ofgem Making a positive difference for energy consumers

RIIO-ED2

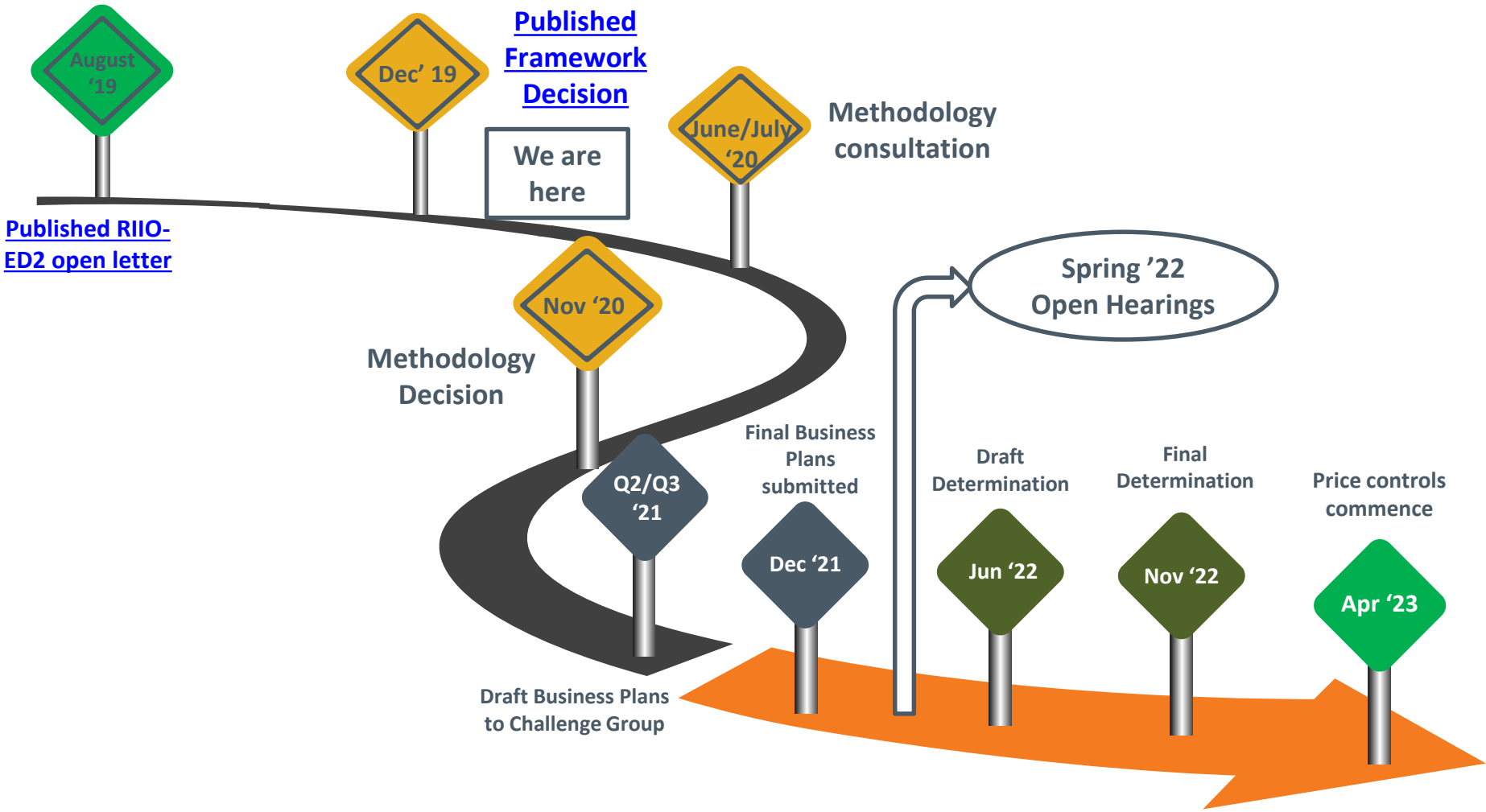
Cost Assessment Working Group – Meeting 3

Electricity Distribution Team
25th February 2020

Agenda

- Welcome and introduction from Ofgem
- Terms of Reference
- Frontier Economics presentation on Ofgem RPI-X@20, random effects and ED1 totex models.
- UKPN / SPEN presentation on totex models
- Ofgem overview of ED1 totex
- WPD presentation on Business Plan Incentive (BPI)
- Ofgem review of regional and special factors in ED1
- How it all fits together – Cost Assessment principles for ED2
- Actions, Next Steps, AOB

Pathway to ED2



Proposed dates and topics for CAWG

- We propose to hold a WG session approximately every three weeks with feedback sessions to make sure all ground is covered and prioritised appropriately.
- We plan to run sessions in the Glasgow and London Ofgem offices.
- Depending on room availability, we may need to restrict the number of representatives that each member organisation sends to meetings of the Group

Date	Location	Summary	Items to cover
14 January 20	London	Introductory session	ToR, Priorities
11-Feb-20	Glasgow	Key principles	
25-Feb-20	London	Totex, BPI & interpolation, Regional and special factors, How it all fits together	Drivers, duration periods, role of history vs forecasts Review totex models
13-Mar-20	London	Role of disagg modelling Uncertainty mechanisms	How disagg is disagg? PR19 and middle model reviews
27-Mar-20	London	Productivity, frontier shift, indexation, RPEs	
8-Apr-20	London	How it all fits together (again)	
28-Apr-20	Glasgow	CBA development EJP development	

Some key comments from licensees on ToR:

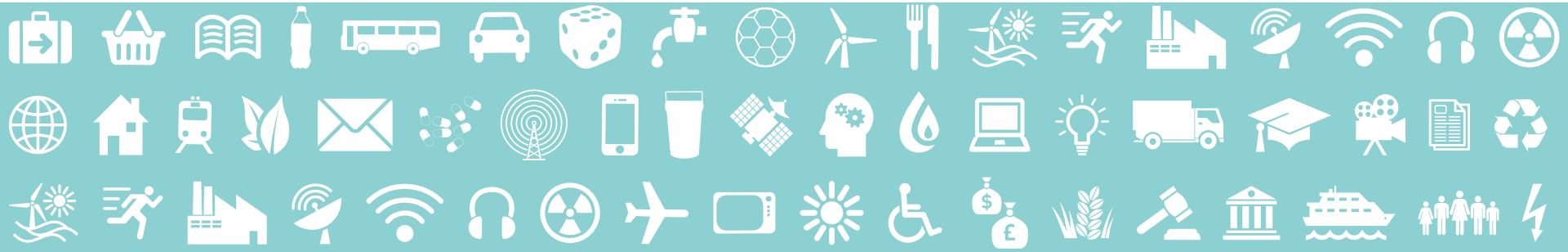
- Update some text in the ToR to make it more specific and relevant to the Cost Assessment Working Group (CAWG).
- A need for Ofgem to provide a level of assurance that the contributions of DNOs to this working group are actively considered by Ofgem or else justifiably discounted.
- Some clarification required around use of the term 'future activities'. Does this relate to ED2 or longer term?
- Clarification required around 'use of disaggregated modelling based on asset base, as well as activity'.
- Clear definition required on what will be considered 'fixed costs', and their application to Business Support Costs (BSCs).
- Item 1.8 has far too many identified items. Prioritisation of this list may be required.

Frontier Economics presentation on Ofgem RPI-X@20, random effects and ED1 totex models

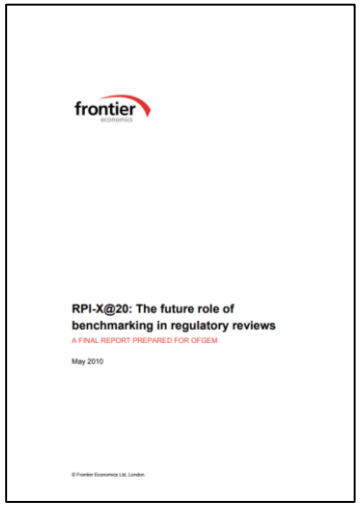
Totex benchmarking: why, what, how?

