex ante allowance was appropriate as DNOs are able to manage their exposure to RPEs. We considered that the efficiency incentive appropriately shares the risk created by the uncertainty inherent in a forecast between the DNO and consumers. However, as seen in figure 12.5, there is arguably a greater degree of uncertainty now than there has been in the past.

12.58. We therefore consider it appropriate to review the options for including RPEs in the price control settlement in the light of this uncertainty for the RIIO-ED1 period. We will consult on whether there is a better way to deal with this uncertainty before final determinations.

Ongoing efficiency

Fast-track assessment

12.59. For RIIO-GD1 and T1 we developed an ongoing efficiency assumption, drawing on productivity data from the EU KLEMS database.[39] At fast-track we considered this assessment to also apply to the electricity distribution sector as more recent productivity data was not available.[40]

12.60. We considered that all DNOs' ongoing efficiency assumptions were efficient. We did not apply a separate assumption for ongoing efficiency for our cost assessment as the DNOs' efficiency assumptions were already included in the DNOs' forecasts forming part of the UQ calculation.

Key comments on the fast-track assessment

12.61. There were no comments received in response to the consultation on our fast-track approach to assessing ongoing efficiency.

[39] See the EU KLEMS online database: http://www.euklems.net/
[40] For more information on our approach at RIIO-GD1 and T1, see the RIIO-T1/GD1 initial proposals – real price effects and ongoing efficiency appendix: https://www.ofgem.gov.uk/ofgem-publications/48211/riiot1andgd1initialproposalsrealeffects.pdf

Revised approach for the slow-track assessment

12.62. We have followed the same approach as for the fast-track assessment. We have not updated our assumptions for ongoing efficiency. We consider that all DNOs' ongoing efficiency assumptions are efficient and no cost adjustment has been made.

Results

12.63. As for the fast-track assessment, we have not made a cost adjustment for ongoing efficiency. All DNOs have made assumptions that are similar and in line with our view, mostly between 0.8 and 1.0 per cent productivity improvement per year. We therefore accept all the DNOs' ongoing efficiency assumptions to be efficient. A combination of DNOs' assumptions feeds into the calculation of the UQ.

12.64. These ongoing efficiency improvements are in addition to smart grid savings. We asked the DNOs to identify ongoing efficiency and smart grid savings separately to ensure there was no double counting. In assessing additional smart grid savings (see Chapter 11) we have sought to ensure no double counting with ongoing efficiency.

Appendices

Appendix 1 – Disaggregated model key results

Appendix summary

This appendix summarises the key finding from our disaggregated analysis for each of the ten DNOs subject to our slow-track assessment. It provides the greatest detail on areas where the difference between our modelled costs and the DNOs' submitted costs are greatest. The numbers in the narrative are based on the difference between net forecast costs and modelled costs after the application of the UQ, smart grids savings, RPE adjustments, and the interpolation of the IQI. The description of the cuts on asset replacement is based on normalised data.

ENWL

Reinforcement

A1.1 ENWL benchmarks well on reinforcement with our modelled costs 4.5 per cent above its forecast costs. Our model suggests no reductions to its submitted volumes and a small positive adjustment to its volumes for LCT related reinforcement. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median.

A1.2 It has relatively high unit costs associated with primary network reinforcement but these are more than offset by low costs for secondary network reinforcement. On fault level reinforcement we applied a qualitative adjustment so that our view of unit costs and volumes is the same as ENWL's submitted view. This was on the basis that it has both high volumes and low unit costs relative to the majority of DNOs.

Asset replacement

A1.3 ENWL benchmarks well on asset replacement volumes for the majority of asset categories.

A1.4 Our view of LV switchgear volumes is slightly lower than ENWL's forecast. This takes into account a qualitative adjustment for LV metered cut outs where in our modelling we were making a negative adjustment. However, a review of ENWL's supporting narrative suggested higher volumes were justified than so our reduction was scaled back.

A1.5 Our view of pole-mounted 6.6/11kV switchgear volumes is lower than ENWL's forecast because no justification was provided for this and it is unclear what is driving the volumes submitted. We scaled back our negative adjustment to 6.6/11kV RMUs following a cross check with the asset health and criticality secondary deliverables. We also applied a qualitative adjustment to scale back our modelled negative adjustment for ground mounted transformers as our consultants suggested that higher volumes were justified.

A1.6 Our modelled view of ENWL's 132kV fixtures and fittings volumes is significantly lower than ENWL's forecast and ENWL has provided insufficient justification to support the difference.

A1.7 ENWL has relatively high asset replacement unit costs for a number of categories including underground LV cables and services, LV switchgear, EHV towers, EHV poles and conductors and 132kV switchgear and transformers.

Refurbishment

A1.8 ENWL ranks 7th of the ten slow-track DNOs for refurbishments costs. Our modelled costs are £19m or 17.2 per cent lower than ENWL's forecast costs. We believe ENWL's forecast HV Pole refurbishment volume is too high. ENWL benchmarks poorly because of its high 132kV tower refurbishment costs.

Civil works

A1.9 ENWL benchmarks relatively well on civil works with our modelled costs £8m higher than its forecasts. It is efficient on unit costs and this more than outweighs any negative volume adjustments.

Non-core non-load-related network investment

A1.10 Our modelled view of ENWL's non-core costs is 16.5 per cent lower than its forecast.

A1.11 ENWL is one of the frontier DNOs in diversions. Our modelled view of its operational IT&T is 30.4 per cent lower than ENWL's view. In reviewing ENWL's costs, our consultants consider these too high, particularly costs for contract and energy management, costs to refresh the control room and costs for the BT 21st century (BT21C) refresh.

A1.12 Our modelled view is a 26.7 per cent lower than ENWL's forecast for legal and safety expenditure, a difference driven by particularly high unit costs for safety climbing fixtures (supports or plant items) and site security for HV substations.

A1.13 Our modelled view is 17.8 per cent lower than ENWL's submitted costs for losses and other environmental expenditure. This is driven primarily by relatively high unit costs for losses reduction schemes.

Network operating costs (NOCs)

A1.14 ENWL benchmarks well overall on NOCs with low costs for troublecall and tree cutting more than offsetting high costs for ONIs.

Closely associated indirects (CAI)

A1.15 ENWL is one the frontier DNOs on CAI costs and our modelled view is £55m or 16.9 per cent higher than its submitted forecasts. Except for small differences between our view and ENWL's view of streetworks costs, ENWL is efficient across all of the sub-categories of CAI costs.

Business support and non-op capex

A1.16 Our efficient view of ENWL's costs is slightly lower than its forecast expenditure for business support. This is £2m or 0.9 per cent of its total cost forecast.

A1.17 ENWL is one of the more efficient DNOs on non-op capex. Its relatively low costs for vehicles and transport more than compensate for relatively high costs for IT&T.

NPgN

Reinforcement

A1.18 NPgN is in the middle of the pack on reinforcement with our modelled costs 3.2 per cent lower than submitted forecasts.

A1.19 Our modelled view of NPgN's volumes for LCT related network interventions is lower than its forecast. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median. The difference is more than offset by positive unit cost and qualitative adjustments (following a separate assessment of unlooping of shared services). There are no adjustments to our modelled volumes elsewhere in other reinforcement areas.

A1.20 It has relatively high unit costs associated with primary network and secondary network reinforcement, while it has relatively low unit costs for fault level reinforcement. For secondary network reinforcement (non-LCTs) we applied a positive qualitative adjustment to our modelled view due to NPgN's relatively low unit cost for MVa of capacity.

A1.21 We are making no adjustments to TCP charges.

Asset replacement

A1.22 NPgN ranks 3rd of the ten slow-track DNOs in asset replacement. Our view is 4.6 per cent lower than its forecast costs.

A1.23 NPgN benchmarks well on asset replacement volumes for the majority of asset categories.

A1.24 We applied a reduction to pole mounted HV switchgear in our modelled view due to NPgN's comparatively high replacement volumes. Our consultants conducted a review and found that a significant amount of NPgN's HV switchgear had been replaced in the last ten years and should not require such replacement volumes. We applied a qualitative adjustment to scale back our modelled reductions for 20kV RMUs as our consultants suggested that higher volumes were justified.

A1.25 We scaled back reductions to our modelled view of 33kV pole volumes following a cross check with the asset health and criticality secondary deliverables. We also applied a qualitative adjustment to scale back our modelled reductions for indoor LV pillars and 66kV non-pressurised underground cable following assessment work on smart enablers.

A1.26 NPgN has relatively high asset replacement unit costs for a number of categories including underground LV cables and services, HV switchgear, EHV towers, EHV switchgear and transformers. Adjustments have been made to protect NPgN's submitted unit costs due to the review undertaken surrounding smart enablers. These adjustments were made to indoor LV pillars and 33kV non-pressurised cable.

Refurbishment

A1.27 NPgN ranks 9th of the ten slow-track DNOs for refurbishments costs. Our modelled costs are £26m or 42.1 per cent lower than forecast costs. Its volumes for EHV and 132kV transformers are comparatively high. It also has high HV and EHV pole refurbishment unit costs.

Civil works

A1.28 NPgN benchmarks relatively poorly on civil works with our modelled costs £10m lower than its forecasts. The key reasons for this are the adjustments in both volumes and unit costs for plinths and groundworks at EHV substations (for work driven by asset replacement).

A1.29 For HV substation work driven by condition we made a positive qualitative adjustment to indoor substation volumes, following our technical consultants' review. The submitted volumes are significantly lower than historical rates, and NPg have presented a credible case.

Non-core non-load-related network investment

A1.30 Our view of NPgN's non-core costs is £11m or 11.5 per cent lower than its forecast. The largest difference between modelled and submitted costs is on its legal and safety expenditure which is driven by particularly high submitted unit costs for asbestos management: meter positions.

A1.31 Our modelled view also suggests inefficiencies for diversions and flooding costs. The diversionary unit costs at EHV are considerably higher than the industry median and the cost of a change in risk point (ie £ per risk point) for NPgN was higher than the industry median.

Network operating costs (NOCs)

A1.32 NPgN benchmarks poorly on NOCs, ranking 13th of the 14 DNOs. Our modelled costs are £27m or 9.4 per cent lower than its forecast costs. This is largely driven by high costs in troublecall and ONIs.

Closely associated indirects

A1.33 NPgN is one of the frontier DNOs on CAI costs, ranking 5th of the ten slow-track DNOs. Our modelled view is £4m or 1.6 per cent higher than its submitted forecasts. The difference between our modelled and NPgN's submitted wayleaves costs (because of high unit costs) are more than compensated for by efficient costs in all other CAI categories.

Business support and non-op capex

A1.34 NPgN is the frontier DNO for BSCs. Our modelled costs are £24m or 17.9 per cent higher than NPgN's forecast costs.

A1.35 NPgN is also one of the more efficient DNOs on non-op capex. Our modelled costs are largely in line with its forecast costs.

NPgY

Reinforcement

A1.36 NPgY benchmarks relatively poorly on reinforcement with our modelled costs 8 per cent lower than submitted forecasts.

A1.37 Our modelled view of NPgY's volumes of LCT related network interventions is lower than its forecast. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median. The difference is partially offset by positive unit cost and qualitative adjustments (following a separate assessment of unbundling of shared services). Our modelled view of volumes in other areas show no significant differences.

A1.38 It has relatively high unit costs associated with N-1 primary network reinforcement and other work captured in the load index secondary deliverables, while it has relatively low unit costs for fault level reinforcement and LCT reinforcement. We have made a positive qualitative adjustment for secondary reinforcement (non-LCTs) to reflect its low unit costs per MVa of capacity.

A1.39 We are making no adjustments to the forecast costs for TCP charges.

Asset replacement

A1.40 NPgY ranks 11th of the 14 DNOs in asset replacement. Our modelled costs are £45m or 13 per cent lower than its forecast costs.

A1.41 Our modelled view of LV cables is lower than NPgY's forecast due to high replacement volumes in comparison to historical volumes.

A1.42 NPgY's pole-mounted HV switchgear replacement volumes are high compared to our modelled view. Our consultants conducted a review and found that a significant amount of NPgY's HV switchgear had been replaced in the last ten years and should not require such replacement volumes. We also applied a qualitative adjustment to scale back our modelled negative adjustment for 6.6/11kV RMU's as our consultants suggested that higher volumes were justified.

