ARUP

Electricity North West Limited

Non-load Related Capex Summary Final Report

April 2020

ARUP

Covering Letter

Dear Sirs/Madams

Electricity North West Limited – Non-Load Related Capex Summary

In accordance with the terms of reference set out in our engagement letter dated March 2020, (the "Engagement Letter") we enclose our Draft Report (the "Report") in relation to the summary of our non-load related capex review associated with our vendor due diligence review in 2019 (the "Project"). The basis of preparation of our work to date is attached. Those terms of reference comprise the agreed scope of our work to date, directed at those issues which you determined to be critical to the valuation. You should note that our findings do not constitute recommendations to you as to whether or not you should proceed with the proposed transaction.

This document is private and confidential and is intended only for the information of the addressee. It may not be copied or distributed without our prior written consent.

The information contained in this the document is supplied to the addressee only on the condition that Arup and any employee of Arup are not liable for any error, or inaccuracy contained therein, whether negligently caused or otherwise, or for any loss or damage suffered by any person due to such error, omission, or inaccuracy, as a result of such supply.

This report is addressed to you in accordance with the terms of the Engagement Letter.

Yours faithfully

Project Director

James Theobalds
Transaction Director

t +44 (0)20 7755 4318
m +44 (0) 77 1306 8059
e James.Theobalds@arup.com

Ove Arup & Partners Ltd
13 Fitzroy Street
London
W1T 4BQ

Claire Beaumont
Transaction Associate Director

t +44 +44 (0)20 7755 5316
m +44 +44 (0) 78 8127 4809
e Claire.Beaumont@arup.com

Ove Arup & Partners Ltd
13 Fitzroy Street
London
W1T 4BQ

ARUP

Glossary of Terms

Glossary	
AMS	Asset Management System
BAU	Business as Usual
Capex	Capital Expenditure
CBP19	Company Business Plan 2019
CNAIM	Customer Network Asset Indices Methodology
CoF	Consequence of Failure
CPI	Consumer Price Index
CPIH	Consumer Prices Index including owner occupiers' housing costs
DNO	Distribution Network Operator
DPCR	Distribution Price Control Review
DSO	Distribution System Operator
EHV	Extra High Voltage
ENWL	Electricity North West Limited
HV	High Voltage
IQI	Information Quality Incentive
IRM	Innovation Rollout Mechanism
LV	Low Voltage
NIA	Network Innovation Allowance
NIC	Network Innovation Competition
NMS	Network Management System
Ofgem	Office of Gas and Electricity Markets
OHL	Overhead Line
Opex	Operational Expenditure
PCFM	Price Control Financial Model
PoF	Probability of Failure
RIIO	Revenue, Incentives, Innovation, Outputs
RMS	Risk Management System
RPI	Retail Price Index
SAMP	Strategic Asset Management Plan
SDS2017	Strategic Direction Statement 2017
TIM	Total Incentive Mechanism
TOTEX	Total Expenditure
VDD	Vendor Due Diligence
VOLL	Value of Lost Load
WJBP	Well Justified Business Plan
WSC	Worst Served Customers

Important Notice

This report has been prepared specifically for and under the instructions and requirements of Electricity North West Limited (our "**Client**") under an Appointment dated 23rd March 2020 in connection with this Project.

This report is prepared for use by our Client only. We do not in any circumstances accept any duty, responsibility or liability to any third party whatsoever. Accordingly, we disclaim all liability of whatever nature (including in negligence) to any third party other than to our Client.

In preparing this report we have relied on information provided by others and we do not accept responsibility for the content, including the accuracy and completeness, of such information. In no circumstances do we accept liability in relation to information provided by others. For the avoidance of doubt, Arup has not carried out any audits of information provided as part of this review.

We emphasise that any forward-looking projections, forecasts, or estimates are based upon interpretations or assessments of available information at the time of writing this report. The realisation of the prospective financial information is dependent upon the continued validity of the assumptions on which it is based. Actual events frequently do not occur as expected, and the differences may be material. For this reason, we accept no responsibility for the realisation of any projection, forecast, opinion or estimate.