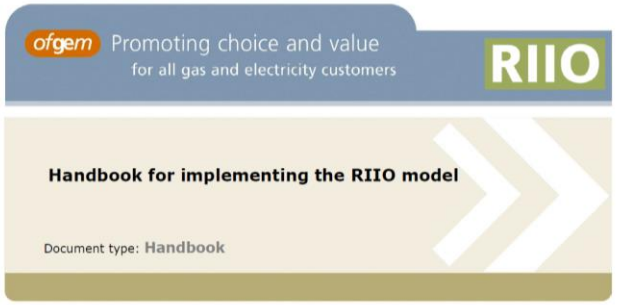
A presentation to the CAWG

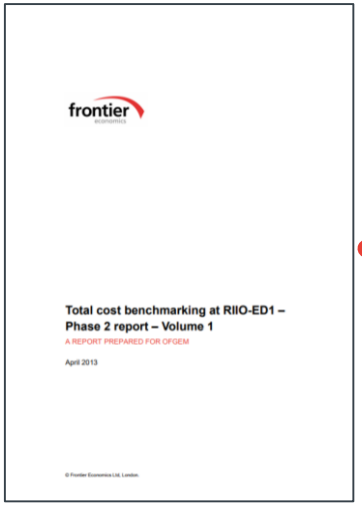
25 February 2020



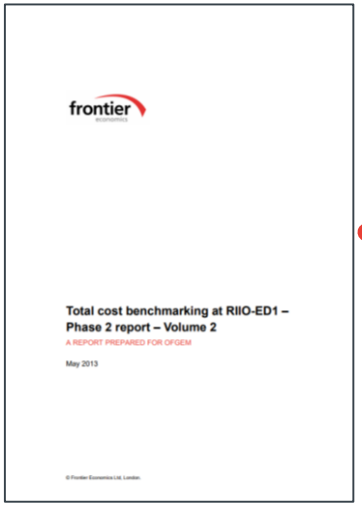
Source material for this presentation







Volume 1 described what was in the model and why



Volume 2 described what was not in the model and why

RPI-X@20 – what were we asked to do?

Frontier Economics was commissioned by Ofgem to produce a report on the future role of benchmarking in regulatory reviews in light of the proposals emerging from the RPI-X@20 review. **In particular, Ofgem asked us to consider the potential role of total cost benchmarking** and provide practical recommendations on the preferred approach for all four of the networks regulated by Ofgem (i.e. electricity transmission, gas transmission, electricity distribution and gas distribution).

In the following slides we summarise the key points we made

RPI-X@20 – why totex benchmarking is important?

- Operators incur many different types of cost in undertaking a range of different activities, all of which contribute to the delivery of network services.
- Where those different cost types are exposed to different incentive arrangements, and where there is scope to substitute those costs for one another, there is a danger that operators respond to those incentives by **reclassifying** costs from one type to another, in order to increase profits.
- Where the difference in incentive strength is particularly material, there is even a risk that operators might **physically substitute** one cost for another, i.e. might change the specification of a project

The equalisation of incentives across competing costs is now a well established principle in incentive design.

- The totex incentive mechanism has removed one of the primary differences in incentive strength
- But competing costs should also be subjected to as similar a benchmarking process as possible (ideally identical). This would more perfectly align the interests of the operators with those of customers, leaving an incentive to seek the lowest cost solution rather than favouring one type of cost over another.
- Totex benchmarking is the most straightforward way to deliver this equalisation

RPI-X@20 – a spectrum of options exist

Top down — **Mid model** — **Bottom Up**

"Totex"

- Total resource use can then be compared to the basket of explanatory factors and outputs delivered, to derive an overall assessment of the relative value for money delivered by each operator.
- It is "blind" to the more detailed input choices made by the operator that ultimately lead to the recorded total resource use.
- For example, it is irrelevant whether operators choose to replace or maintain assets, to contract out or keep work in-house.
- Very pure incentives created.
- But provides no narrative on exactly why firms are inefficient.

"Opex plus"

- Benchmark broad "blocks" of expenditure
- Something of a halfway house
- Provides some narrative on causes of inefficiency
- But unlikely to satisfy the desire for a detailed engineering appraisal
- Fewer boundaries between cost categories, so easier to understand incentives created
- And to manage the risks of incentives to substitute

"Granular disag"

- Each cost type entering a different model and being compared to different cost drivers, potentially using very different techniques.
- Has the potential to yield more information to the regulator on why different operators might be efficient or otherwise.
- Increased risk of differences in business model leading to differences in apparent performance.
- Risk of cherry picking.
- Risk of confusing, unintended, perverse incentives being created.
- Resource intensive.

RPI-X@20 – treatment of capital costs

While there are many benefits from adopting such an approach, principally around reducing potential distortions described above, it does give rise to a number of technical and regulatory issues. In particular, the treatment of capital costs can prove difficult.

Benchmark expenditure flows

- The flow of capital expenditure could be added to other costs and this total expenditure (totex) subject to a single benchmarking process
- However, capital costs are sometimes "lumpy" in nature. Consequently, the benchmarking results for a totex model might be volatile from year to year and the results for any single year might be an unreliable guide to prevailing performance
- Similarly, operators might be at different points in their investment cycle and this might need to be captured.

Benchmark opex + capital consumption

- Alternatively, could benchmark on the basis of ongoing operating costs together with a measure of their capital consumption (i.e. depreciation plus return)
- Has the effect of smoothing capital costs since no single year of capex has a disproportionate impact on measured capital consumption
- But the measurement of capital consumption is potentially controversial
- The most obvious basis for such analysis is to make use of the prevailing regulatory accounting arrangements.
- The RAV is a regulatory construct and a potentially poor reflection of "capital stock"
- Where an operator is found to be inefficient on this basis, is the implication that some of their past capital investments be written off?
- Can also lead to technical estimation challenges

RPI-X@20 – recommendations

Recommended focus on totex – and to look at both measures of capital cost. But…

Table 9. Summary of recommendations for Electricity Distribution

	Recommendation
Costs	Total cost, making use of two measures. Planned operating expenditure plus a measure of capital consumption. Planned operating expenditure plus planned capital expenditure.
Cost drivers	Ideally, the full set of explanatory factors presented in Section 4.3, guided by empirical analysis at each review. Include directly, where possible, outputs, if supported by empirical analysis.
Sample	The scenarios presented in the 14 DNO business plans. Make use of historic costs (as per Option 2 in Section 5) to increase the scope for plans to be tested.
Technique	While Stochastic Frontier Analysis (SFA) is usually preferred when undertaking efficiency analysis, data contained in operator plans will not contain statistical noise. This allows the robust use of Ordinary Least Squares (OLS) or Corrected OLS (COLS).

Connections

Peak load

Volumes distributed

Density

CI/CML/losses (monetised and added to LHS)

…also recommended that Ofgem undertook a benchmark of historical cost using DPCR5 style "mid models" as a crucial validity check on business plans

We also noted that benchmarking business plans would only work if there was tension in the planning process – i.e. an effective BPI

ED1 totex benchmark – what were we asked to do?

In the summer of 2012 Frontier Economics was commissioned by a group of DNOs, led by UKPN, to undertake an assignment to demonstrate the feasibility of totex benchmarking for the electricity distribution companies regulated by Ofgem. Since the conclusion of that first study, Frontier has worked with Ofgem and the DNOs to take forward our work on totex benchmarking.

ED1 totex benchmark – Methodological overview

- Total expenditure for 06/07 to 11/12
  - we did explore capital consumption models but it was agreed that limits on historical data made this hard, so only totex was explored in the final phase of work
- Some exclusions agreed by the DNOs

COST

COST DRIVER

- Core drivers were
  - Peak load
  - Customer numbers
- CI/CML were monetised and added to cost
- Details for other cost drivers follow in the next few slides

- The cross section available for GB DNO benchmarking will always be limited to 14
- Historical data only – at the time of the work, business plans had not been completed

SAMPLE

TECHNIQUE

- Random effects
  - individual-specific effects are uncorrelated with the independent variables
  - Fixed inefficiency component which is helpful in averaging out lumpy investment spend
- Fixed effects considered but
  - Not supported statistically (Hausman test)
  - Some cost drivers change only slowly over time leading to poor precision with Fixed Effect models
- Cobb-Douglas production function
  - Translog specification tested but not supported

ED1 totex benchmark – including price series

No pre adjustment for input prices

'The role of input prices is clear. Where prices change either over time or between regions, it is reasonable to anticipate that this will lead to changes in totex. In order to ensure a robust estimation (and specifically to avoid the risk of a missing variable bias) it is necessary to capture these effects through the inclusion of appropriate input prices in the model.'

Imposing homogeneity in prices

- The coefficient on input price series can be interpreted as a "budget share"
- By definition, all budget shares must sum to one
- This should be imposed as a restriction

Table 4 Input price series for categories capital, labour and the general inflation

Capital	Labour	General Inflation
BEAMA	SIC_35 (regional)	UK RPI
PPI-MGT(Eu)	SIC_35 (national)	UK GDP deflator
PPI-MGT(Uk)	SIC_3513 (national)	
PPI-appa(Eu)	SOC_2123 (regional)	
PPI-appa(Uk)	SOC_2123 (national)	
RCI-Infras	SOC_3112 (regional)	
RCI-build	SOC_3112 (national)	
GFCFD	SOC_41 (regional)	
	SOC_41 (national)	
	SOC_52 (regional)	
	SOC_52 (national)	
	SOC_524 (regional)	
	SOC_524 (national)	
	SOC_5241 (regional)	
	SOC_5241 (national)	
	SOC_5243 (national)	
	BEAMA_electrical_labour (national)	

Found to be unnecessary – highly correlated with other series

ED1 totex benchmark – accounting for density

Why density?