A1.43 We scaled back the negative adjustments of our modelled view of EHV poles and switchgear following a cross check with the asset health and criticality secondary deliverables. We also applied a positive qualitative adjustment to our modelled view of indoor and outdoor LV pillars at substations following assessment work on smart enablers.

A1.44 NPgY has relatively high asset replacement unit costs for a number of categories including underground LV cables, HV poles and switchgear, EHV conductor, poles, switchgear and transformers, 132kV towers and switchgear. Adjustments have been made to protect NPgN's submitted unit costs due to the review undertaken surrounding smart enablers. These adjustments were made to indoor and outdoor LV pillars and 33kV non-pressurised cable.

Refurbishment

A1.45 NPgY ranks 8th of the ten slow-track DNOs for refurbishments costs. Our modelled costs are £25m or 31.9 per cent lower than forecast costs. We think NPgY refurbishment volumes for EHV and 132kV transformers are too high. NPgY benchmarks comparatively poorly due to its high HV and EHV pole refurbishment costs. NPgY also benchmark poorly due to its comparatively high tower painting costs.

Civil works

A1.46 NPgY benchmarks relatively poorly on civil works with our modelled costs £17.8m or 26.6 per cent lower than its forecasts. As with NPgN, the key reason for the differences are the volumes and unit costs for plinths and groundworks at EHV substations (for work driven by asset replacement), which are high relative to our benchmark.

A1.47 For NPgY we make a positive qualitative adjustment for HV indoor substation volumes. The submitted volumes are significantly lower than historical rates, and NPg have presented a credible case.

Non-core non-load-related network investment

A1.48 NPgY ranks 4th of the ten slow-track DNOs for non-core non-load-related expenditure. Our modelled view is £10m or 6.3 per cent lower than NPgY's forecast costs. This is almost entirely accounted for by the large reduction to its legal and safety expenditure. Like NPgN this is driven by particularly high unit costs for asbestos management: meter positions and high fire protection unit costs.

Network operating costs (NOCs)

A1.49 NPgY benchmarks poorly on NOCs (10th of the ten slow-track DNOs). Our modelled view is £22m or five per cent lower than NPgY's forecast costs. This is largely driven by differences in troublecall and ONIs costs between modelled and forecast costs.

Closely associated indirects

A1.50 NPgN is one of the most efficient DNOs on CAI costs (2nd of the 10 DNOs). Our modelled view is £30m or 10.9 per cent higher than its submitted forecasts. A minimal reduction in streetwork costs is outweighed by higher modelled costs in all other CAI categories.

Business support and non-op capex

A1.51 NPgY ranks second only to NPgN for BSCs. Our modelled costs are £27m or 17.9 per cent higher than NPgY's forecast costs.

A1.52 NPgY is one of the most efficient DNOs on non-op capex costs. Our modelled costs are £6m or 9.3 per cent higher than NPgY's forecast costs.

LPN

Reinforcement

A1.53 LPN benchmarks poorly on reinforcement with our modelled costs 16.0 per cent lower than its submitted forecasts.

A1.54 It benchmarks poorly on capacity added relatively to maximum demand growth for N-1 primary network reinforcement and other work captured in the load index secondary deliverables, but we applied a qualitative adjustment to close 70 per cent of the gap based on the strength of its scheme papers. It benchmarks well on unit costs associated with this work.

A1.55 Our modelled view applies a reduction to submitted volumes for LCT related network interventions. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median. This reduction is partially offset by an increase to its unit costs as they are below the industry median. We are applying no other volume adjustments.

A1.56 We are applying a small increase to submitted unit costs for other primary reinforcement and a large reduction to our view of costs for secondary reinforcement (non-LCTs). We are making no adjustments to TCP charges.

Asset replacement

A1.57 LPN benchmarks poorly on asset replacement ranking 8th of the ten slow-track DNOs. Our modelling is £49m or 16.8 per cent lower than forecast costs.

A1.58 LPN benchmarks well on asset replacement volumes for the majority of asset categories.

A1.59 We applied an adjustment to our modelled view of EHV circuit breakers as our consultants suggested that higher volumes were justified. We also adjusted our modelled view of 33kV switchgear following a cross check with the asset health and criticality secondary deliverables.

A1.60 LPN has high asset replacement unit costs for a number of categories including underground LV switchgear, HV cable, EHV cable and 132kV cable, switchgear and transformers.

Refurbishment

A1.61 LPN is at the frontier of the ten slow-track DNOs for refurbishments costs. Our modelled costs are very close to LPN's submitted forecasts; £0.3m or 2.3 per cent higher than forecast costs. It benchmarks very well on 132kV protection refurbishment costs.

Civil works

12.65. LPN is relatively inefficient ranking 10th of the DNO slow-track DNOs for civil works costs. Our modelled view is £29m or 42.6 per cent lower than forecast costs. Our modelled view is lower in most of the civil works cost activities, with the largest negative unit cost adjustment for cable tunnels. For LPN this is a reflection of the volume reductions for substation works and relatively high unit costs for cable tunnels.

Non-core non-load-related network investment

A1.62 LPN ranks 7th of the ten slow-track DNOs for non-core non-load-related expenditure. Our modelled costs are £14m or 10.4 per cent lower than LPN's forecast costs. This is driven largely by differences between our modelled and LPN's forecast costs in operational IT&T.

A1.63 Our lower modelled view of costs compared with LPN's forecasts for diversions relate to LV, EHV and 132kV voltage levels.

Network operating costs (NOCs)

A1.64 LPN is among the most inefficient DNOs for NOCs. Our modelled view of costs is £21m or 6.6 per cent lower than LPN's forecast costs. Differences in costs in troublecall, inspection and maintenance and NOCs other account for this.

Closely associated indirects

A1.65 LPN, like the other UKPN licensees is among the least efficient for CAI costs. It ranks 8th of the ten slow-track DNOs for CAI costs. Our modelled view is £8m or 2.5 per cent lower than its submitted forecast. Our lower modelled costs compared with LPN's forecast in the eight regressed areas of CAI costs, operational training and streetworks are not offset by higher modelled costs in wayleaves and vehicles and transport.

Business support and non-op capex

A1.66 LPN ranks 9th for BSCs but is still efficient according to our benchmarking. Our modelled costs are £13m or 7.7 per cent higher than LPN's forecast costs.

A1.67 LPN is among the least efficient DNOs for non-op capex costs. Our modelled costs are £6m or 10.2 per cent lower than LPN's forecast costs. The high costs for IT&T and property outweigh the efficiencies in vehicles and transport and STEPM.

SPN

Reinforcement

A1.68 SPN is in the middle of the pack on reinforcement with our modelled costs 3.1 per cent lower than its submitted forecasts.

A1.69 We apply a reduction to SPN's submitted volumes of LCT related network interventions and associated unit costs. This is based on benchmarking SPN's forecast of network interventions per MW of LCTs connected and the unit costs of interventions to the industry median. We are applying no other volume adjustments.

A1.70 We are making a small reduction to SPN's unit costs for N-1 primary network reinforcement and other work captured in the load index secondary deliverables, but we applied a qualitative adjustment to close 90 per cent of the gap based on the strength of its scheme papers. Our modelled view also makes cuts to unit costs for secondary reinforcement (non-LCTs) and fault level reinforcement. We are making no adjustments its TCP charges.

Asset replacement

A1.71 SPN benchmarks poorly on asset replacement (9th of the ten slow-track DNOs). Our modelling is £49m or 17.4 per cent lower than SPN's forecast costs.

A1.72 It also benchmarks poorly on asset replacement volumes for a number of asset categories.

A1.73 We applied a reduction overall to our modelled view of LV switchgear volumes because we view that forecast volumes were far higher than their historic replacement rates with insufficient justification to support the difference.

A1.74 We applied significant reductions to our modelled view of SPN's HV conductor replacement volumes because our consultants believe the volumes forecast are not credible and significantly higher than in DPCR5. We scaled back reductions to our modelled view of SPN's HV switchgear volumes following a cross check with the asset health and criticality secondary deliverables. We have also made a large reduction to our modelled view of SPN's 132kV conductor forecast volumes as there was insufficient justification to support them.

A1.75 SPN has high asset replacement unit costs for a number of categories including underground LV services, HV cable, 132kV cable and switchgear.

Refurbishment

A1.76 SPN ranks 3rd of the ten slow-track DNOs for refurbishment costs. Our modelled costs are £2m or 7.9 per cent lower than forecast costs. SPN benchmarks well on pole refurbishment costs when compared with our view but this is outweighed by high transformer refurbishment costs.

Civil works

A1.77 SPN is among the most efficient DNOs for civils costs, ranking 2nd. Our modelled costs are £18m or 41.3 per cent higher than SPN's forecast costs. We make positive adjustments to our modelled view of both the volumes and unit costs for civils work driven by condition at HV and EHV substations.

Non-core non-load-related network investment

A1.78 SPN ranks 6th for non-core non-load-related expenditure. Our modelled view is £14m or 7.1 per cent lower than SPN's forecast costs. This is driven by SPN's comparatively high costs in operational IT&T, BT21C and legal and safety.

Network operating costs (NOCs)

A1.79 SPN ranks 7th for NOCs. Our modelled costs are £17m or 4.9 per cent lower than its forecast costs. Its comparatively high costs in troublecall, inspections and maintenance, tree cutting and NOCs other account for this. Performance is better for ONIs costs.

Closely associated indirects

A1.80 SPN is the least efficient DNO for CAI costs. Our modelled view is £41m or 10.7 per cent lower than its submitted forecasts. Costs are assessed as inefficient in all areas except wayleaves, with the most significant difference in the eight regressed areas of CAI costs.

Business support and non-op capex

A1.81 SPN ranks 8th for BSCs. Our modelled costs are £13m or 7.8 per cent higher than SPN forecast costs.

A1.82 SPN ranks 11th for non-op capex costs. Our modelled costs are £8m or 11.2 per cent lower than SPN's forecast costs. Our modelled view of costs is lower than SPN's forecast for IT&T, property and vehicles and transport.

EPN

Reinforcement

A1.83 EPN benchmarks well on reinforcement with our modelled costs 17.2 per cent higher than its submitted forecasts.

A1.84 We are making a reduction to EPN's submitted view of capacity added relative to maximum demand growth for N-1 primary network reinforcement and other work captured in the load index secondary deliverables, but have closed 81 per cent of the gap based on the quality of its schemes papers. The reduction is more than offset by an increase to our modelled view of its unit costs that are below the industry median.

A1.85 We also apply an increase to the submitted view of EPN's volumes of LCT related network interventions. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median. This increase is partially offset by a reduction to its submitted unit costs of network interventions which are above the industry median.

A1.86 Our modelled view of EPN's unit costs for other primary network reinforcement and costs for secondary reinforcement (non-LCTs) are higher than EPN's forecast costs which on average are low relative to the industry median. We are cutting its unit costs for fault level reinforcement.

A1.87 We are making no adjustments to our modelled view of its TCP charges.

Connections

A1.88 For connections, like SPN, our modelled costs are in line with EPN's forecast costs. Our modelled costs are only £1.4m or 2.9 per cent lower than the forecast costs.

Asset replacement

A1.89 EPN is the least efficient DNO on asset replacement. Our modelling is £103m or 23.7 per cent lower than EPN's forecast costs.

A1.90 EPN benchmarks poorly on asset replacement volumes for a number of asset categories.

A1.91 We applied a reduction overall to our modelled view of LV switchgear volumes because the forecast volumes were far higher than their historic replacement rates with insufficient justification to support the difference.

A1.92 Our modelled view of HV conductor volumes is lower than EPN's forecast. We scaled back the reductions our modelling suggested following a review of EPN's supporting narrative. Despite this, our view is still significantly lower than EPN's forecast.

A1.93 We applied a large reduction to EPN's 132kV conductor volumes as its forecast was significantly above our modelled volumes and there was insufficient justification to support the difference. We scaled back our modelled view of reductions to EPN's HV switchgear and transformer volumes following a cross check with the asset health and criticality secondary deliverables.