Findings are time-sensitive and relevant only to conditions at the time of writing this report We will not be under any obligation to update the report to address changes in facts or circumstances that occur after the date of our report that might materially affect the contents of the report or any of the conclusions set forth therein.

No person other than our Client and any party to whom reliance has been expressly permitted by us pursuant to a reliance letter may copy (in whole or in part), use or rely on the contents of this report without our prior written permission. Any copying or use of this report (in whole or in part) whatsoever shall be accompanied by or incorporate this notice at all times.

We accept no responsibility for, and have not authorised, the contents of any report, prospectus, supplementary prospectus, listing particulars, supplementary listing particulars, presentation or other document or communication in respect of the sale, acquisition, offering or transfer of any shares or securities or interest in them, whether on the primary or secondary market or otherwise, which uses, includes or incorporates any report, deliverable or information, or any element thereof, prepared by us under or in connection with our Appointment.

Contents

ARUP

ENWL: Non-load Related Capex Summary

Section 1: Introduction

ARUP

1. Introduction

This report condenses Arup's 2019 analysis pertaining to the Non-Load Related Capex component of ENWL's totex.

Basis of Preparation

- This report is a summary based on previous work undertaken by Arup over the period November 15, 2018 and March 11, 2019 as part of the Vendor Due Diligence process for Electricity North West Limited.
- It is important to note that our analysis from our previous vendor due diligence (VDD) work has not been updated to reflect any further developments from ENWL, Ofgem or other relevant bodies.

Context of this report

- As part of the Vendor Due Diligence of ENWL's electricity distribution network, Arup carried out an independent analysis of ENWL's totex.
- The totex analysis was composed of an investigation of the company's historical cost breakdown and efficiencies, as well as a forecasting exercise where Arup provided a forward outlook of the various totex sub-categories.
- Totex was broken down into the following components in line with the cost categories reported by Ofgem's Price Control Financial Model (PCFM): load related capex; non-load related capex; faults; tree cutting; controllable opex.
- The following report summarises Arup's totex analysis with a focus on the non-load related capex (NLRC) up to the end of the next price control period, RIIO-ED2 (i.e. up to 2028).
- In doing so we provide:
  - A summary of 3 key considerations impacting NLRC spend. In particular we touch on:
    - The asset management approach undertaken by ENWL;
    - Technical findings regarding asset condition which support our forecasting work; and
    - Relevant innovation projects undertaken by the company which are expected to deliver future cost efficiencies in NLRC spend.
  - An overview of ENWL's expected ED1 NLRC cost make up based on information provided by Management;
  - Our independent bottom-up forecasts for RIIO-ED2 and the methodology underpinning our asset replacement and refurbishment volume requirement outlook.

Category details and Items Contained

Category	Sub-category	Items contained
Non-load related capex – Asset Replacement	Asset Replacement	
	Refurbishment	Refurbishment SDI; Refurbishment no SDI
	NLRC – AR - Residual	Civil Works Condition Driven; Diversions (Excluding Rail Electrification); QoS; Legal & Safety; Rising and Lateral Mains; Flood Mitigation; Overhead Line Clearances; Losses; Blackstart; Environmental Reporting; Diversions (Rail Electrification); Physical Security; IRM – Smart Street
Non-load related capex - Other	Operational IT and Telecoms	
	Worst Served Customers	
	NLRC – Other - Residual	IT and Telecoms (Non-Operational); Vehicles and Transport (Non-Operational); Visual Amenity; Small Tools and Equipment; Property (Non-Operational); BT21CN; Deduct: Cash proceeds from sales of assets and scrap

Source: Arup analysis

ARUP

1. Introduction

ENWL is a regulated distribution network, operating under the RIIO framework established by Ofgem, which determines its targets and revenue. The RIIO framework has been in operation since 2013.