- **Geometric effect** – Fewer assets are needed to serve customers as they become closer together, reducing costs as density increases. This implies a downward sloping relationship between density and total costs.
- **Urbanisation effect** – At some point the geometric effect could be, at least partly, offset by increased costs associated with serving high density areas. For example, this could be the result of safety requirements resulting in more distribution assets being located underground in urban areas, increased traffic congestion, more difficulty accessing infrastructure, and associated higher installation and maintenance costs.

Developing detailed measures

- Gather data from public sources on the density of sub areas within each DNO's operating region;
- Use this data to prepare histograms that describe the underlying density composition of each DNO's operating area;
- Use these underlying histograms as a basis from which to develop a wide range of alternative measures of density that describe more fully the underlying distribution.
- Test empirically whether these measures are able to better describe the data than the simple measures used during Phase 1.

Table 12. Measures used in the density analysis

Measure	Description
Mean	Mean density, weighted by sub-area surface area. Conceptually identical to the density variable used in our Phase 1 work, but derived from the detailed ONS data.
Standard deviation	Standard deviation of the distribution of density, weighted by sub-area surface area.
Skewness	Skewness of density, weighted by sub-area surface area, summarising the extent to which the tail on one side of the distribution is longer than the other (equivalently, whether the bulk of the distribution lies to below or above the mean).
Kurtosis	Kurtosis of density, summarising how "peaked" the distribution is.
Gini coefficient	A measure of inequality between zero and one where zero would imply that density is equal across the DNO's surface area and 1 would imply that customers are concentrated in one unit of the DNO's surface area, with the remaining surface area empty. .
Share of surface area below a given density threshold	The proportion of the DNO's surface area below a given density level.
Total surface area below a given density threshold	The DNO's total surface area below a given density level.
Share of surface area above a given density threshold	The proportion of the DNO's surface area above a given density level
Total surface area above a given density threshold	The DNO's total surface area above a given density level

Conclusions

- Nothing was better than a simple average density measure
- A negative relationship found (i.e. costs decrease as density increases)
- Squared term rejected statistically
  - Which doesn't mean to say that this is "true"
- LDN and SSEH outliers at opposite ends of the spectrum

ED1 totex benchmark – drivers tested and rejected

Asset condition	▪ At the time little data available (average age, early stage Health Index) ▪ Technical problem – variable is endogenous ▪ No econometric support for including the data that did exist
Investment cycle	▪ If companies are “out of cycle” then expenditure flows will vary simply for reasons of timing ▪ We collected data on “investment” back to 1972 from a variety of sources ▪ This provided no evidence that companies were “out of cycle”
Asset related outputs	▪ We tested MEAV and network length as cost drivers ▪ We noted the technical weakness of this approach – both variables are endogenous ▪ And also the incentive problems that arise ▪ From a pure statistical perspective, we found that these variables could substitute for density and create a viable model – but did not favour them for well understood reasons
Voltage structure	▪ We tested dummy variables for Scotland (no 132 kV network) ▪ We also tested share of HV customers/peak (which has been found significant elsewhere) ▪ None of these variables were significant or improved the overall model

Our final model specification

Table 24. Comparison of Specification 1 (SIC35, regional) and Specification 2 (SIC-35, national); Random Effects

	SIC 35, Regional	SIC 35, National
Customers	0.469***	0.585***
Peak	0.351***	0.239*
Density	-0.078***	-0.056*
Wages	0.326***	0.542***
Price of capital[52] (BEAMA)	0.674	0.458
Constant	-8.21***	-8.64***
R^2 [53]	0.887***	0.875***

The table reports the estimated coefficient for each variable and the confidence intervals using a 95% probability.[54]

*** Significant at 1% ** Significant at 5% *Significant at 10%

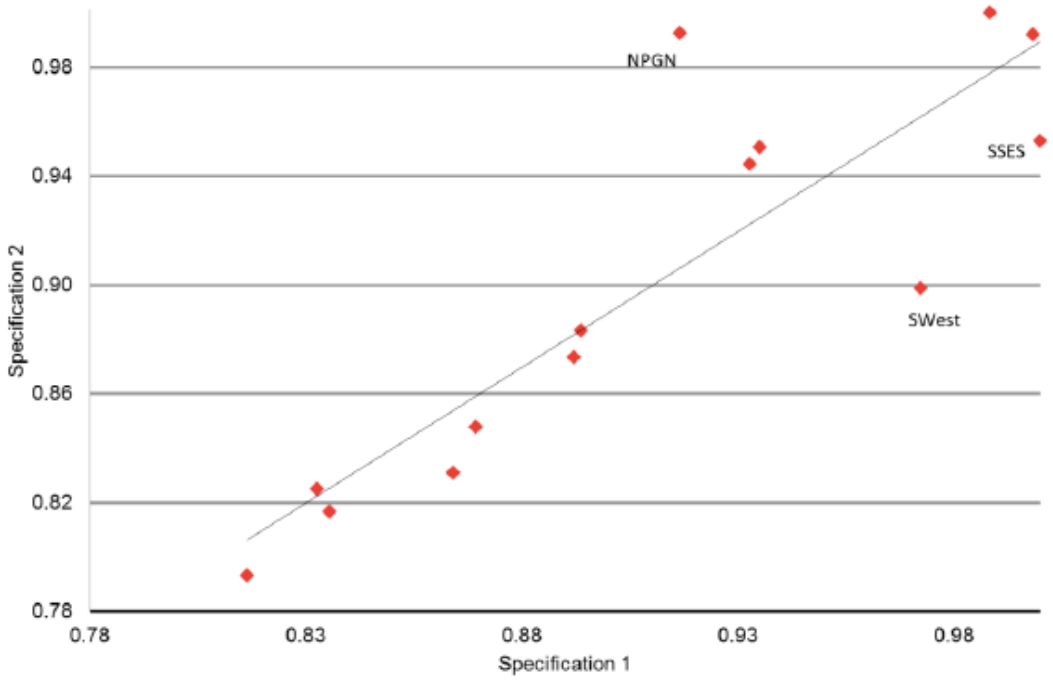
Source: Frontier Economics

Differences in model coefficients not so important. Always significant and sum of the two variables = 0.82 regardless

Our main conclusion was that fitting a high level totex model using structural variables required a lot work, but it was definitely feasible and the outcome of the model was robust

Efficiency scores were highly correlated

Figure 19. Scatter of efficiency scores under Specification 1 and Specification 2



Source: Frontier Economics

National wage variable

Regional wage variable

Other assumptions on error term structure

Table 25. Efficiency estimates for Specification 1 under RE and POLS

DNO	RE	POLS (average sample period)	POLS (Last year estimate)
WMID	0.840	0.809	0.805
EMID	0.947	0.933	0.939
ENWL	0.900	0.869	0.683
NPgN	0.938	0.909	0.893
NPgY	1.000	0.988	0.928
SWales	0.996	0.98	0.879
SWest	0.967	0.947	0.852
LPN	0.896	0.877	0.996
SPN	0.874	0.847	0.809
EPN	0.842	0.816	0.854
SPD	0.941	0.923	0.881
SPMW	0.820	0.798	0.736
SSEH	0.865	0.839	0.767
SSES	0.996	1.000	1.000

Source: Frontier Economics

High correlation between RE and average POLS.