A1.94 EPN has relatively high asset replacement unit costs for a number of categories including underground HV cables and switchgear, EHV conductor, cable and transformers and 132kV switchgear and cables.

Refurbishment

A1.95 EPN ranks 4th of the ten slow-track DNOs for refurbishment costs. Our modelled costs are £3m or 8.6 per cent lower than forecast costs. EPN benchmarks well on pole refurbishment costs when compared with our view however this is outweighed by high transformer refurbishment costs.

Civil works

A1.96 EPN ranks 5th for civil costs, with our modelled costs £3.1m or 3.7 per cent higher than EPN's forecast costs. Our modelled view shows a large positive adjustment for civil works driven by condition at HV substations.

Non-core non-load-related network investment

A1.97 EPN ranks 5th of the ten slow-track DNOs for non-core non-load-related expenditure. Our modelled costs are £21m or 6.7 per cent lower than EPN's forecast costs. This is driven largely by comparatively high costs in BT21C and diversions. For diversions, this is due to high unit costs at LV, EHV and 132kV voltage levels.

Network operating costs (NOCs)

A1.98 EPN is among the frontier DNOs for NOCs, ranking 3rd. Our modelled costs are largely in line with EPN's forecast costs. The strong performance in our tree cutting analysis more than compensates for comparatively high forecast costs in most other NOCs areas.

Closely associated indirects

A1.99 EPN ranks 7th for CAI costs. Our modelled view is £2m or 0.4 per cent lower than its submitted forecasts. Higher forecast costs in the eight regressed areas are offset by modelled costs being higher for wayleaves and vehicles and transport.

Business support and non-op capex

A1.100 EPN ranks 7th for BSCs. Our modelled costs are £17m or 7.8 per cent higher than EPN forecast costs.

A1.101 EPN ranks 5th of the ten slow-track DNOs for non-op capex costs. Our modelled costs are £2m or 2.3 per cent lower than EPN's forecast costs. EPN's higher forecast costs for IT&T and property are only slightly greater than the higher modelled costs in vehicles and transport and STEPM.

SPD

Reinforcement

A1.102 SPD benchmarks relatively well on reinforcement with our modelled costs only 0.5 per cent lower than its submitted forecasts.

A1.103 We have also applied an increase to SPD's submitted volumes of LCT related network interventions and associated unit costs. This is based on benchmarking its forecast of network interventions per MW of LCTs connected and associated unit costs to the industry median. We are applying no other adjustments to its volumes.

A1.104 Our modelled view of SPD's unit costs is lower than its forecast for N-1 primary network reinforcement and other work captured in the load index secondary deliverables, but we have closed 90 per cent of the gap based on the quality of its schemes papers. We are also applying reductions to submitted unit costs for other primary reinforcement and fault level reinforcement. Our modelled costs are slightly higher than SPD's forecast costs for secondary reinforcement (non-LCTs).

A1.105 We are making no adjustments to its TCP charges.

Asset replacement

A1.106 SPD is at the frontier for asset replacement costs. Our modelled view is £6m or 2.5 per cent lower than its forecast cost.

A1.107Despite the overall strong performance, SPD benchmarks poorly on asset replacement volumes for a number of asset categories.

A1.108 We applied a reduction to our modelled view of SPD's HV conductor volumes because we view that forecast volumes were far higher than their historic replacement rates with insufficient justification to support the difference. We have also applied a significant reduction to our modelled view of SPD's HV cable volumes for similar reasons.

A1.109 We applied a large reduction to our modelled view of SPD's EHV cable volumes as our consultants could not disaggregate between replacement volumes for 11 and 33kV cables and SPD does not justify the increased 2014 volumes, which were high. Our consultants recommended significant reductions be made to our view of SPD's 33kV conductor replacement volumes due to there being almost no spend historically.

A1.110 We scaled back the differences between our modelled view and SPD's forecasts for HV pole and switchgear volumes following a cross check with the asset health and criticality secondary deliverables.

A1.111 SPD generally has low asset replacement unit costs, however our modelled view is significantly lower than its forecast for LV conductor and switchgear and EHV switchgear.

Refurbishment

A1.112 SPD ranks 6th of the ten slow-track DNOs for refurbishment costs. Our modelled view is £6m or 12.0 per cent lower than its forecast costs. Our modelled view of both 6.6/11kV and 33kV pole refurbishment is significantly lower than SPD's forecast, but SPD do benefit in these areas due to comparatively low refurbishment costs. SPD also benchmark very well against our 33kV protection refurbishment cost.

Civil works

A1.113 SPD benchmarks 6th on civil works with our modelled costs £2m or 3.2 per cent lower than its forecasts. For EHV building and HV outdoor substations volumes our modelled view is lower than the SPD's submitted.

Non-core non-load-related network investment

A1.114 Our modelled view of SPD's non-core costs is £5m or 2.2 per cent lower than SPD's forecast in our disaggregated benchmarking. This reflects a combination of our modelled costs being lower for diversions, legal and safety, BT21C and environmental. This was offset to some degree by SPD's relatively strong performance in operational IT&T and blackstart.

Network operating costs (NOCs)

A1.115 SPD's forecast costs for NOCs are in line with our modelled costs. Our modelled view of costs for tree-cutting being significantly lower than SPD's forecast was countered by its relative efficiency in inspection and maintenance.

Closely associated indirects

A1.116 SPD ranks 3rd of the ten slow-track DNOs on CAI costs. Our modelled costs are £22m or 8.2 per cent higher than SPD's forecast costs. Our modelled view of costs for operational training are higher than SPD's forecast, but its relatively strong performance for the eight regressed areas of CAI costs, wayleaves and vehicles and transport result in our modelled costs being higher than forecast costs.

Business support and non-op capex

A1.117 SPD ranks 5th for BSCs. Our modelled costs are £16m or 10.6 per cent higher than SPD's forecast costs.

A1.118 Our modelled costs are largely in line with SPD's forecast costs.

SPMW

Reinforcement

A1.119 SPMW ranks 3rd on reinforcement with our modelled costs 3.3 per cent lower than its submitted forecasts.

A1.120 Our modelled view showed a small reduction to SPD's capacity added relative to maximum demand growth for N-1 primary network reinforcement and other work captured in the load index secondary deliverables, but we have closed 90 per cent of the gap based on the quality of SP's schemes papers. We are also applying a small reduction to its submitted unit costs for this work.

A1.121 Our modelling applies a reduction to SPMW's submitted volumes of LCT related network interventions. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median. We are applying no other adjustments to its volumes.

A1.122 We are applying a large reduction to SPMW's submitted costs of other primary network reinforcement based on its high unit costs and are applying an increase for secondary network reinforcement (non-LCTs). We have accepted SPMW volumes and unit costs for fault reinforcement in the round as they have high volumes and low unit costs compared to the majority of other DNOs.

A1.123 We are making no adjustments to its TCP charges.

Asset replacement

A1.124 SPMW ranks 6th of the ten slow-track DNOs on asset replacement. Our modelled costs are £42m or 9.7 per cent lower than its forecast costs, largely due to submitted unit costs being assessed as high.

A1.125 SPMW benchmarks relatively well on asset replacement volumes for the majority of asset categories.

A1.126 Our modelled view of batteries at ground mounted HV substations was significantly lower than SPMW's forecast. We applied a reduction to our modelled view of SPMW's to EHV switchgear volumes because it was unclear why addition volumes were higher than disposals.

A1.127 We have scaled back the reductions our model makes to SPMW's forecast EHV pole, switchgear and 132kV switchgear volumes following a cross check with the asset health and criticality secondary deliverables.

A1.128 SPMW has relatively high asset replacement unit costs. Some of the categories that we consider to have high unit costs are underground LV conductor and switchgear, 132kV conductor, poles, towers, transformers and switchgear.

Refurbishment

A1.129 SPMW is the least efficient DNO on refurbishment. Our modelled view of refurbishment costs is 48.2 per cent lower than SPMW's forecast. It benchmarks relatively poorly due to high 33kV and 132kV volumes and costs. Our modelled view is also significantly lower than SPMW's forecast due to high HV switchgear and transformer refurbishment costs. Our modelled view applies a significant volume reduction to both 6.6/11kV and 33kV pole refurbishment, however SPMW does benchmark well in these areas due to low refurbishment costs.

Civil works

A1.130 SPMW ranks 9th of the ten slow-track DNOs on civil works with our modelled costs £22m or 28.4 per cent lower than its forecasts. For SPMW some of our modelled costs for civil works at 33kV and 66kV substations and HV indoor substations were lower than SPMW's forecasts due to its high unit costs, and our modelled volumes for plinths and groundworks at 132kV were also lower.

Non-core non-load-related network investment

A1.131 SPMW is the frontier DNO for non-core costs. Our modelled costs are largely in line with its forecast costs.

A1.132 For most categories under non-core costs, our view is in line with that of SPMW. Our modelled view shows reductions to forecast costs in blackstart and losses and other environmental expenditure. These are more than offset by the performance on BT21C costs.

Network operating costs (NOCs)

A1.133 SPMW is the second most efficient DNO on NOCs. Our modelled costs are £7m or eight per cent higher than forecast costs. Our lower modelled costs in NOCs and ONIs are more than offset by efficient costs for tree cutting, inspections and maintenance and troublecall.

Closely associated indirects

A1.134 SPMW ranks in the middle of the pack on CAI costs. Our modelled view is in line with SPMW's forecast costs, only 0.1 per cent lower than its submitted forecasts. Lower modelled costs for operational training and wayleaves are offset by SPMW's strong performance in the CAI regressed areas and vehicles and transport.

Business support and non-op capex

A1.135 Our modelled costs are higher than SPMW's forecast costs for BSCs (£13m or 10.6 per cent). SPMW ranks 6th for BSCs of the ten slow-track DNOs,

A1.136 SPMW ranks 7th of the ten slow-track DNOs for non-op capex costs. Our modelled costs are £3m or 6.5 per cent lower than SPMW's forecast costs because of high IT&T and vehicles and transport costs.

SSEH

Reinforcement

A1.137 SSEH is in the middle of the pack on reinforcement with our modelled costs 3.2 per cent lower than its submitted forecasts.

A1.138 Our modelled view shows an increase to SSEH's forecast volumes of LCT related network interventions. This is based on benchmarking its forecast of network interventions per MW of LCTs connected to the industry median. This is partially offset by our modelled unit costs being lower than SSEH's forecasts. We are applying no other adjustments to its volumes.

A1.139 Our modelled view of SSEH's unit costs for N-1 primary network reinforcement and other work captured in the load index secondary deliverables is lower than its forecast. Given the relatively poor quality of its scheme papers we have not closed any of the gaps for our quantitative assessment. Our modelled unit costs for other primary network reinforcement are also lower than SSEH's forecast.

A1.140 Our modelled view shows an increase to SSEH's forecast cost due to low unit costs for fault level reinforcement relative to the industry median.

A1.141 We are making no adjustments to its TCP charges.

Asset replacement

A1.142 SSEH ranks 5th on asset replacement. Our modelled view is £20m or 9.7 per cent lower than its forecast costs.

A1.143 SSEH benchmarks well on asset replacement volumes for the majority of asset categories.

A1.144 We scaled back the reductions to SSEH's submitted volumes in our modelled view of HV and EHV submarine cables due to input from our consultants as these cables are installed in rocky environments with strong tides and have undergone recent condition assessments. However, SSEH provided insufficient evidence for its assumed average life of 24 years therefore was unable to bridge the gap completely.

A1.145 We scaled back our modelled view's reductions to SSEH's EHV switchgear volumes following a cross check with the asset health and criticality secondary deliverables.

A1.146 SSEH has relatively low asset replacement unit costs however our modelled view was significantly lower than its forecast for LV conductor, HV poles, submarine cables and switchgear.

Refurbishment

A1.147 Our modelled costs are largely in line with SSEH's forecast costs for reinforcement. It benchmarks well on LV and HV pole refurbishment costs, however our modelled costs are lower due to its high HV switchgear volumes.

Civil works

A1.148 SSEH is the frontier DNO on civil works with our modelled costs £7m or 51.6 per cent higher than its forecasts. For SSEH the efficiency is explained by both volume and unit costs. Positive volume adjustments to our modelled view were made for civil works at EHV substations and positive unit cost adjustment for civil works at HV indoor substations.

Non-core non-load-related network investment

A1.149 SSEH is among the least efficient DNOs for non-core costs. Our modelled costs are £8m or 16.8 per cent lower than SSEH's forecast costs. This is largely driven by its comparatively high unit costs for losses and other environmental costs. This is largely explained by its high unit costs in oil pollution mitigation schemes.

Network operating costs (NOCs)

A1.150 For NOCs, our modelled view is only slightly lower than SSEH's forecast costs (£3m or 1.1 per cent). Relatively inefficient costs in NOCs and troublecall are largely offset by efficient costs in tree cutting and inspections and maintenance.

Closely associated indirects

12.66. SSEH ranks 9th of the ten slow-track DNOs on CAI costs. Our modelled view is £19m or 7.7 per cent lower than its submitted forecasts. Our modelled view's lower costs for vehicles and transport and wayleaves are only offset to a degree by the stronger performance in the CAI regressed areas and operational training.

Business support and non-op capex

A1.151 Our modelled costs are higher than SSEH's forecast costs for BSCs (£21m or 14.6 per cent). SSEH ranks 4th for BSCs.

A1.152 SSEH ranks 3rd of the ten slow-track DNOs for non-op capex costs. Our modelled view is 0.3 per cent lower than SSEH's forecast costs, due to high vehicles and transport and STEPM costs. This is offset to some degree by its relative performance in IT&T costs.

SSES

Reinforcement

A1.153 SSES performs poorly on reinforcement with our modelled costs 14.0 per cent lower than its submitted forecasts.

A1.154 Our modelled view shows a reduction to SSES's capacity added relative to maximum demand growth for N-1 primary network reinforcement and other work captured in the load index secondary deliverables. Our modelled view of its associated unit costs is also lower. We have closed 30 per cent of the gap based on a review of its scheme papers.

A1.155 Our modelled view shows an increase to SSES's forecast volumes of LCT related network interventions and associated unit costs. This is based on benchmarking its forecast of network interventions per MW of LCTs connected and associated unit costs to the industry median. We are applying no other adjustments to its volumes.

A1.156 Our modelled view of SSES's unit costs for other primary network reinforcement and secondary reinforcement (non-LCTs) is lower than its forecast. We are applying a positive adjustment for fault level reinforcement.

A1.157 We are making no adjustments to its TCP charges.

Asset replacement

A1.158 SSES ranks 5th on asset replacement. Our modelled view of costs is £14m or 2.9 per cent lower than its forecast costs.

A1.159 SSES benchmarks well on asset replacement volumes for most asset categories.

A1.160 Our modelled view of SSES's HV cable volumes is significantly lower than its forecast, however this gap was reduced as plans to underground large amounts of overhead line were found to be justified by our consultants.

A1.161 We scaled back our modelled reductions to SSES's EHV switchgear and 132kV switchgear volumes following a cross check with the asset health and criticality secondary deliverables.

A1.162 SSES has low asset replacement unit costs, however our modelled view of its LV conductor, cables, EHV cables and 132kV conductor asset categories was significantly lower than its forecasts.

Refurbishment

A1.163 SSES ranks 5th on asset replacement. Our modelled view is £9m or 9.4 per cent lower than its forecast costs. It benchmarks well on tower foundation refurbishment costs, but other tower refurbishment costs are very high. Our modelled view was significantly lower for 33kV transformer refurbishment volumes, however that is offset due to its low cost in this asset category.

Civil works

A1.164 SSES is among the frontier DNOs on civil works with our modelled costs £10m or 25.1 per cent higher than its forecasts. Our modelled view is notably higher for civil works at HV indoor substations.

Non-core non-load-related network investment

A1.165 SSES is among the frontier DNO for non-core costs. Our modelled costs are largely in line with SSES's forecast costs. Our modelled view's lower environmental and legal and safety costs are largely offset by higher modelled costs for operational IT&T and diversions.

A1.166 Like SSEH, the lower modelled costs in losses and environmental is largely explained by high unit costs for oil pollution mitigation schemes.

Network operating costs (NOCs)

A1.167 Our modelled view is £12m or 2.5 per cent lower than the NOCs forecast costs for SSES, largely due to comparatively high tree cutting and inspections and maintenance costs. This is offset to a degree by the efficiencies in troublecall.

Closely associated indirects

A1.168 SSES ranks in the middle of the pack on CAI costs. Our modelled view is £11m or 2.2 per cent higher than its submitted forecasts. Our lower modelled view of costs for vehicles and transport are fully offset by the strong performance in the CAI regressed areas and operational training.

Business support and non-op capex

A1.169 SSES is among the frontier DNOs on BSCs. Our modelled costs are higher than SSES's forecast costs for BSCs (£35m or 15 per cent). SSES ranks 3rd for BSCs.

A1.170 SSES ranks 8th for non-op capex costs, with our modelled view £7m or 8.1 per cent lower than its forecast costs. Our modelled costs are lower for property, vehicles and transport and STEPM. This is offset a little by the relative performance in IT&T costs.

Appendix 2 - Approach to econometric benchmarking

Summary of econometric approach for the fast-tracking analysis

A2.1 The approach we adopted for estimating efficient costs for the fast-track assessment followed a number of steps.

Normalisations and other adjustments

Given the nature of the data we had available, we used regression models in conjunction with both pre and post-regression adjustments. We applied adjustments to the companies' actual and forecast expenditure to take account of differences in regional labour costs, company specific factors and costs that we excluded for separate analysis as we considered that they were inappropriate for regression analysis.

Estimation of cost models

A2.2 The main estimation technique that we adopted for our fast-track assessment was Pooled Ordinary Least Squares (pooled OLS) (with cluster robust standard errors) using a log-log (Cobb Douglas) cost function. This was adopted for both our totex regressions using high level and disaggregated activity level drivers and for our nine disaggregated regressions covering tree cutting expenditure, some elements of troublecall, occurrences not incentivised (ONIs) and the majority of closely associated indirect (CAI) costs.

A2.3 Ordinary least squares (OLS) estimates the line of best fit (the cost function) through the data points. We pooled the historical data for 2010-11 to 2012-13 for the 14 DNOs into a single data set for the regressions and estimated a single set of slope parameters for all years using this data.

A2.4 We then used these parameters to forecast modelled costs for RIIO-ED1 using our view of forecast cost drivers. We tested a number of sensitivities to our analysis. We estimated the parameters in the cost functions using 13 years of data rather than data for just the historical years. This failed a number of the statistical tests. We also considered the impact of using Random Effects rather than our pooled OLS methodology. This produced very similar results to pooled OLS.

A2.5 We applied our view of RPEs to estimate modelled costs including RPEs.

Calculation of efficiency scores and the UQ

A2.6 We calculated the efficiency scores for each DNO as the ratio of total forecast costs for RIIO-ED1 relative to total modelled costs. We calculated the UQ level of efficiency (low quartile efficiency score) across the 14 DNOs.

Reversal of adjustments

A2.7 We reversed the regional factors and added back our view of efficient company specific factors and costs excluded from the regressions.

Modelled costs

A2.8 The final step was to apply the UQ to our estimated costs (post reversal of adjustments) to determine efficient costs. This is effectively equivalent to shifting the regression line so that it passes through the UQ level of efficiency (lower quartile in the distribution of efficiency scores).

Key DNO comments on our econometric analysis

A2.9 The DNOs have raised a range of concerns with our econometric analysis. Several DNOs suggested that we had not adequately justified the weighting that we applied to different elements of our cost assessment and that we should have published further information on sensitivities with different weightings and alternative cost drivers. They suggested that additional weight should be applied to the totex regression benchmarking as this was a more appropriate approach and addressed trade-offs between different activities.

A2.10 Several DNOs noted poor statistical fit of a range of our regressions with low R-squared and in some cases counter-intuitive drivers. There were particular concerns relating to the use of weighted MEAV in the fast-track assessment, which they considered did not have a clear economic rationale.

A2.11 Two DNOs suggested that there should be a much better documented model selection process that highlights why we consider drivers to be appropriate from an economic or engineering perspective and then how we have narrowed them down from the short-list of drivers to the final model.

A2.12 Several DNOs suggested that we haven't adequately justified our choice of estimation techniques. They suggested that we should run alternative approaches such as Random Effects (RE) regressions, Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis. They have suggested the statistical tests indicate that RE and SFA estimators are preferred over pooled OLS.

A2.13 As part of our fast-track assessment we applied scaling to our modelled costs for RIIO-ED1 to ensure that the overall modelled costs were no greater than the aggregate industry forecast. This was due to the modelled costs based on the estimated parameters from the historical regressions significantly exceeding the RIIO-ED1 forecasts. A number of the DNOs have highlighted that they consider such adjustments are inappropriate. They suggest that these are arbitrary adjustments that highlight inadequacies in our approach.

A2.14 A number of the DNOs have suggested alternative cost drivers, time periods and levels of aggregation for the regression benchmarking.

A2.15 SPEN has suggested the weighting of the components of the CSV for the totex regression using high level drivers is inappropriate as we are constraining the coefficients in the regressions before they are run. These weightings should be based on econometric analysis.

A2.16 SPEN has noted that we have used a single explanatory variable in most of our regressions and should give greater consideration to multivariate regressions as part of the slow-track assessment.

A2.17 SSEPD has indicated that it consider that TCP charges should be excluded from the totex regressions as the costs were pass-through items in DPCR5 and the level of the costs has changed significantly between price controls.

Revised slow-track assessment

Model Selection Process

A2.18 We have developed a revised model selection process in response to concerns raised by the DNOs regarding the justification for our models. This involved the following steps:

- **developing a short list of appropriate cost drivers:** for both totex and our activity-based analysis we have identified a set of appropriate cost drivers that are relevant to the costs being considered from either an economic or an engineering perspective. We have also considered whether the drivers are within or outside of the DNOs' control. Further we investigated various combinations of these possible drivers throughout the process[41]:
    - For our top down totex model we considered that that possible drivers included: customer numbers; units distributed; network length; MEAV; peak; and density.
    - For the bottom up totex model specification we were satisfied that this model was fit for purpose as identified at fast-track with drivers being chosen that were related to the cost areas (eg units distributed for reinforcement).
    - For the disaggregated regressions we wanted to keep the drivers as closely aligned to the activity volumes for each area – tree cutting based on spans cut and inspected, LV and HV fault costs driven by associated faults, CAI was subject to more investigation and Appendix 8 outlines our approach for CAIs in detail.

- **selection of regression models for totex and each activity**: given the number of data points and issues with multi-collinearity, it is not practical to follow a general to specific approach, starting with a model including all of the cost drivers and then eliminating variables until we have the final regression model for each activity area. We have therefore tested regressions with a single driver and multivariate regressions with sensible permutations using up to three of the listed cost drivers. We have assessed the appropriateness of the models using the following factors:

    - whether the driver(s) are sensible and relate appropriately to the costs being assessed
    - whether the coefficients of the variables have plausible signs and magnitudes,

[41] The supplementary question and audit processes that we used in slow-track affected our choice of final model specifications through the data changes and corrections identified.

    - whether the regression meets our statistical tests including the pooling test, Ramsey Reset test and tests for normality and heteroskedasticity. The key statistical tests are the Ramsey Reset and Pooling tests. Our regression approach uses cluster robust standard errors which are robust to heteroskedasticity. As such we have included some regressions in our final modelling which fail on normality and heteroskedasticity but are otherwise robust
    - whether the fit of the regression as a whole based on the R-Squared is reasonable.

  The final models for totex and our activity-based analysis have been selected on the basis that they best meet these criteria. Where no regressions have met these criteria or where the results from the modelling were not plausible. we have adopted alternative approaches such as ratio benchmarking or qualitative analysis.

- **sensitivities**: we have run sensitivities using a random effects estimator as an alternative to OLS. We have also estimated a totex model using alternative cost drivers. These are described in Appendix 5. We ran a range of alternative models with different cost drivers and periods for the estimation of parameters for CAI and totex in particular. These are described in Appendix 8 and Appendix 9.