Much weaker correlation between RE/average POLS and efficiency derived from one year only

Ofgem's ED1 totex models

Cost	Cost driver	Technique	Sample
Totex (top-down)	▪ Composite scale variable (CSV) composed of: ▪ Customer numbers (12%) ▪ MEAV (88%)	▪ Pooled Ordinary Least Squares (OLS) regression	▪ 13 years of data for licensees with: ▪ 5 years of historical data; ▪ 8 years of forecast data; and ▪ the following exclusions: ▫ transmission connection point (TCP) charges, ▫ critical national infrastructure (CNI), ▫ rising and lateral mains (RLM), ▫ improved resilience, ▫ smart meter call out cost, ▫ quality of service, ▫ new streetwork costs.
Totex (bottom-up)	▪ CSV composed of the weighted average* of disaggregated cost drivers: ▫ MEAV (68.1%) ▫ Units distributed (13%) ▫ Overhead line length (0.8%) ▫ Total faults (9.5%) ▫ Total length (3.9%) ▫ Total ONI (1.9%) ▫ Spans cut (3.1%)		

Source: ***Ofgem (2014), RIIO-ED1: Final determinations for the slowtrack electricity distribution companies: business plan expenditure assessment***

Note: * the weights are rounded, so add up to 100.3%, in line with Ofgem's report, annex 5 (p199)

Ofgem's ED1 totex models - issues

Endogenous cost drivers	▪ used across the modelling suite. ▪ has the potential to distort incentives and unduly favour certain types of business model ▪ an issue for a number of the cost drivers selected, in particular Modern Equivalent Asset Value (MEAV), which was used extensively throughout Ofgem's modelling
Two totex models or essentially one?	▪ the two models utilised cost drivers which were both heavily dependent on MEAV ▪ therefore unclear whether there was additional explanatory power associated with undertaking two separate models.
No cross check on POLS	▪ pooled OLS approach is reasonable but more sophisticated techniques are available which may have provided more robust results.
Benchmarking of forecasts only	▪ has potentially perverse incentive properties, and meant that the credibility of the forecasts across the industry was not tested against the reality of what has been achieved previously. ▪ a blend of historical and forecast benchmarks could have been used.
Factor prices	▪ No variable to capture factor prices ▪ Pre-adjustment for regional wages

SPEN presentation on totex models

ED2 Totex Benchmarking

SP ENERGY NETWORKS

Introduction

DPCR 1 - 5 (1990-2015)	Didn't use Totex approach
RIIO-ED1 (2015-2023)	Toolkit approach to Cost Assessment using mixture of **Totex** and Disaggregated benchmarking

Totex Benchmarking is still in its infancy and ED2 should firstly assess whether ED1 approach worked

Purpose of these slides;

1) To understand limitations within the RIIO-ED1 top-down Totex modelling
2) To understand additional challenges RIIO-ED2 presents to Totex modelling
3) To test the validity of ST FD Totex top-down Regression models with ED1 actuals
4) Agree problem areas with CAWG and discuss potential solutions

ED1

Limitations of top-down Totex Model	
Scale of Investment programmes	• Attributed legitimate, and justified differences in the scale of modernisation between DNOs as being inefficiency, this contradicted Disaggregated models for which it was accepted.
Network and Investment Cycles	• Unable to account for asynchronous investment cycles between DNOs that resulted in different rates of modernisation or differing business models. • Model unable to appropriately take into account specific regional factors.
Model interpretation and Statistical Tests	• No statistical tests to detect presence of outliers within data. • Arbitrary weightings between Totex and Disag models and different from Fast Track.
Output Setting	• The inconsistencies between disag and Totex modelling set contradictory output setting for secondary deliverables targets.

RIIO-ED2 should firstly recognise that these were limitations that should be addressed

ED2

Additional Challenges for top-down Totex	
Innovative > Conventional Solutions	• Recognise different solutions to consider cost differences between flex/active network management vs traditional reinforcement and wider consequences this will have. • Importance of exogenous cost drivers: the use of MEAV is not appropriate
Low Carbon Technology, Net Zero, and DSO	• Regional differences between varying ambitions for Low Carbon Technology • Scenario uncertainty • Development of a DSO function • Anticipatory Investment in regards to making assets 2050 ready. • Uncertainty mechanisms
Stakeholder Feedback	• Increases in Totex due to Stakeholder demands • Demonstrating validity/robustness of approach more important than ever

Need to demonstrate that the ED2 complexities have been accounted for in model development

OLS Regression testing – scope

Tests been conducted with the information available through the annual RRP Data Share

Technique

- Cobb Douglas OLS estimation
- 2 explanatory variables

Costs

- DPCR5 and ED1 Actuals & M16 Forecasts (2012/13 price basis) – 13 years

Cost Drivers

- Exogenous Drivers: Customer Numbers, Network Length, Network Peak Demand, Units Distributed
- Endogenous Drivers: MEAV, V1 Additions, V1 Disposals
- Testing on a CSV and Individual Driver basis

Samples

- 2011 – 2019 (D5 and ED1 Actuals)
- 2016 – 2023 (ED1 Actuals & Forecast)
- 2011 – 2023 (D5 and ED1 Actuals & Forecast)

Cost Driver 2020 – 2023 Calculation

Test Results – Individual Drivers

45 regression models analysed with 2 explanatory variables and year

- R-Squared less than 70% rejected
- Negative coefficients rejected – counterintuitive interpretation
- P value significance greater than 5% rejected

14 models accepted

Test	Model Specification	Cost Drivers	Sample Years	ED1 Drivers	Regression R-squared	R_Squared Model Suitability	Coefficient Model Suitability	p-value Significance
ED1 Bid	Ln-Ln	MACRO_CSV (MEAV and Customers)	2011-2023	Y	87%			
34	Ln-Ln	MEAV Total and V1 Disposals Total	2011-2019	N	77%			
37	Ln-Ln	MEAV Total and Customer Numbers	2011-2019	N	77%			
40	Ln-Ln	MEAV Total and Units Distributed	2011-2019	N	79%			
49	Ln-Ln	Customer Numbers and Network Length	2011-2019	N	77%			
52	Ln-Ln	Network Length and Units Distributed	2011-2019	N	79%			
55	Ln-Ln	MEAV Total and Network-wide peak demand	2011-2019	N	80%			
64	Ln-Ln	V1 Additions Total and Customer Numbers	2011-2019	N	77%			
67	Ln-Ln	V1 Additions Total and Network-wide peak demand	2011-2019	N	81%			
70	Ln-Ln	V1 Additions Total and Units Distributed	2011-2019	N	79%			

Observations

- The R^2 is better when actuals are used compared to forecasts.
- A couple of models using exogenous drivers look feasible.
- Although model passes statistical tests it is **not an enhancement on RIIO-ED1**

Test Results – Composite Scale Variable

Scale variables are used as they pick up significant differences in size between DNOs and change very slowly

27 regression models analysed with CSV and year

- Same selection criteria as for individual drivers
- Use of either two or three drivers
- CSV calculated using weightings found from regression

6 models accepted

Test	Model Specification	Cost & Cost Driver	Macro Cost Drivers	Sample Years	ED1 Drivers	Regression R-squared	R_Squared Model Suitability	Coefficient Model Suitability	p-value Significance
ED1 Bid	Ln-Ln	Totex and MACRO_CSV	MEAV and Customers	2011-2023	Y	87%			
1	Ln-Ln	Totex and MACRO_CSV	MEAV and Customers	2011-2019	Y	78%			
3	Ln-Ln	Totex and MACRO_CSV	MEAV and Customers	2011-2023	Y	71%			
9	Ln-Ln	Totex and MACRO_CSV 2	Total network length and Customers	2011-2023	N	70%			
15	Ln-Ln	Totex and MACRO_CSV 4	Units Distributed and Total network length	2011-2023	N	71%			
24	Ln-Ln	Totex and MACRO_CSV 7	Network-wide peak demand and Total network length	2011-2023	N	71%			
30	Ln-Ln	Totex and MACRO_CSV 9	Network length and Customer Numbers and Units Distributed	2011-2023	N	69%			

Observations

- The R^2 is better when forecasts are included.
- MEAV and Customer Numbers (same as in ED1) give the most suitable model
- Although model passes statistical tests it is **not an enhancement on RIIO-ED1**

Summary

The statistical significance of the ED1 Final Determination model remains with the addition of ED1 actuals, but continuing with this approach does not address the material limitations, or the new challenges arising in ED2.

Considerations for CAWG

1. **Do we continue with Totex modelling?** If so, the model needs to address the limitations. If this cannot be done, then the results should be informative only, rather than definitive.
2. **Data** – Do the challenges impose require additional data to be collected?
3. **BPI** - How interlinked will Totex Modelling and the BPI assessment be?