Weighting of totex and activity level assessment

A2.19 We have given further consideration to the relative weighting of the totex analysis and disaggregated assessment taking account of the DNOs' responses. The different modelling approaches all provide useful information in assessing the appropriateness of DNOs' forecasts for RIIO-ED1 and setting efficient expenditure baselines. For example, totex models take into account trade-offs between activities, differences in business models and reporting. They identify those DNOs that have minimised total costs. By contrast activity level analysis enables us to use a richer model specification, ie in total we can take account of a greater number of factors that influence costs across the different elements of our cost modelling. At slow-track the DNOs have made significant improvements to the quality of their business plan data and we have scrutinised this data in detail. We therefore have more confidence in the data underlying the totex regressions and consider it is appropriate to place greater weight on the totex regressions. We have concluded that it is appropriate to give a 25 per cent weighting to each of our totex models as both specifications of totex provide useful information in terms of the efficiency of the DNOs and a 50 per cent weighting to our disaggregated assessment in our slow-track assessment. Our totex regressions models have better statistical than the disaggregated regression models in our slow-track assessment.

Choice of data for the model estimation

A2.20 We have considered alternative time periods for estimating the parameters in our regression models. This includes running regression for the historical years of DPCR5 (2010-11 to 2013-14), forecast data for RIIO-ED1 (2015-16 to 2022-23) and the full thirteen year period (2010-11 to 2022-23). The estimation of the parameters in the two totex models are based on the full 13-year period, the estimation of the parameters in the troublecall models are based on four years' historical data and the estimation of the parameters in the tree cutting and CAI regression models are based on the eight-year RIIO-ED1 forecasts. Our choice of time period has been based on the quality of the underlying data and the appropriateness of the models based on the criteria discussed in paragraph A1.19. For example, for CAI we estimated regressions on the full 13 year period, but they performed poorly against our statistical tests. We consider that making greater use of forecast data where possible better takes into account the scope for efficiency savings in RIIO-ED1.

Setting the efficiency benchmark

A2.21 We have continued to determine efficiency at the UQ level of efficiency across DNOs at a totex level as this takes into account interactions between our activity level analysis. This ensures that we avoid setting an artificially efficient benchmark that no company can achieve. We applied the UQ after the modelled costs for each of the three benchmarking models have been combined using a 25 per cent weighting for the two totex models and a 50 per cent weighting for our disaggregated model. This avoids the risk of applying UQ separately and setting an unrealistic cost benchmark.

A2.22 As discussed in Chapter 3 we apply our assumptions for RPEs and smart grids savings to the UQ cost benchmarks.

A2.23 Under the IQI our final cost allowances are then based 75 per cent on the Ofgem benchmark and 25 per cent on the DNO forecast. As such we are assuming that the DNOs would close 75 per cent of the assessed gap between their forecasts and our efficiency benchmark. Our proposed approach to closing the gap and the use of the UQ rather than the frontier acknowledges that a part of the difference in costs across the DNOs relates to factors other than DNOs' relative efficiency (egg statistical errors).

Choice of estimator

A2.24 We have carried out sensitivity analysis using both pooled OLS and Random Effects estimators for our totex models and our results show that there is very little difference in the parameter estimates, modelled costs and efficiency scores between the two estimators. Further details are set out in Appendix 5.

A2.25 A relatively small sample size was being used in our analysis for RIIO-ED1 (both in terms of the number of DNOs and number of years) and inspection of the data reveals relatively limited time series variation. Therefore we have used pooled OLS with cluster robust standard errors as the main estimation technique in our cost modelling. We do not consider the use of RE provides much benefit given the additional complexity involved, and the very similar results we estimated. Kennedy (1998)[42] argues that in panel data with a small number of companies the RE estimator should typically not be used. A large number of companies are required to estimate a time invariant DNO effect such as inefficiency.

A2.26 There is insufficient data to support the use of SFA. We tested a broad range of these models as part of our fast-track assessment which failed our diagnostic tests. In addition SFA requires the use of specific distribution assumptions regarding the error term. We do not consider that this is more appropriate than making well justified regulatory adjustments.

A2.27 Given the nature of the data, our approach to benchmarking relies on both econometric modelling and well justified pre-and post-estimation adjustments as

[42] Peter Kennedy, A Guide to Econometrics, 1998

discussed in Chapter 4. We treat the error terms or residuals from the econometric models as inefficiency based on using our regulatory knowledge and judgement to capture other factors that influence costs. We make appropriate adjustments to normalise company data prior to the benchmarking, reverse our normalisations after the regression and benchmark at the UQ.

Appendix 3 – Statistical tests and regression results

Statistical tests

A3.1 We have used a number of statistical tests in consultation with our academic advisor for the panel data models. These tests provide an indication of the robustness of the modelling results and also indicate where some of the parameter estimates from the regressions might be biased and require an adjustment to the model specification.

A3.2 We use results from statistical diagnostic tests to inform our judgement in identifying the best models. The tests are:

- Ramsey RESET test for model misspecification
- White test for heteroskedasticity
- Skewness and Kurtosis test for normality and
- F-test for parameter stability.

A3.3 We investigated the outcome of the statistical tests and made appropriate adjustments to the specified model. For example we re-specified models when the RESET test failed, we reviewed the functional form of the model and tested different drivers.

A3.4 Some of these tests are more critical than others, particularly the Ramsey RESET test because it is directly relevant in assessing the validity of a given model specification.

The Ramsey RESET test

A3.5 The Ramsey Regression Specification Error Test (RESET) is a general test for model misspecification. For example, the test might identify incorrect functional form - some or all of the variables (ie the costs and the driver) may need to be transformed to logs, powers, reciprocals, or in some other way.

White test for heteroskedasticity

A3.6 When an OLS regression is run it produces estimates of the standard errors for each of the coefficients in the model. These standard errors are a measure of the uncertainty surrounding the parameter estimates and can be used to perform hypothesis tests on the coefficients from the model.

A3.7 Heteroskedasticity can cause the standard errors (and therefore any hypothesis testing) to be biased. It typically occurs when the variation in the residuals is very different over time. For example, if the residuals were very large in magnitude in some periods compared to others then this would be an indication of heteroskedasticity.

A3.8 Heteroskedasticity may also be driven by the error variance differing as a result of the model not fully capturing scale differences for the cross-section of comparators. We test for heteroskedasticity since any violation might be an indicator of a more general model misspecification.

A3.9 The White test examines whether the variance in the model's residuals is constant (homoscedasticity). If there is evidence of variation in the residual variance (heteroskedasticity) it implies that the standard errors of the coefficients (and therefore any hypothesis testing) may be biased. We address issues of heteroskedasticity through cluster robust standard errors discussed below.

Panel robust standard errors

A3.10 We have estimated our models using clustered robust standard errors to allow for the fact that the set of observations in the panel are not independent but clustered by DNO. These standard errors are also robust to heteroskedasticity.

Skewness and Kurtosis test for normality

A3.11 The Skewness and Kurtosis test (SKtest) is used to test whether the residuals are normally distributed. Normality of residuals is not a necessity, but it is an indication of a well behaved model. The SKtest returns a combined test statistic for normality based on skewness and another based on kurtosis.

F-test for parameter stability

A3.12 The F-test examines whether the slope coefficients are stable over time. If any differences are not found to be statistically significant, then the data can be pooled over the given years. If they are statistically different then there is no justification for pooling the data.

Data terms

Table A3.1: Explanation of terms

Data term	Explanation of the term
ln_totex_excl	The natural log of total expenditure excluding certain costs.
ln_bu_csv	The natural log of the disaggregated activity level analysis drivers (comprised of units distributed, total network length, LV and HV overhead line length, MEAV*, customer numbers, spans cut, total faults, and total ONIs).
MACRO_CSV	The high level drivers (log of customer numbers, and log of MEAV*)
ln_tree_cutting	The natural log of tree cutting expenditure.
ln_spans_cut	The natural log of spans cut.
ln_spans_inspected	The natural log of spans inspected.
ln_tc_lv_hv_ohl	The natural log of LV and HV overhead line expenditure.
ln_faults_lv_hv_ohl_ex_sw	The natural log of LV and HV overhead line faults excluding switching related faults.
ln_CAI2	The natural log of closely associated indirect expenditure for the following cost areas: network design; project management; system mapping; engineering management and clerical support; stores; network policy; control centre; and call centre.
ln_TotMEAV_excRLM_OtherWLA	The natural log of MEAV*.

ln_V1_additions	The natural log of new assets installed.
year	A time trend variable.

*MEAV excludes the following assets in its calculation: rising and lateral mains (RLM), LV service associated with RLM, batteries at ground mounted HV substations, batteries at 33kV substations, batteries at 66kV substations, batteries at 132kV substations, pilot wire overhead, pilot wire underground, cable tunnels (DNO owned), cable bridges (DNO owned), and electrical energy storage.

Data characteristics

A3.13 The following tables show the characteristics of the panel data that was used for each of the five regressions.

Table A3.2: Regression 1 – Totex bottom-up driver

var	category	mean	sd	min	max	obs
ln_totex_excl	overall	5.353367	.2802903	4.782834	6.043639	182
ln_totex_excl	between	.	.2782579	4.827106	5.843223	14
ln_totex_excl	within	.	.0791739	5.155443	5.57593	13
ln_totex_excl	B/W Variation	.	3.514516	.	.	.
ln_bu_csv	overall	5.374032	.3079785	4.808183	5.943733	182
ln_bu_csv	between	.	.3184651	4.829023	5.918381	14
ln_bu_csv	within	.	.0124389	5.330336	5.401679	13
ln_bu_csv	B/W Variation	.	25.6024	.	.	.
year	overall	2017	3.751979	2011	2023	182
year	between	.	0	2017	2017	14
year	within	.	3.751979	2011	2023	13
year	B/W Variation	.	0	.	.	.

Table A3.3: Regression 2 – Totex Macro driver

var	category	mean	sd	min	max	obs
ln_totex_excl	overall	5.353367	.2802903	4.782834	6.043639	182
ln_totex_excl	between	.	.2782579	4.827106	5.843223	14
ln_totex_excl	within	.	.0791739	5.155443	5.57593	13
ln_totex_excl	B/W Variation	.	3.514516	.	.	.
MACRO_CSV	overall	15.79228	.320723	15.16559	16.37074	182
MACRO_CSV	between	.	.331282	15.21109	16.33046	14
MACRO_CSV	within	.	.0197882	15.74679	15.83436	13
MACRO_CSV	B/W Variation	.	16.74143	.	.	.
year	overall	2017	3.751979	2011	2023	182
year	between	.	0	2017	2017	14
year	within	.	3.751979	2011	2023	13
year	B/W Variation	.	0	.	.	.

Table A3.4: Regression 3 – Tree cutting

var	category	mean	sd	min	max	obs
ln_tree_cutting	overall	1.82317	.4549234	1.169263	2.804558	104
ln_tree_cutting	between	.	.4693444	1.194398	2.681385	13
ln_tree_cutting	within	.	.04052	1.709005	1.98662	8
ln_tree_cutting	B/W Variation	.	11.58302	.	.	.
ln_spans_cut	overall	10.0694	.4619677	9.054622	10.90719	104
ln_spans_cut	between	.	.4776067	9.170373	10.90719	13
ln_spans_cut	within	.	.0284339	9.953648	10.16622	8
ln_spans_cut	B/W Variation	.	16.7971	.	.	.
ln_spans_inspected	overall	11.17803	.3474645	10.59552	11.94592	104
ln_spans_inspected	between	.	.3560996	10.6076	11.94592	13
ln_spans_inspected	within	.	.0504238	10.96572	11.34054	8
ln_spans_inspected	B/W Variation	.	7.062127	.	.	.

Table A3.5: Regression 4 – Trouble call LV & HV overhead faults

var	category	mean	sd	min	max	obs
ln_tc_lv_hv_ohl	overall	1.149514	.4013864	.5923213	2.178881	52
ln_tc_lv_hv_ohl	between	.	.3073842	.6982485	1.659514	13
ln_tc_lv_hv_ohl	within	.	.2686707	.5052005	1.751889	4
ln_tc_lv_hv_ohl	B/W Variation	.	1.144093	.	.	.
ln_faults_lv_hv_ohl_ex_sw	overall	7.743276	.3577645	6.912743	8.445912	52
ln_faults_lv_hv_ohl_ex_sw	between	.	.3459377	6.995191	8.317065	13
ln_faults_lv_hv_ohl_ex_sw	within	.	.1239441	7.499227	8.110024	4
ln_faults_lv_hv_ohl_ex_sw	B/W Variation	.	2.791079	.	.	.

Table A3.6: Regression 5 – CAI

var	category	mean	sd	min	max	obs
ln_CAI2	overall	3.553878	.2688479	3.032809	4.176156	112
ln_CAI2	between	.	.2751105	3.081758	4.098825	14
ln_CAI2	within	.	.0369644	3.464242	3.69028	8
ln_CAI2	B/W Variation	.	7.442585	.	.	.
ln_TotMEAV_excRLM_OtherWLA	overall	15.99778	.3122864	15.43638	16.55563	112
ln_TotMEAV_excRLM_OtherWLA	between	.	.322356	15.45637	16.53091	14
ln_TotMEAV_excRLM_OtherWLA	within	.	.0127475	15.97252	16.02295	8
ln_TotMEAV_excRLM_OtherWLA	B/W Variation	.	25.28786	.	.	.
ln_V1_additions	overall	4.646542	.2916109	4.18834	5.372311	112
ln_V1_additions	between	.	.286391	4.262525	5.191335	14
ln_V1_additions	within	.	.090496	4.479783	4.973134	8
ln_V1_additions	B/W Variation	.	3.16468	.	.	.

Regression results

Table A3.7: Regression equations

Cost Area	Regression Number	Regression Equation
Totex	1	ln(totex_excl) = a + b1*ln(bu_csv) + b2*year
	2	ln(totex_excl) = a + b1*MACRO_CSV + b2*year
Tree Cutting	3	ln(tree_cutting) = a + b1*ln(spans_cut) + b2*ln(spans_inspected)
Trouble Call	4	ln(tc_lv_hv_ohl) = a + b1*ln(faults_lv_hv_ohl_ex_sw)
Closely Associated Indirects	5	ln(CAI2) = a + b1*ln(TotMEAV_excRLM_OtherWLA) + b2*ln(V1_additions)

Regression 1 – Totex bottom up CSV

```
Linear regression                                      Number of obs =      182
                                                       F(  2,     13) =   155.00
                                                       Prob > F       =   0.0000
                                                       R-squared      =   0.8898
                                                       Root MSE       =   .09356

                                    (Std. Err. adjusted for 14 clusters in dno)
------------------------------------------------------------------------------
             |               Robust
ln_totex_e~l |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   ln_bu_csv |   .8474958   .0515473    16.44   0.000     .7361345     .958857
        year |   -.013706   .0019281    -7.11   0.000    -.0178714   -.0095406
       _cons |   28.44389   3.888449     7.31   0.000     20.04341    36.84438
------------------------------------------------------------------------------
```

Statistical Test	p-value
Normality	0.11
Reset	0.47
White	0.01
Pooling	0.96
Observations	182
Adjusted R-squared	0.89

Regression 2 – Totex Macro CSV

```
Linear regression                                      Number of obs =       182
                                                       F(  2,     13) =   129.76
                                                       Prob > F      =   0.0000
                                                       R-squared     =   0.8803
                                                       Root MSE      =   .09753

                                        (Std. Err. adjusted for 14 clusters in dno)
------------------------------------------------------------------------------
             |               Robust
ln_totex_e~l |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   MACRO_CSV |   .8103245   .0522214    15.52   0.000      .697507    .9231419
        year |    -.01557   .0019087    -8.16   0.000    -.0196934   -.0114466
       _cons |   23.96117   3.725001     6.43   0.000     15.91379    32.00854
------------------------------------------------------------------------------
```

Statistical Test	p-value
Normality	0.08
Reset	0.51
White	0.02
Pooling	0.94
Observations	182
Adjusted R-squared	0.88

Regression 3 – Tree cutting

```
Linear regression                                      Number of obs =       104
                                                       F(  2,     12) =    44.18
                                                       Prob > F      =   0.0000
                                                       R-squared     =   0.8549
                                                       Root MSE      =   .17502

                                        (Std. Err. adjusted for 13 clusters in dno)
------------------------------------------------------------------------------------
                   |               Robust
   ln_tree_cutting |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
      ln_spans_cut |   .6773354   .1685048     4.02   0.002      .310195    1.044476
ln_spans_inspected |   .4570703   .1964148     2.33   0.038     .0291192    .8850214
             _cons |  -10.10634   1.407021    -7.18   0.000    -13.17197   -7.040701
------------------------------------------------------------------------------------
```

Statistical Test	p-value
Normality	0.01
Reset	0.15
White	0.00
Pooling	1.00
Observations	104
Adjusted R-squared	0.85

Regression 4 – Trouble Call

```
Linear regression                                     Number of obs =       52
                                                      F(  1,    12) =    51.58
                                                      Prob > F      =   0.0000
                                                      R-squared     =   0.4069
                                                      Root MSE      =    .3122

                                 (Std. Err. adjusted for 13 clusters in dno)
```

ln_tc_lv_hv_ohl	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_faults_lv_hv_ohl_ex_sw	.7156451	.0996413	7.18	0.000	.4985453	.932745
_cons	-4.391923	.7826319	-5.61	0.000	-6.097132	-2.686715

Statistical Test	p-value
Normality	0.09
Reset	0.39
White	0.33
Pooling	0.59
Observations	52
Adjusted R-squared	0.40

Regression 5 - CAI

```
Linear regression                                     Number of obs =      112
                                                      F(  2,    13) =    91.27
                                                      Prob > F      =   0.0000
                                                      R-squared     =   0.8702
                                                      Root MSE      =   .09776

                                 (Std. Err. adjusted for 14 clusters in dno)
```

ln_CAI2	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_TotMEAV_excRLM_OtherWLA	.5525597	.1113345	4.96	0.000	.3120363	.7930832
ln_V1_additions	.3068501	.1307044	2.35	0.035	.0244804	.5892197
_cons	-6.711645	1.292324	-5.19	0.000	-9.503541	-3.919749

Statistical Test	p-value
Normality	0.00
Reset	0.58
White	0.06
Pooling	0.14
Observations	112
Adjusted R-squared	0.87

Appendix 4 – Calculation of composite scale variable (CSV)

A4.1 In our top down totex analysis we are using a CSV as the cost driver based on customer numbers and MEAV excluding Rising Mains and Laterals, protection, cable tunnels and cable bridges. We recognise there were concerns with our fast-track approach which used an equal weighting for each of the elements of the CSV. We have therefore adopted an alternative approach for slow-tracking which bases the weightings in the CSV on the results of regression analysis. This is similar to the approach we adopted as part of DPCR5.

A4.2 There are a number of steps in this approach:

- The first step is to standardise each of the components of the CSV, log MEAV and log customer numbers by subtracting the average of these variables from each observation and dividing by the standard deviation. This standardisation avoids a driver with a large average having an undue effect on the calculation of the weights.
- The next step is to run a multivariate regression including each of the standardised log variables: $\log(\text{totex}) = \text{Intercept} + b_1 \text{Std.} \log(\text{MEAV}) + b_2 \text{ Std.} \log(\text{customer numbers}) + \varepsilon$
- The weight on MEAV is then $x=b_1/(b_1+b_2)$ and the weight on customers numbers is $y=b_2/(b_1+b_2)$.
- The CSV is then calculated using the original unstandardised variables as $\text{CSV} = \text{MEAV}^x \text{x customer numbers}^y$ or $\log \text{CSV} = \text{xlogMEAV} + \text{ylog customer numbers}$.

A4.3 This approach results in a CSV with an 87 per cent weighting on MEAV and a 13 per cent weighting on log customer numbers which we have used in the top down totex regression.

Appendix 5 – Sensitivity using Random Effects estimation

A5.1 In reaching our draft decision we considered the use of an alternative estimation technique, Random Effects (RE). This had been proposed for cost benchmarking in RIIO-ED1 by Frontier Economics based on the initial work for Ofgem and the DNOs.

A5.2 RE is an estimation model that exploits the structure of the data. RE does this by recognising that some variation in the data relates to variation over time from the mean for a given DNO ("within" variation) and that is different from variations between DNOs ("between" variation).

A5.3 For slow-track we investigated the use of RE instead of the pooled OLS (with cluster robust standard errors) approach. We reviewed the modelled costs, the efficiency scores, and the parameter estimates from both estimation techniques.

A5.4 Holding all other aspects constant (eg same normalisations, same period, same cost drivers), but only changing the estimation technique, the modelled costs, efficiency scores, and parameter estimates were very similar for each of the models, and are presented in Table A3.1 below. We are satisfied that the impact of switching estimation techniques would not provide a fundamentally different outcome from our econometric modelling. This is what we had expected in advance of this investigation given our use of cluster robust standard errors as part of our pooled OLS method.

A5.5 As part of our slow-track assessment we also investigated the use of the specification suggested by Frontier Economics in their work, with some change of drivers due to data availability (output performance data beyond 2014 is not available) and pre-existing normalisations (labour costs). Their suggested model used RE estimation.

A5.6 The cost drivers used were customers, density, peak, and in one approach a time trend. The suggested model did not include a time trend, but we have identified a clear trend in the data and feel that its use is appropriate. The first model had all of these drivers included in it, while the second one dropped the time trend. The inclusion of this time trend causes the model to produce a negative and insignificant parameter estimate for peak, which is counterintuitive, and this model also failed the RESET test. Further testing of this model found a high degree of collinearity between peak and customers, which may be influencing the unexpected estimate to the peak coefficient. Therefore we do not have confidence in this driver's estimated parameter. Given the high degree of correlation between peak and customers it is likely that they are picking up similar scale effects, which led to us dropping peak. Dropping peak led to density becoming statistically insignificant and the model failed the RESET test as well.

A5.7 Taking the results of this sensitivity testing on board, we feel that this model is too sensitive to consider using. To overcome sensitivity created by multicollinearity and to capture scale in a more comprehensive way we constructed a CSV which was also tested to include density. This had a less material effect on DNOs than we would have expected. Furthermore, because density related issues were part of the regional cases put forward by both SSEH and LPN and included in our pre-estimation normalisations, there was the potential for double counting under models that included density.

Table A5.1

Technique	Pooled OLS		Random Effects	
Model **ln_totex_excl =**	a + b*ln_bu_csv + b*year	a + b*MACRO_CSV + b*year	a + b*ln_bu_csv + b*year	a + b*MACRO_CSV + b*year
Time period	2011 - 2023			
	Bottom up	**Top Down**	**Bottom up**	**Top Down**
ENWL	1,859	1,907	1,861	1,910
NPGN	1,344	1,364	1,341	1,362
NPGY	1,823	1,810	1,825	1,811
WMID	1,884	1,895	1,887	1,898
EMID	2,072	2,119	2,077	2,124
SWales	1,062	1,063	1,057	1,059
SWest	1,444	1,391	1,442	1,389
LPN	1,526	1,572	1,525	1,572
SPN	1,687	1,726	1,687	1,727
EPN	2,623	2,561	2,636	2,571
SPD	1,572	1,582	1,571	1,581
SPMW	1,504	1,477	1,503	1,476
SSEH	1,040	1,035	1,035	1,031
SSES	2,454	2,380	2,465	2,388
GB Total	**23,894**	**23,884**	**23,912**	**23,898**

Stata output efficiencies

ENWL	0.95	0.92	0.95	0.92
NPGN	0.97	0.96	0.97	0.96
NPGY	0.95	0.96	0.95	0.96
WMID	1.03	1.03	1.03	1.03
EMID	0.94	0.92	0.94	0.92
SWales	0.93	0.93	0.93	0.93
SWest	1.10	1.15	1.10	1.15
LPN	1.07	1.04	1.07	1.04
SPN	1.02	1.00	1.02	1.00
EPN	1.02	1.04	1.02	1.04
SPD	0.90	0.89	0.90	0.89
SPMW	1.14	1.16	1.14	1.16
SSEH	1.03	1.04	1.03	1.04
SSES	0.93	0.96	0.93	0.96

Coefficient on:

Driver one	0.85	0.81	0.86	0.82
Driver two	-0.01	-0.02	-0.01	-0.02
_cons	28.44	23.96	28.44	23.92

Appendix 6 – Replacement of outdoor with indoor circuit breakers

Overview

A6.1 Within asset replacement there are many instances where DNOs may dispose of an asset and then replace it with a similar but not identical asset. An example of this is LV underground cable replacement where old LV main Consac cables and LV main paper cables are being disposed of and replaced with LV main plastic cables. In fast-track we grouped assets where we believe these substitutions take place and applied a blended unit cost to account for this aggregation. In slow-track we assessed volumes at each asset category taking account of substitutions and therefore dispensed the need for a blended unit cost.