Appendix

Issues with the use of MEAV in a Totex model

Asset Category	Voltage	Industry Total MEAV (£bn)	% Share Industry MEAV
Cable	132kV	3.17	2.4%
Cable	EHV	6.76	5.0%
Cable	HV	16.58	12.3%
Cable	**LV**	**62.25**	**46.2%**
Other		1.90	1.4%
SWG & TX	132kV	2.92	2.2%
SWG & TX	EHV	4.58	3.4%
SWG & TX	HV	9.25	6.9%
OHL	HV	7.53	5.6%
OHL	LV	3.93	2.9%

LV Cable has almost a 50% share of Industry total MEAV made up of;

LV UG Services MEAV – 23.9%
LV Main MEAV – 12.8%

LV Services MEAV worth more than;

- Entire 132kV asset base
- Entire OHL network
- Entire Switchgear and Transformer asset base

Voltage	% share MEAV
132kV	8%
EHV	10%
HV	25%
LV	56%
Other	1%

High Cost & Low Volume

Low Cost & High Volume

Use of MEAV favours companies who have a heavy asset addition delivery model

Lunch

Ofgem overview of ED1 totex

Overview of ED1 totex models

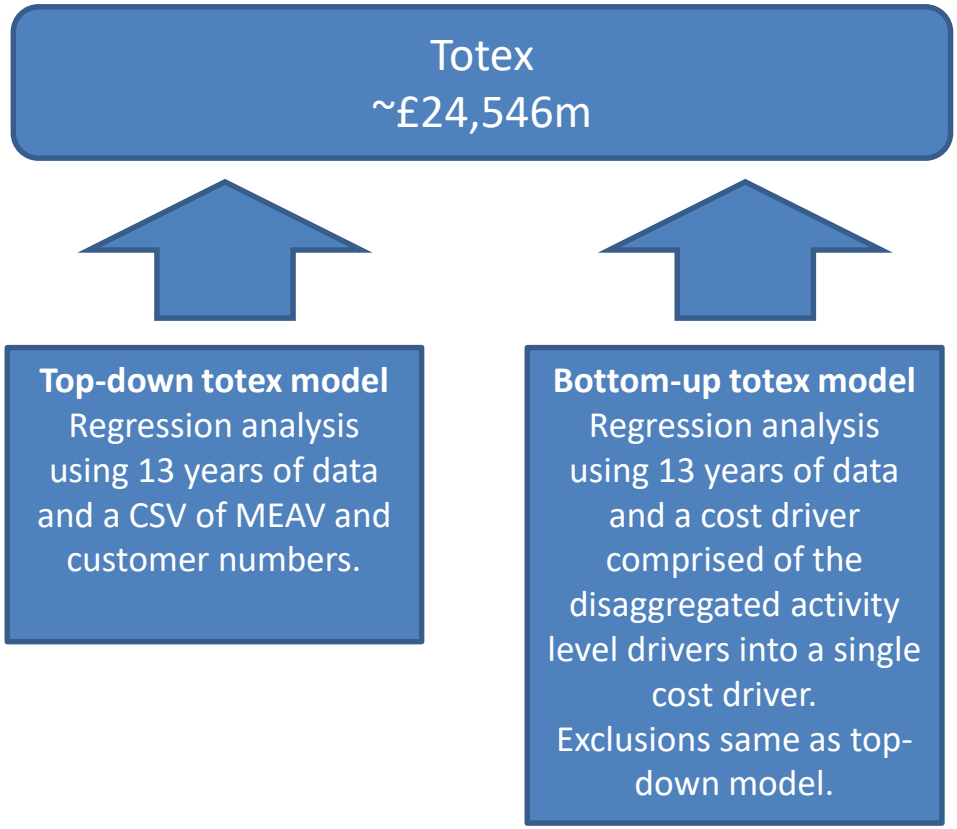


Table 2.3: Results of cost assessment prior to the application of RPEs and smart grid savings – by DNO (2012-13 prices)

DNO	Slow-track final submitted totex excluding RPEs*	Modelled costs before the application of the UQ				Modelled post-UQ and pre-smart grids adjustment and RPEs	Difference (modelled minus submitted)		Efficiency scores before smart grid adjustment and RPEs
	£m	Top-down totex £m	Bottom-up totex £m	Disagg activity level analysis £m	Combined based on 25%/25%/50% weighting £m	£m	£m	%	
ENWL	1,794	1,934	1,885	1,836	1,873	1,810	17	1%	0.99
NPgN	1,334	1,351	1,330	1,241	1,291	1,248	-86	-6%	1.07
NPgY	1,752	1,790	1,800	1,669	1,732	1,674	-78	-4%	1.05
WMID	1,931	1,880	1,876	1,884	1,881	1,818	-113	-6%	1.06
EMID	1,945	2,099	2,060	1,939	2,009	1,942	-2	0%	1.00
SWALES	1,011	1,079	1,077	1,046	1,062	1,026	15	2%	0.98
SWEST	1,583	1,396	1,446	1,552	1,486	1,437	-146	-9%	1.10
LPN	1,892	1,837	1,784	1,767	1,788	1,729	-164	-9%	1.09
SPN	1,796	1,817	1,776	1,702	1,749	1,691	-105	-6%	1.06
EPN	2,663	2,517	2,577	2,632	2,590	2,503	-160	-6%	1.06
SPD	1,495	1,662	1,653	1,562	1,609	1,556	60	4%	0.96
SPMW	1,837	1,592	1,616	1,783	1,694	1,637	-200	-11%	1.12
SSEH	1,145	1,095	1,103	1,144	1,121	1,084	-61	-5%	1.06
SSES	2,343	2,460	2,529	2,341	2,418	2,337	-6	0%	1.00
Total	24,521	24,507	24,513	24,098	24,304	23,493	-1,028	-4%	
Total excluding WPD	**18,051**	**18,053**	**18,053**	**17,678**	**17,865**	**17,269**	**-782**	**-4%**	

* The costs exclude RPEs to allow a direct comparison of modelled costs prior to the application of RPE savings. We have excluded DNOs' submitted costs of Network Rail's electrification programme and of remediating link boxes that will be covered by re-openers.

Other areas for consideration

RPEs

Smart grids and ongoing efficiency

Combination of models

Upper quartile

Regional labour adjustments

Company specific factors

Indirect cost allocations

Excluded costs from totex

MEAV calculation

Disaggregated models – Ratchet mechanisms

Other areas for consideration

Programme Area	Draft Determination Approach	Final Determination Approach
RPEs	Common assumption for all DNOs using an average weighting of a selection of input price indices. Used a base year of 2012-13 from which to roll forward RPE growth and used actual data for 2013-14. We made an adjustment for a step-change in RPI in 2010.	As draft determinations but base year set at 2013-14 and use actual data to date for 2014-15. Corrected minor errors, changed wage growth forecast and updated assumptions for latest data.
Smart grids and ongoing efficiency	Used the DNOs' submissions, the Transform model and DECC's smart metering impact assessment to determine the level of savings DNOs should achieve. We assessed claims of smart savings made by the DNOs and disallowed a number of these. We allocated the savings between DNOs as a proportion of totex.	No longer use the Transform model or DECC's smart metering impact assessment to directly inform any of the adjustments. Now only benchmark the DNOs' submissions to determine the savings that should be achieved. Reviewed additional information and accepted some extra smart savings claimed by DNOs. Savings are allocated in proportion to expenditure in each relevant cost area.
Combination of models	25% weighting to each totex model and 50% weighting to the disaggregated model.	No change.
Upper quartile	Applied UQ to the combined total costs of all three models before application of RPEs and smart grid savings.	No change.
Regional labour adjustments	Adjustment for three regions and no adjustment for BSCs. Calculated labour indices for the three regions of London, South East and rest of Great Britain using ASHE data. 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.	As draft determinations with two key changes. Removed the weighting on some Standard Occupational Classification (SOC) codes not consider relevant to the activity areas we are adjusting. Moved to a notional weighting approach based on the DNOs' average labour to gross expenditure ratio for each activity.

Other areas for consideration

Programme Area	Draft Determination Approach	Final Determination Approach
Company specific factors	Case by case review using engineering expertise.	No change. Reviewed cases and corrected errors in adjustments.
Indirect cost allocations	Apply DNO cost allocation.	
Excluded costs from totex	Fifteen areas excluded from both totex models: transmission connection point (TCP) charges, critical national infrastructure (CNI), rising and lateral mains (RLM), improved resilience, smart meter call out cost, quality of service (QoS), new streetwork costs, flood mitigation, BT21C, losses and environmental, operational and non-op capex IT&T, ETR 132 tree cutting activity, wayleaves and third party connections.	Only excluded the first eight areas listed.
MEAV calculation	Calculated for each DNO by multiplying every asset on the DNO's asset register by our view of the unit cost of that asset. It excludes: rising and lateral mains (RLM), LV service associated with RLM, batteries at ground mounted HV substations, 3kV substations, 66kV substations, and 132kV substations, pilot wire overhead, pilot wire underground, cable tunnels (DNO owned), cable bridges (DNO owned), electrical energy storage.	As draft determinations but now excludes the volumes as well as the costs of the assets associated with the SPMW special case.

WPD presentation on Business Plan Incentive

Review of regional and special factors in ED1

Regional Labour Adjustments

These adjustments are made as operating in certain parts of the country attracts significantly higher labour costs. These apply to the two totex models and the disaggregated model in the same way.

Draft determinations Approach

- Adjustment for three regions and no adjustment for BSCs. Calculated labour indices for the three regions of London, South East and rest of Great Britain using ASHE data. 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.

Final determinations approach

- As draft determinations with two key changes.
- Removed the weighting on some Standard Occupational Classification (SOC) codes not consider relevant to the activity areas we are adjusting.
- Moved to a notional weighting approach based on the DNOs' average labour to gross expenditure ratio for each activity.

Company Specific Factors

These are additional costs associated with operating a particular DNO network. The size of the adjustments differs in the disaggregated model compared to the two totex models. For some activities the disaggregated analysis already factors in the special case and to apply these adjustments again would be a double count. For example, if the special case is based on the need to do more volumes of work and our disaggregated model allows all the submitted volumes, we would not make a further company specific adjustment.

Draft determinations Approach

- Case by case review using engineering expertise.

Final determinations approach

- No change. Reviewed cases and corrected errors in adjustments.

Final determinations: Totex model normalisations and exclusions (£m 2012-13 prices)

DNO	Regional labour cost adjustments	Company specific factors	Costs excluded from the totex regression	Total adjustments over RIIO-ED1
	£m	£m	£m	£m
ENWL	25	0	-33	-8
NPgN	19	0	-24	-5
NPgY	25	0	-23	2
WMID	24	0	-11	13
EMID	23	0	-11	12
SWALES	13	0	-5	8
SWEST	21	0	-6	15
LPN	-163	-117	-85	-365
SPN	-67	0	-63	-130
EPN	-32	0	-55	-87
SPD	21	0	-97	-76
SPMW	28	-113	-47	-132
SSEH	15	-32	-59	-76
SSES	-58	0	-26	-84
TOTAL	**-106**	**-262**	**-545**	**-913**

Final determinations: Disaggregated model normalisations factors (£m 2012-13 prices)

DNO	Regional labour cost adjustments	Company specific factors	Total adjustments over RIIO-ED1
	£m	£m	£m
ENWL	25	0	25
NPgN	19	0	19
NPgY	25	0	25
WMID	24	0	24
EMID	23	0	23
SWALES	13	0	13
SWEST	21	0	21
LPN	-163	-117	-280
SPN	-67	0	-67
EPN	-32	0	-32
SPD	21	0	21
SPMW	28	-13	15
SSEH	15	-32	-17
SSES	-58	0	-58
TOTAL	**-106**	**-162**	**-268**

Regional labour adjustments – difference between draft and final determinations (£m 2012-13 prices)

DNO	Regional labour adjustment		Difference (fd minus dd)
	RIIO-ED1 draft derminations (£m)	RIIO-ED1 final determinations (£m)	
ENWL	28	25	-3
NPgN	26	19	-7
NPgY	33	25	-8
WMID	24	24	0
EMID	23	23	0
SWALES	13	13	0
SWEST	20	21	1
LPN	-191	-163	28
SPN	-79	-67	12
EPN	-37	-32	5
SPD	25	21	-4
SPMW	31	28	-3
SSEH	16	15	-1
SSES	-59	-58	1
TOTAL	**-127**	**-106**	**21**

Developments for RIIO-ED1

- Use of more data:
  - Full eight-year forecast models passed statistical tests.
  - Five years of historical data also used.

- Two different totex models:
  - One 'top-down' totex model and one 'bottom-up' totex model, with different cost drivers used.
  - Totex model 1 (25%), totex model 2 (25%), bottom-up models (50%).

- Application of the upper quartile adjustment:
  - The upper quartile was derived after combining each of the models.
  - This was done to avoid 'cherry-picking' (GD1 approach).

Recap of GD1 regional factors

For **Labour**, we:

1. Used ONS ASHE data to calculate regional wage differences in London and the South-East, and adopted the area inside the M25 as the proxy for the London region.
2. Calculated the % of work required to be done 'locally'.
3. Calculated the labour indices for the London and Southern GDNs and standardised the indices.

For **Sparsity**, we:

1. Identified district population sizes for each GDN, eliminated districts with no gas coverage, then calculated each GDN's district population density.
2. Classified all districts whose population density was less than industry population density as sparse
3. Applied adjustments to Emergency and Repair opex activities.

For **Urbanity**, we:

1. Accepted there are additional costs associated with **reinstatement** in highly dense urban areas. We applied adjustments to Repair and Maintenance costs.
2. Accepted there is reduced **labour productivity** associated with working in the London area. We applied a 15% adjustment to the labour cost element of Repex, Reinforcement and Connections based on the proportion of work carried out within the M25.

Annual average RIIO-GD1 adjustments, £m 2009-10

Adjustment factor	EoE	Lon	NW	WM	NGN[1]	Sc	So	WWU	Industry
Labour	4.31	-25.1	4.42	3.47	4.89	3.61	-17.5	4.89	-17.0
Sparsity	-0.8	0.72	0.50	0.07	-0.5	-1.3	0.44	-2.6	-3.5
Urbanity	-0.5	-14.0	0.13	0.09	0.19	0.10	-5.5	0.09	-19.4
Salt cavity			-0.6						-0.6
Total	3.01	-38.4	4.47	3.63	4.58	2.38	-22.5	2.34	-40.5

[1]NGN's salt cavity adjustments is applicable only to the GDPCR1 period

RIIO-2 Guidance

Companies should be able to sufficiently justify that:

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

Regional Labour: GD2 Cost Assessment Methodology

1. As at GD1, we intend to apply pre-modelling adjustments
   a. A conceptually simple approach
   b. A clear monetary effect on specific activities

2. A within-model explanatory variable is unsuitable
   a. Poor regulatory precedent (Bristol Water 2015)
   b. Practical considerations to overcome, use of labour price indices historically unsuccessful

Urbanity/Sparsity: GD2 Cost Assessment Methodology

1. As at GD1, we intend to apply pre-modelling adjustments
    a. A conceptually simple approach
    b. A less clear monetary effect on specific activities (compared to labour) and still some methodology issues to consider

2. We may still explore a within-model 'density' explanatory variable for some models
    a. Early model testing not promising – relationship between density and costs somewhat ambiguous, variable may be capturing other effects
    b. "Further work is required to construct a suitable sparsity/density measure and to understand whether including such a measure in the regressions is a feasible approach to accounting for this regional factor" – Oxera (WWU)
    c. We intend to compare the shortlisted Emergency and Repair models (with pre-model adjustments) against models with different density variables