Substitution of 132kV air insulated busbar circuit breakers for 132kV gas insulated busbar circuit breakers

A6.2 In our volume assessment we have paid particularly close attention to DNOs' 132kV circuit breaker replacement policies. Two types of 132kV circuit breakers (CBs) are assessed in our benchmarking: air insulated busbars (AIS) and gas insulated busbars (GIS). These can be housed both indoor and outdoor, although indoor AIS assets are rare due to their size.

A6.3 In RIIO-ED1 some DNOs are replacing their outdoor 132kV AIS CBs with indoor GIS assets. Indoor GIS are over three times more expensive than outdoor AIS CBs which are expensive assets in their own right. Ofgem's view of 132kV AIS CB replacement cost is £144.6k whereas to replace a 132kV GIS CB it is £639k.

A6.4 Other DNOs conducted like for like replacement. Because of the significant difference in unit cost between outdoor AIS and indoor GIS we felt it important that any asset substitution was clearly justified.

A6.5 The main argument for the substitution was that AIS CBs require a large area of land and in order for the asset to be replaced you must build the new asset alongside the old one before dismantling the old asset. GIS CBs occupy about a quarter of the space that AIS CBs would occupy and therefore in small properties replacing AIS with GIS may be the only option.

A6.6 In our assessment there were circumstances in which our modelling and the DNO's justification identified the need to replace AIS CBs but did not justify clearly the reason why they were to substitute indoor GIS CBs. In these circumstances we have provided the DNO with the volume for AIS CBs and therefore given the DNO the unit cost for the AIS asset.

Appendix 7 – IT&T qualitative assessment

A7.1 We employed technical consultants to undertake a qualitative assessment of the DNOs' IT&T expenditure as part of the slow-track assessment. This involved a review of all DNOs' IT&T strategies. It collectively reviewed the costs for operational IT&T, non–operational capex IT&T and business support IT&T (opex).

A7.2 It was based on a detailed evaluation of each DNO's IT&T strategy and the related RIIO-ED1 expenditure to justify IT&T replacement and development costs. The assessment looked at historical expenditure but this was not used to make adjustments. The assessment focused on answering four main questions:

- does the IT Strategy directly align with the objectives and outputs of the business case?
- has the IT Strategy been constructed using best practice techniques and can it therefore be expected to produce a robust plan that will successfully support the business case?
- does the IT Strategy demonstrate a best practice approach to implementation that is grounded in reality?
- how do the long-term costs of running IT services compare and are they efficient, reasonable and justified?

A7.3 The results of the qualitative assessment are shown in Table A7.1.

Table A7.1: Qualitative assessment results

	ENWL	NPg		WPD				UKPN			SPED		SSEPD	
DNO submitted cost (£m)	ENWL	NPgN	NPgY	WMID	EMID	SWALES	SWEST	LPN	SPN	EPN	SPD	SPMW	SSEH	SSES
Operational IT&T	65.6	23.3	41.6	24.4	25.6	23.9	24.4	49.0	36.7	46.8	20.6	33.0	18.5	23.0
Non Operational IT&T	21.3	33.9	31.2	37.9	37.9	19.0	31.6	37.3	41.4	60.7	25.2	25.2	18.7	22.4
Business Support IT&T	110.7	57.4	64.2	84.2	84.5	43.0	71.0	65.3	72.5	98.1	74.3	66.6	65.8	99.8
ED1 cost allowance (£m)														
Operational IT&T	43.4	23.3	41.6	24.4	25.6	23.9	24.4	36.0	30.3	43.6	20.6	33.0	18.5	23.0
Non Operational IT&T	21.3	33.8	31.2	45.9	45.9	19.0	28.4	32.5	37.6	56.7	25.3	25.3	18.7	22.4
Business Support IT&T	101.1	53.4	76.2	84.2	84.5	44.6	63.0	65.3	72.5	110.1	74.3	66.6	61.0	90.2
Difference (£m)														
Operational IT&T	-22	0	0	0	0	0	0	-13	-6	-3	0	0	0	0
Non Operational IT&T	0	0	0	8	8	0	-3	-5	-4	-4	0	0	0	0
Business Support IT&T	-10	-4	12	0	0	2	-8	0	0	12	0	0	-5	-10
Difference (%)														
Operational IT&T	-34%	0%	0%	0%	0%	0%	0%	-27%	-17%	-7%	0%	0%	0%	0%
Non Operational IT&T	0%	0%	0%	21%	21%	0%	-10%	-13%	-9%	-7%	0%	0%	0%	0%
Business Support IT&T	-9%	-7%	19%	0%	0%	4%	-11%	0%	0%	12%	0%	0%	-7%	-10%

NB: SSEPD submitted figures exclude regional adjustment costs for non-operational capex and business support

Operational IT&T

A7.4 For operational IT&T our consultants believed that the costs for all DNOs in the groups of NPg, WPD, SPED and SSEPD were justified. Conversely, they did not believe the forecast costs for ENWL and UKPN were fully justified and recommended we cut 34 per cent of the forecast costs of ENWL, 27 per cent for LPN, 17 per cent for SPN and seven per cent for EPN.

A7.5 Our consultants are aware that ENWL needs to make changes to its IT estate and this will come at a cost. However, they consider the cost too high and therefore recommend ENWL to identify where reductions can be made. They suggest reduction in: contract and energy management, costs to refresh the control room and costs for the BT21C refresh.

A7.6 For the UKPN licensees, our consultants note that the overall expenditure is among the highest. Although the business plan provides narrative on the cost, they are of the view that there is insufficient information to provide credible evidence for such high expenditure. In particular they note that the associated IT volumes of asset replacement are too high for EPN and LPN.

Non-operational IT&T

A7.7 For non-operational IT&T, our consultants believed that the costs for the DNOs under four company groups – ENWL, NPg, SPED and SSEPD – were fully justified.

A7.8 For UKPN, they recommended we reduce forecast costs of LPN, SPN and EPN by 13 per cent, nine per cent and seven per cent, respectively. For UKPN the consultants note in particular that its non-operational IT&T forecast costs are among the highest across all DNOs for all three of its licensees and there was not sufficient credible justification to challenge our quantitative analysis.

Business support IT&T

A7.9 For business support IT&T, the consultants thought that NPgY and EPN were frontier in terms of cost efficiency whilst they recommended reductions for others: ENWL (nine per cent), NPgN (seven per cent), SSEH (seven per cent) and SSES (ten per cent).

A7.10 Our consultants recognised that the cost of a single network can be higher than DNOs in a larger group but even after taking this into consideration our consultant was of the view that ENWL's forecast costs were not fully justified. They noted that the support cost for smart meter infrastructure from 2020-21 should be managed within the forecast costs. They noted that the costs associated with new IT&T to improve current inefficiencies are not fully explained in the submitted information.

A7.11 For NPgN our consultants reviewed our quantitative analysis and in line with our quantitative analysis, they suggest a reduction to the forecast costs. They are of the view that information submitted did not contain sufficient credible justification to challenge our quantitative analysis.

A7.12 For SSEH and SSES our consultants have suggested reductions of seven and ten per cent on submitted costs because the information submitted does not provide credible justification.

Appendix 8 – Detailed CAI regression approach

Introduction

A8.1 CAI collectively includes the activities of:

- network design and engineering
- project management
- system mapping – cartographical
- engineering management and clerical support (EMCS)
- stores
- network policy
- control centre
- contact centre
- vehicles and transport
- operational training including workforce renewal.

Data

A8.2 In Table A8.1 we show the differences between the average expenditure in DPCR5 and RIIO-ED1. The majority of DNOs are forecasting a decrease in expenditure in RIIO-ED1, with only SSEH and SSES forecasting an increase. SSEPD state that the cost increase in RIIO-ED1 is due to a number of factors but primarily the growth in customer numbers and tighter regulatory requirement for customer fault restoration.

Table A8.1: DPCR5 and RIIO-ED1 CAI annual average normalised adjusted costs

	DPCR5*	**RIIO-ED1**	**Difference**
ENWL	41.5	37.3	-10%
NPgN	26.9	26.0	-3%
NPgY	34.2	32.0	-6%
EMID	52.4	42.4	-19%
WMID	51.1	40.8	-20%
SWALES	22.2	21.8	-2%
SWEST	31.6	33.4	6%
LPN	42.4	40.0	-6%
SPN	42.2	40.3	-4%
EPN	65.0	60.3	-7%
SPMW	48.2	33.8	-30%
SPD	48.7	30.0	-39%
SSEH	19.2	23.1	20%
SSES	43.3	47.2	9%
Total	**569.0**	**508.5**	**-11%**

*Four years of actual data and one year of forecast data

A8.3 Overall in RIIO-ED1 the DNOs are forecasting to spend on average 11 per cent less than in DPCR5 on CAIs annually. The business plan commentaries cite reduced direct work and improved efficiency as the reasons for this.

A8.4 We modelled various time periods including historical data (2010-11 to 2013-14), forecast data (2015-16 to 2022-23) and a combination of both (2010-11 to 2022-23).

A8.5 Some DNOs argued that only historical performance should be taken into account in modelling CAI costs. We investigated different time periods for slow-track, and found the RIIO-ED1 period to be the most appropriate.

Cost drivers

A8.6 The first step in developing our revised approach to CAIs was to consider which drivers make economic or engineering sense. In Table A8.2 we set out the cost drivers we tested for CAI costs and the rationale behind their selection.

Table A8.2: Proposed cost drivers for CAI costs

Cost driver	Rationale
MEAV (excluding RLM, pilot wires, cable tunnel/bridges and batteries) – Core driver	MEAV reflects the scale and composition of the network, with unit costs working as 'weights' to show the required level of work for each asset.
Composite Scale Variable (CSV) Core driver	We constructed a CSV using MEAV, customer numbers and fault volumes, to encompass a wider range of the factors influencing costs than can be captured by a single driver. We regressed CAI on each of the components of the CSV in a multivariate regression. We then calculated the weights for each of the drivers based on the ratio of the driver's slope coefficients to the sum of all slope coefficients. We constructed various CSVs using different drivers but found issues of multicollinearity, where the MEAV was highly correlated with the number of drivers we tested eg peak demand and fault volumes.
Customer numbers Scale driver	Customer numbers reflect the scale of a network and impacts on a number of cost areas such as call centre.
Network length Scale driver	Network length reflects the scale of a network and impacts on a number of cost areas.
Density Scale driver	Density reflects how the number of customers in a DNO's distribution service area relative to the size of the area impacts on network design and operation costs.
Units distributed Scale driver	Reflects how the scale and composition of a network impacts on a number of cost areas.
Gini index Scale driver	The Gini index captures the variability of customer density within an area and how this impacts on a number of cost areas.
Call volume Scale driver	Reflects the number of customers and consequently scale of the network.
Peak demand Scale driver	A DNO suggested using MEAV and peak demand as a cost driver, MEAV to reflect the scale of the network and peak demand to reflect activity volumes which are influenced by external factors.
New asset additions (V1 additions) – secondary driver	DNOs' forecasts of new assets installed during RIIO-ED1. This captures workload across the DNOs for RIIO-ED1.
Faults – Secondary driver	Faults are a significant driver of costs as they impact on a number of cost areas, including call centres and control centres.
DPCR5 dummy	Reflects the different price control periods

A8.7 In response to the fast-track decision, a number of DNOs were concerned with the use of weighted MEAV as a cost driver. For slow-track, we decided to use MEAV as a cost driver for CAI activities.[43]

A8.8 Some DNOs proposed using gross network investment and efficient direct spend as a secondary cost driver. However in our strategy decision we stated that we would move away from using expenditure as a cost driver. Other DNOs were also against using expenditure as a cost driver. They state that using cost as a driver penalises companies that have proposed low direct activity programmes, and that large increases in direct spend for the RIIO-ED1 period could indicate under-investment in the current period. It is for this reason they recommend using MEAV as it is a largely exogenous cost driver.