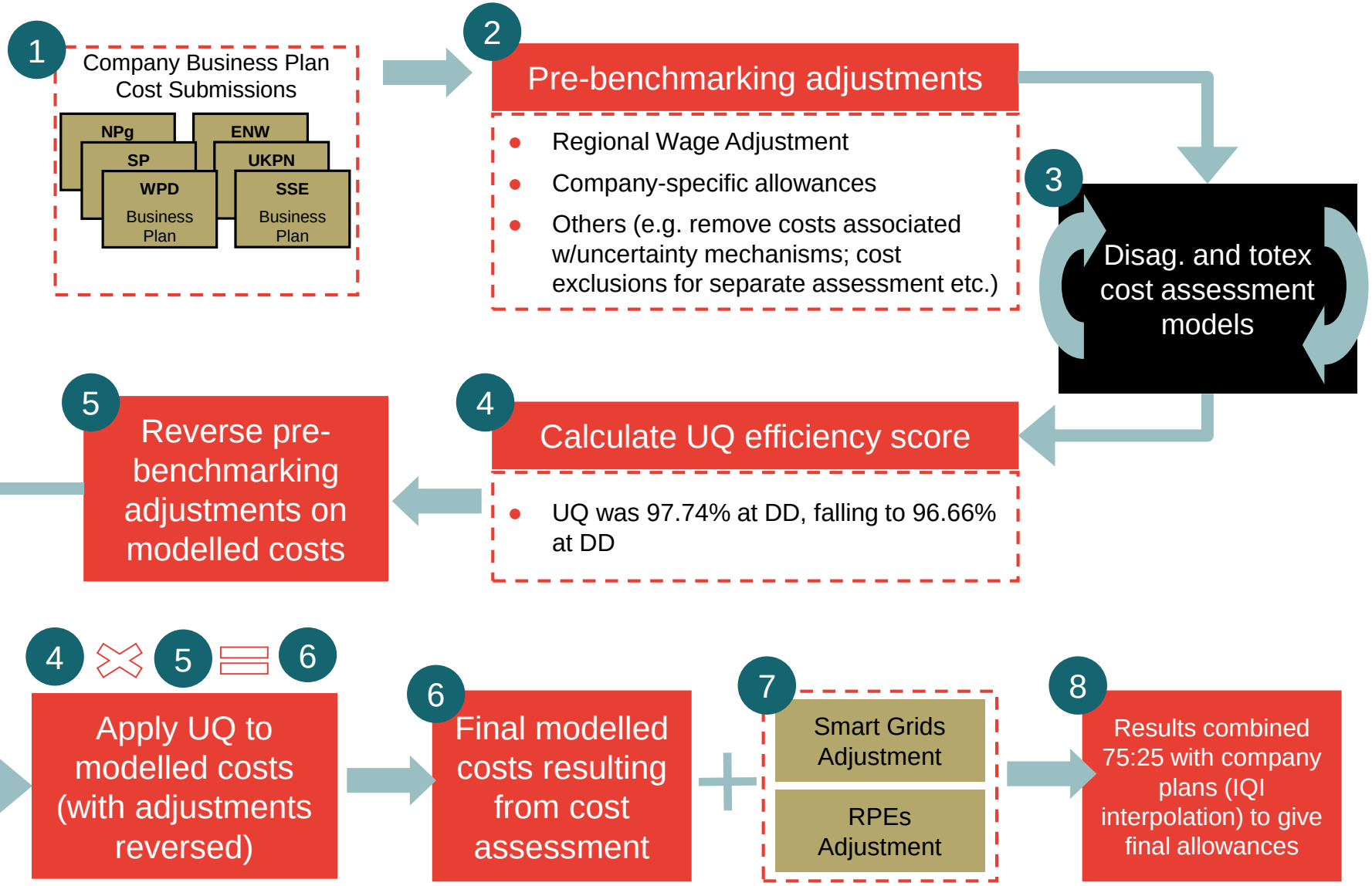
Company Specific Factors

1. GDNs have the opportunity to respond to other GDNs' company-specific factors.

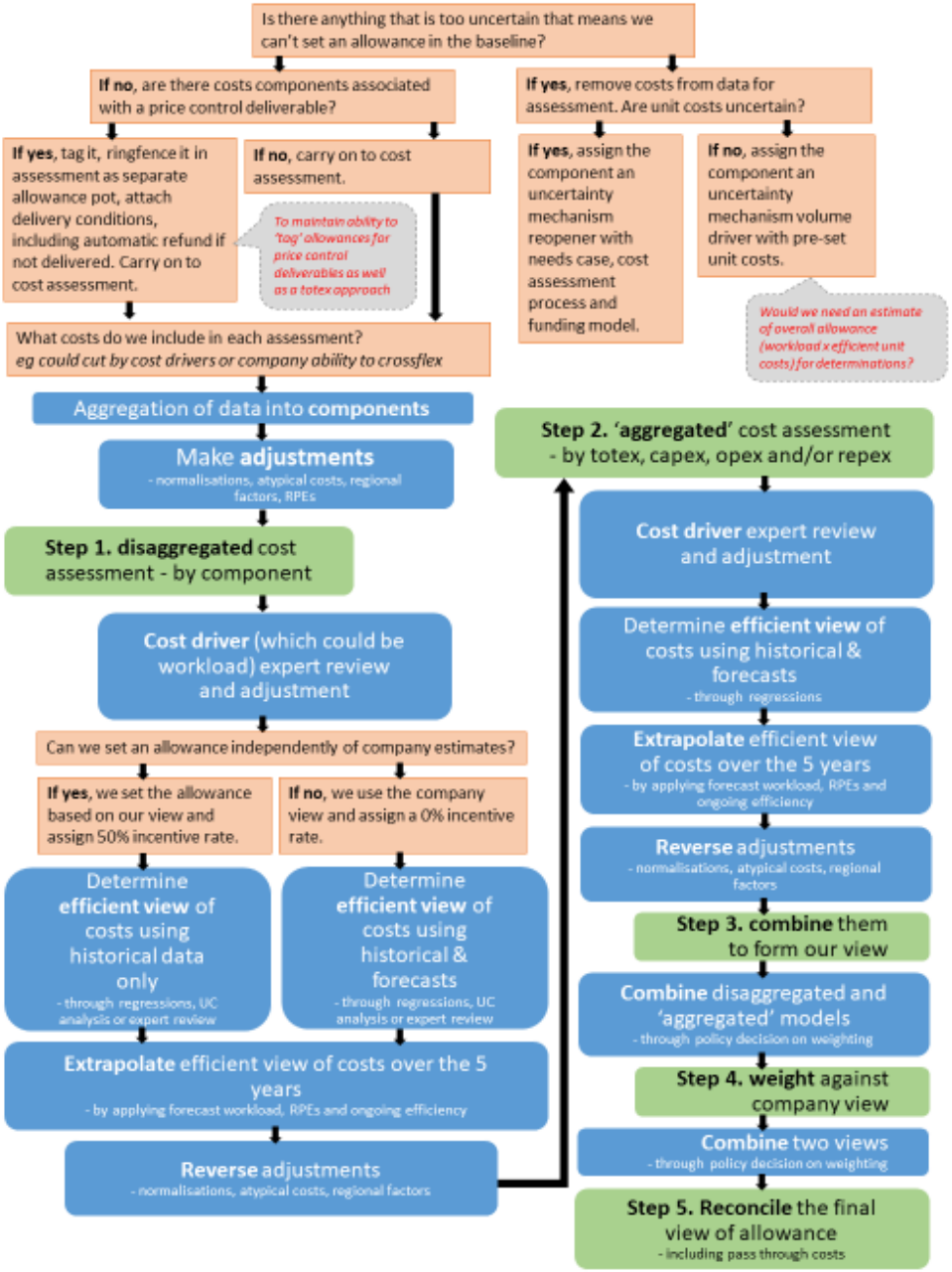
2. Note that we have not set a particular materiality threshold for regional and company-specific factors.

How it all fits together – Cost Assessment principles for ED2

Reminder of flow of models/adjustments etc.



For info - overview of GD2 approach



Actions, Next Steps, AOB

- The next meeting will take place on 13th March. It will be in London.
- We will circulate notes and an actions log from this meeting.

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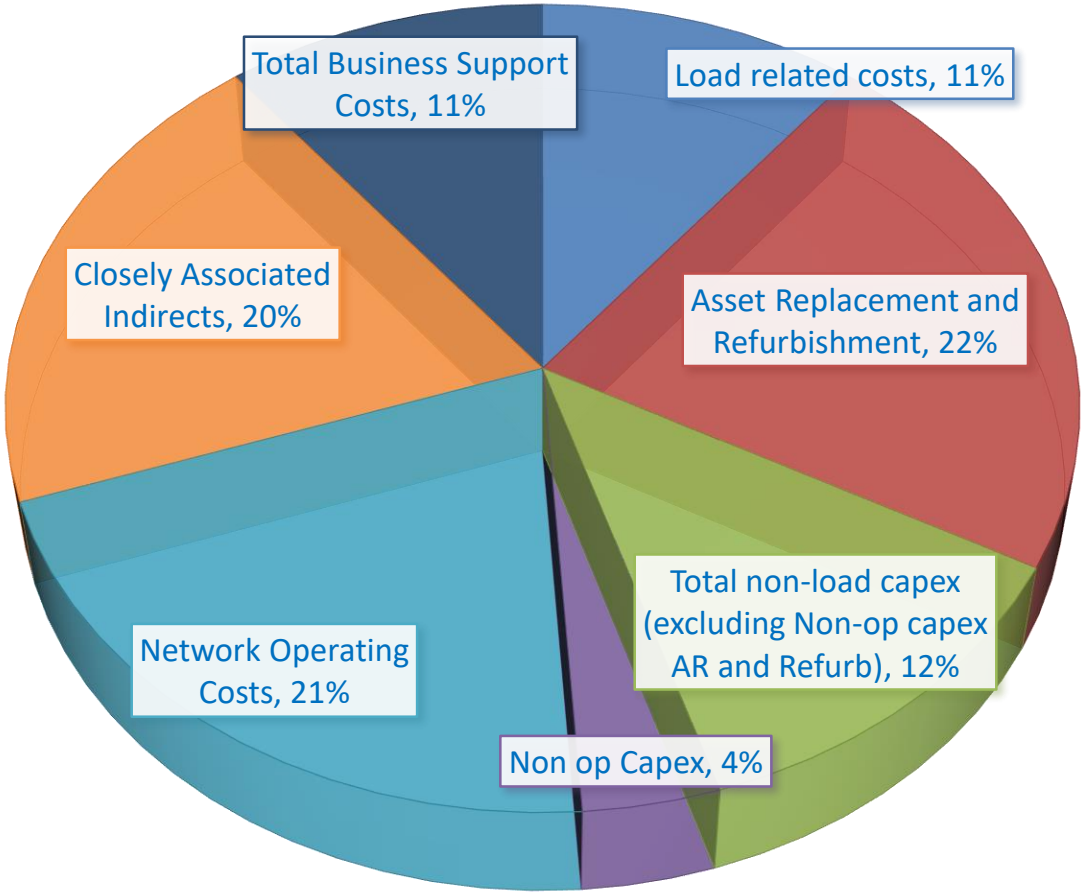
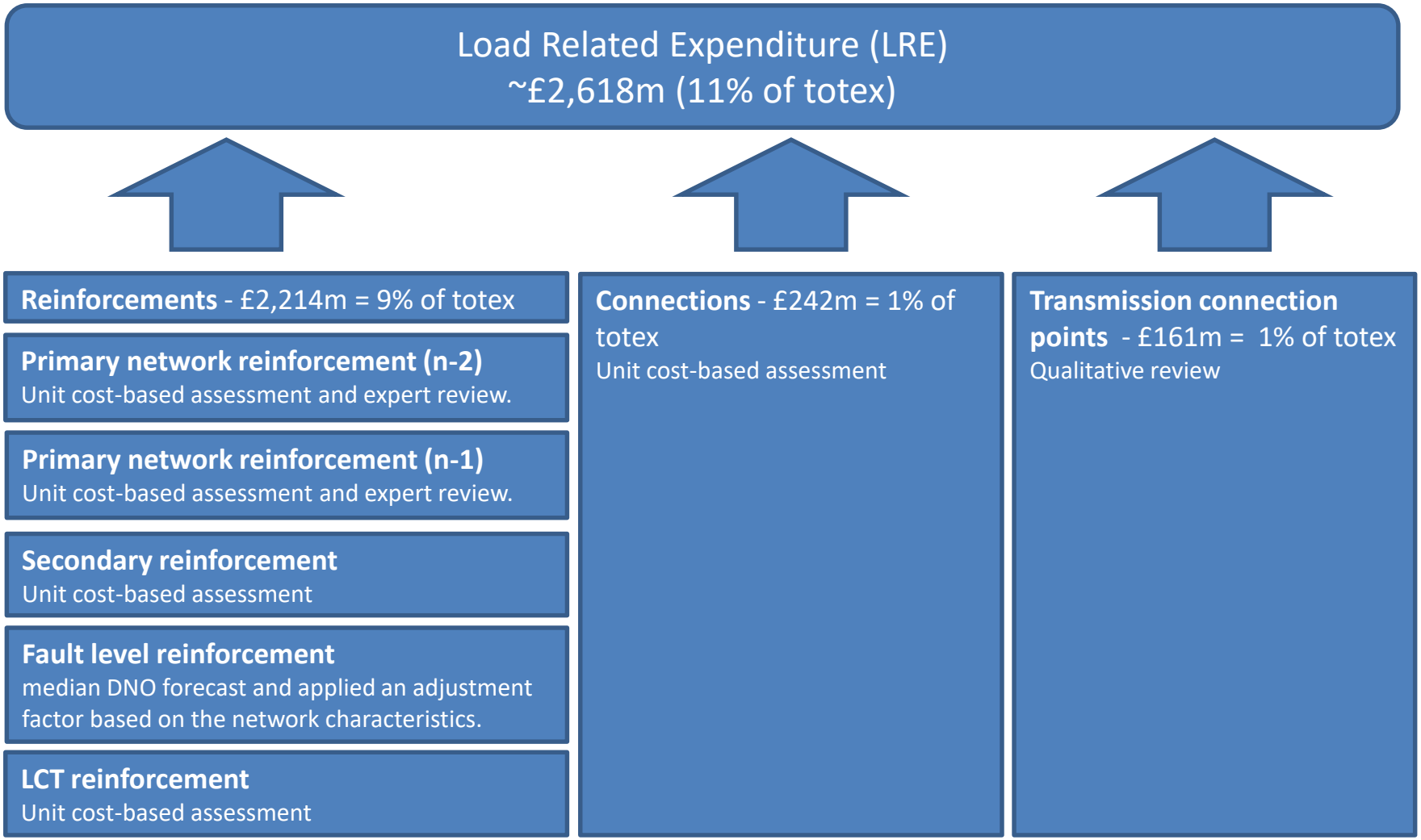
Annexes