A8.9 Most DNOs recommended the use of MEAV along with a relevant workload driver as a suitable model for assessing the efficiency of CAI costs. We ran an aggregate CAI regression on MEAV and peak demand but found that the coefficient on peak demand was not significant at five per cent.

CAI individual analysis versus disaggregated grouped analysis

A8.10 DNOs also highlighted that our two regressions of grouped CAI activities at fast-track had a very poor statistical fit and in particular a low R-squared value which indicated the need for other variables apart from weighted MEAV to explain the variation in DNO costs.

A8.11 For our slow-track approach, we grouped eight CAI activities together (all except vehicles and transport and operational training). We think this is a sensible approach as it deals with any boundary issues for reporting of CAI cost and issues with low R-squared.

DNO versus Group level analysis

A8.12 For the slow-track submission, we asked DNOs in their commentary to explain shared costs between their licensees. Nearly all DNOs stated that significant elements of their indirect costs were shared between their licensees. Based on the shared allocation, we tested regressions at company group level. For the initial company level analysis, we tested two of the core drivers of CAI suggested: MEAV and CSV consisting of MEAV, faults and peak demand.

A8.13 By moving to company level analysis over the RIIO-ED1 period the numbers of observations were reduced from 112 (at DNO level) to 48 (at company level). The reduced sample size impacts on company level regression results. Using MEAV as a cost driver resulted in a coefficient for the group level regressions greater than one (diseconomies of scale). We also trialled regressions including other drivers with MEAV (such as customer numbers, faults, and peak demand), there was high correlation between some of these drivers.

---

[43] MEAV used throughout slow-track excludes the following assets in its calculation: rising and lateral mains (RLM), LV service associated with RLM, batteries at GM HV substations, batteries at 33kV substations, batteries at 66kV substations, batteries at 132kV substations, pilot wire overhead, pilot wire underground, cable tunnels (DNO owned), cable bridges (DNO owned), and electrical energy storage. These exclusions have ensured greater consistency in the data between DNOs.

DNO analysis

A8.14 We used DNO level regression analysis for aggregated CAI due to the limitations of group level regression. Given the range of available cost drivers, we estimated a number of different models to assess the performance of the explanatory variables either in single driver regressions, multivariate regressions or using a CSV (where we had concerns about multicollinearity).

Proposed cost drivers

A8.15 In reference to our strategy decision document we grouped CAI activities into two distinct groups: costs differentiated by flexing in response to changes in the workload driver (Group A); and costs that are substantially fixed regardless of the workload activity (Group B). The proposed drivers that we have tested are listed in table A8.3.

Table A8.3: DNO level analysis over RIIO-ED1

	Constant	MEAV	MEAV + units distributed	MEAV+ Call volumes	MEAV + customer numbers	MEAV + peak demand	MEAV + density	MEAV + total faults	MEAV + total faults & ONIS	MEAV + V1 additions	CSV (MEAV, faults, peak demand)
Control centre	✓	✓			✓			✓	✓		
Call centre	✓	✓		✓	✓						
Group A. Network design, project management and system mapping	✓	✓						✓	✓	✓	
Group B. Engineering management & clerical support, Stores and Network policy	✓	✓	✓		✓	✓					
CAI total	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

Table A8.4: Company level CAI total

CAI total	✓	✓								✓

Assessment criteria

A8.16 There is no single metric or method to assess the models mechanistically. In order to assess the models we have therefore adopted a 'traffic light' system to indicate how well a model performs against a given criterion ie a green light relates to good, an amber light corresponds to acceptable but with a few issues, and a red light means the model is flawed.

Assessment of models

A8.17 Table A8.5 below shows our assessment of each of the more plausible models.

A8.18 We have tested the CAI activities in line with fast-track grouping based primarily on MEAV and/or an additional workload/scale variable. From the regressions, we found that on individual activities the regression did not pass many of the statistical tests and/or were not significant at the 95 per cent confidence level.

Table A8.5: DNO CAI model assessment

Model reference	Explanatory variables	Sample	Coefficients	Statistical test
Control centre	MEAV + total faults	2016-2023	R	A
			MEAV and total faults insignificant at 95%.	Failed white test and normality test. Low R-squared= 0.47
Call centre	MEAV + customer numbers	2016-2023	R	R
			Customer numbers insignificant at 95%.	Failed RESET test. Low R-squared=0.55
Group A. Network design, project management and system mapping	MEAV + V1 additions	2016-2023	R	A
			MEAV is insignificant at 95%.	Failed White test.
Group B. Engineering management & clerical support, Stores and Network policy	MEAV+ peak demand	2016-2023	R	A
			MEAV and V1 additions insignificant at 95%.	Failed Normality and White test. High R-squared=0.72
CAI total	MEAV	2016-2023	G	A
			MEAV significant at 95%.	Passes Normality, Reset and

				Pooling tests, but fails White test. High adjusted R-squared = 0.82.
CAI total	MEAV + V1 additions	2016-2023	G MEAV and V1 additions significant at 95%.	A Passes RESET, Pooling and White test but fails normality. Very high R-squared=0.86
CAI total	CSV (comprised of MEAV, faults and peak demand).	2016-2023	G Very high correlation between MEAV, faults and peak demand.	A Passes RESET, Pooling and White test but fails normality. Very high R-squared=0.83

A8.19 The table below shows our assessment of CAI at company level using two of the core drivers MEAV and CSV. The company level results in table A8.6 show that MEAV and CSV fail either the reasonableness of the coefficient or statistical robustness test. Based on this finding we have decided to run our analysis at DNO level.

Table A8.6: Company level CAI model assessment

Model reference	**Explanatory variables**	**Sample**	**Coefficients**	**Statistical test**
Company CAI total	MEAV	2016-2023	R MEAV coefficent not consistent with expectations. Coefficient estimated to be 1.14 implying diseconomies of scale	G Passes all the statistical tests
Company CAI total	CSV (MEAV, faults and peak demand)	2016-2023	G CSV significant at 5% but suffers from multicollinearity between the variables	R Fails RESET and White test

Selected cost drivers

A8.20 The cost drivers we have chosen to assess CAI expenditure are MEAV and V1 additions. The selection of MEAV makes intuitive sense and passes our statistical test. To account for proposed workloads for RIIO-ED1 we have chosen V1 asset additions as a workload driver. This driver takes into account DNOs' proposed workloads and is statistically significant. Overall our model passes all of the statistical tests apart from the normality test, but overall we are comfortable with the chosen cost drivers.

A8.21 Full details of the statistical test results are provided below. The R-squared is high at 86 per cent and the coefficients on each of the variables make sense. The regressions meet key statistical tests are for pooling, functional form and heteroskedasticity (see Appendix 8).

Table A8.7: Regression results of chosen cost driver

Panel length	2016-2023		t-stats		p-values
ln_MEAV	0.550	t_ln_MEAV	4.89493	Normality	0.000
ln_V1_additions	0.313	t_ln_V1_additions	2.38075	Reset	0.523
_cons	-6.697	t_constant	-5.1248	White	0.106
Adjusted_R-squared	0.861			Pooling	0.186
Smearing_Factor	1.005				

Post regression qualitative adjustment

A8.22 Following a sense check of the results we consider that our model provides too harsh a reduction to submitted costs for the three UKPN licensees. The UKPN and WPD groups are relatively similar in terms of scale and we would therefore expect our model to produce similar results in CAI costs which are largely driven by scale. The gap in modelled allowance between the two groups is wider than we would expect however. We make an adjustment to the UKPN group costs to reflect this and this is reapportioned to the UKPN DNOs (LPN, EPN and SPN) based on the proportion to their submitted forecasts. This positive adjustment does not change the overall positioning. UKPN remains the most inefficient company group. Our modelled costs are seven per cent lower than its submitted CAI costs.

Appendix 9 – Top-down totex model

A9.1 We have taken on board comments from stakeholders regarding our top down totex model. We still use a CSV in calculating our driver for this model, as a number of the possible drivers are correlated. In Appendix 4 we have discussed our approach calculating the CSV.

Cost drivers

A9.2 The first step in updating our top down totex model was to consider which high level drivers could be used to explain totex.

A9.3 We list the high level cost drivers we have tested for our totex model in table A9.1 and the rationale behind their selection.

Table A9.1: Proposed cost drivers for top down totex

Cost driver	Rationale
Customer number	A DNO's totex should be driven by the number of customers they serve. A network is operated, maintained and reinforced to meet its customer requirements.
Network length	DNOs' costs should be related to the length of network that they serve.
Units distributed	Reflects the amount of electricity that is being distributed through a DNO's network on an annual basis.
Density	Reflects the distribution of consumers within a DNO's area which should affect costs incurred.
Peak demand	DNOs' networks are designed to meet the level of peak demand as well as the annual volume of units distributed.
MEAV[44]	MEAV reflects the scale and composition of a network based on it replacement costs. It is therefore a key driver of costs.

A9.4 These drivers are outside of a DNO's control in the short term, which removes their ability to influence efficiency results through changes in the cost drivers.

A9.5 As most of these drivers are scale variables, we expect that there would be a significant degree of correlation between combinations of these. We have used a CSV throughout our slow track assessment to address this.

[44] MEAV used throughout slow-track excludes the following assets in its calculation: rising and lateral mains (RLM), LV service associated with RLM, batteries at ground mounted HV substations, batteries at 33kV substations, batteries at 66kV substations, batteries at 132kV substations, pilot wire overhead, pilot wire underground, cable tunnels (DNO owned), cable bridges (DNO owned), and electrical energy storage.

A9.6 Where the drivers are similar due to either their calculation (ie density is a function of customer numbers and area), or account for similar aspects of companies (ie MEAV and network length), we have tried to avoid adding both such variables into the various iterations of the CSV. Examples of the CSVs we have calculated are in Table A9.2, this list is non exhaustive.

Table A9.2: Proposed cost drivers for top down totex

Drivers in the CSV	**Model option**								
	1	2	3	4	5	6	7	8	9
Network length	✓	✓							
MEAV			✓	✓	✓	✓	✓	✓	✓
Customer number	✓	✓	✓	✓	✓	✓	✓	✓	✓
Units distributed	✓	✓	✓	✓	✓	✓			
Peak demand		✓	✓	✓			✓		
Density		✓	✓		✓		✓	✓	

A9.7 We have included a time trend in both of our totex models as we have observed that there is a change in the totex profile in the DNOs' submitted costs from DPCR5 to ED1. The inclusion of a time trend in the models attempts to pick up differences in totex that are due to the passage of time.

Assessment of models

A9.8 As covered in Appendix 8, there is no single metric or method to assess the models mechanistically. In order to assess the plausibility of models we reviewed them against our statistical tests to check that the iteration passes, that signs on the parameter estimates were as expected and significant. We considered the results, and whether any variable was having an undue effect.

Selected cost drivers

A9.9 The various options for the top down model specification give similar rankings for most of the DNOs. Some results were sensitive to the inclusion of peak demand, density and units distributed however. Having considered the range of specifications, we consider that the top-down model using MEAV and customer numbers in a CSV is most appropriate. MEAV takes into account network length and also captures the additional network required for low or high density areas. There are potential concerns with placing too much reliance on units distributed given issues raised as part of the losses work. The inclusion of peak demand causes customer number to become insignificant and negative, potentially due to issues of multicollinearity. The inclusion of density causes a potential double count with company specific adjustments, the coefficient on density changes between models and also gives counterintuitive results for low density areas.

A9.10 The similarity in results for most DNOs across a range of models gives us greater assurance that our approach is appropriate.