Annex A – Overview of Disaggregated Totex Models

RIIO-ED1: PERCENTAGE BREAKDOWN OF TOTEX ALLOWANCES



Overview of Load categories



Overview of Non-Load categories

Non-Load Related Expenditure (NLRE) excluding Non-op Capex, AR and Refurb ~£3,007m (12% of totex)

Diversions - £714m = 3% of totex
Unit cost-based assessment using eight years of RIIO-ED1 data.

Losses and environment - £116m = 0.5% of totex
Unit cost-based assessment bespoke to each category, but generally median unit costs using 13 years of data.

Operational IT&T - £442m = 2% of totex
Quantitative and Qualitative assessment. Unit cost-based assessment using MEAV as cost driver and 13 years of data.

Civil works - £725m = 3% of totex
Run rate analysis.
Unit cost-based assessment

ESQCR - £199 = 1% of totex
Lower of modelled or submitted costs. Unit cost-based assessment at each voltage using 13 years of data.

Black Start - £55m = 0.2% of totex
Unit cost-based assessment using eight years of RIIO-ED1 data.

BT21C - £74m = 0.3% of totex
Unit cost-based assessment using 13 years of data.

Improved Resilience
Technical review.

Legal & Safety -£446 = 2% of totex
Lower of modelled or submitted costs. Unit cost-based assessment at each voltage using 13 years of data.

Flood Resilience - £101m = 0.5% of totex
Risk-based approach. Unit cost of each risk point reduced/maintained the lower of the DNO's own and the industry LQ. Unit cost applied that to the delta.

Rising and Lateral Mains (RLM) - £177m = 0.7% of totex
Unit cost-based assessment based on customer numbers as cost driver using all 13 years of data.

Overview of Non-Load categories

Asset Replacement and Refurbishment
~£5,445m (22% of totex)

Asset Replacement £4,751m = 19% of totex
Age-based survivor model, run rate analysis and qualitative assessment. Unit cost-based assessment and expert review.

Refurbishment - £611m = 3% of totex
Run rate analysis and qualitative assessment. Unit cost-based assessment and expert review.

Overview of NOCs categories

Network Operating Costs (NOCs)
~£5,110m (21% of totex)

Faults/ Trouble Call - £2,752m = 11% of totex

HV & LV Overhead lines, and Plant and Equipment
Three regressions (fault volumes as driver)

Occurrences not incentivised (ONIs) – x1 Regression (ONIs volume) (£557m)

132kV to LV Network Faults (excl above) – x15 bespoke assessment (fault volumes)– unit cost-based assessment

1 in 20 Severe Weather Exceptional Events– x1 bespoke assessment (£107m)

Tree-cutting - £887m = 3% of totex

"ENATS 43-8" Tree cutting– x1 Regression using spans cut as driver (alternative drivers considered but not used)

"Resilience" Tree cutting– ETR 132 unit cost assessment (excl. NPg)

I&M - £1,060m = 4% of totex

Inspection and Maintenance– x1 Assessment based on Total I&M £m/MEAV OHL+Plant

NOCs Other - £256m = 1% of totex

Substation Electricity– x1 unit cost assessment

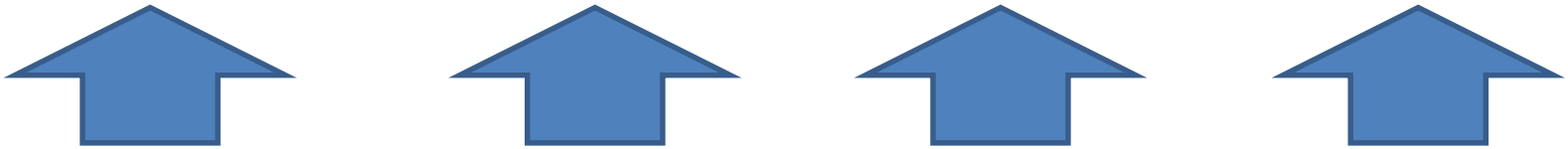
Dismantlement– x1 bespoke assessment – annual DR5 spend

Remote location generation (fuel)– annual DR5 spend

Remote location generation (fuel)– Annual DR5 spend

Overview of Indirects

Closely Associated Indirects (CAIs)
~£4,818m (20% totex)



CAIs network design and engineering, project management, system mapping, EMCS, stores, network policy, control centre, call centre– Regression analysis

CAIs wayleaves – Unit cost-based assessment using 13 years of data and total network length as cost driver.

CAIs vehicles and transport –
Assessed with non-op capex vehicles. Unit cost-based assessment using 13 years of data and total network length as cost driver.

CAIs op training and workforce – Unit cost-based assessment on DNO employee numbers.

Overview of Indirects

Business Support Costs (BSC) ~£2,607m (11% of totex)

BSC finance & regulation, HR & non-op training, property management and CEO – Unit cost-based assessment using 13 years of data and MEAV as cost driver.

BSC IT&T – Quantitative and qualitative assessment and expert review. Unit cost-based assessment using 13 years of data and MEAV as cost driver.

Non-op Capex ~£930m (4% of totex)

Non-opex capex IT&T – Quantitative and qualitative assessment, expert review. Unit cost-based assessment using 13 years of data and MEAV as cost driver.

Non-opex capex Vehicles and transport – As per CAI vehicles and transport.

Non-opex capex Property – Lower of DNO's own or industry annual average RIIO-ED1 cost.

Non-opex capex Small tools, equipment, plant and machinery –Unit-cost based assessment using 13 years of data and MEAV as cost driver.

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