Overview

- At RIIO-ED1 (2015-2023), Ofgem moved to a totex based approach for assessing and setting DNOs' costs over the price control. This approach was implemented in order to incentivise companies to use the most cost-effective solution to an investment decision, regardless of it being a capex or opex-based solution.
- In submitting their business plans, DNOs were required to put forward their totex forecast for the eight year price control period. Companies were incentivised to submit accurate costs through the Information Quality Incentive (IQI). Under this mechanism, where the DNOs' view of costs are closer to Ofgem's view of efficient costs, DNOs receive a higher efficiency incentive rate.
- At ED1, Ofgem determined that ENWL's cost submission was closest aligned to Ofgem's view of efficient costs. Ofgem's cost assessment modelling determined an adjusted final totex for ENWL of £1,810m, resulting in an efficiency score of 0.99.
- Consequently, of the slow tracked DNOs, ENWL received the highest efficiency incentive rate, and is allowed to retain 58% of any cost outperformance with investors, over the duration of ED1.
- The RIIO framework will continue to apply over the foreseeable future and Ofgem has already announced that it will revert back to 5-year price controls for ED2.

Non-load Related Capex

- NLRC is an important component of totex, making up c. 41% of ENWL's ED1 totex.
- NLRC is composed of NLRC – Asset Replacement and NLRC - Other. Spend in these areas are affected by the following factors, discussed further in Section 2:
  - **Asset Management Approach:** ENWL combine a balance of providing a reliable network, while ensuring the safety of operators and general public as well as delivering cost efficiencies and affordability to customers. Effective asset management not only enables performance optimisation for these objectives to be met, it minimises the costs and risks of ownership throughout the lifecycle of the assets and thus provides important context for assessing NLRC.
  - **Asset Characteristics and Condition:** Following from the previous point, the make-up, age and risk profiles of the asset base determines the magnitude and timing of NLRC spend incurred.
  - **Innovation:** Innovation is one of the 3 key elements of the RIIO framework and ENWL has a proven track record of developing and deploying innovative technical solutions, for instance to improve asset lives. Historically these have delivered a host of business benefits in terms of cost reduction and thereby impact NLRC spend.
- The above feed in to ENWL's ED1 NLRC spend projections and Arup's view on ENWL's ED2 NLRC spend in Section 3.

ARUP

1. Introduction

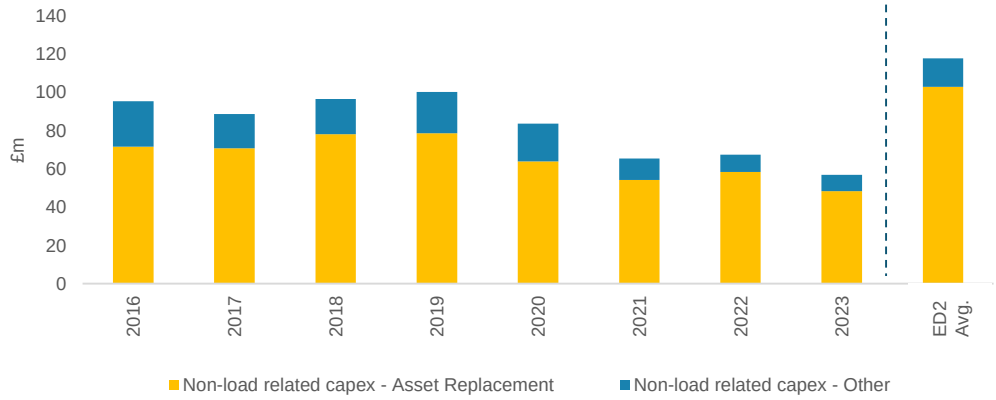
Non-load related capex spend is on average £82m p.a. in ED1. Our forecasts anticipate 3.7% of ENWL's assets being replaced and 0.5% being refurbished over ED2, driving non-load capex spend up to an average of £118m p.a.

Overview

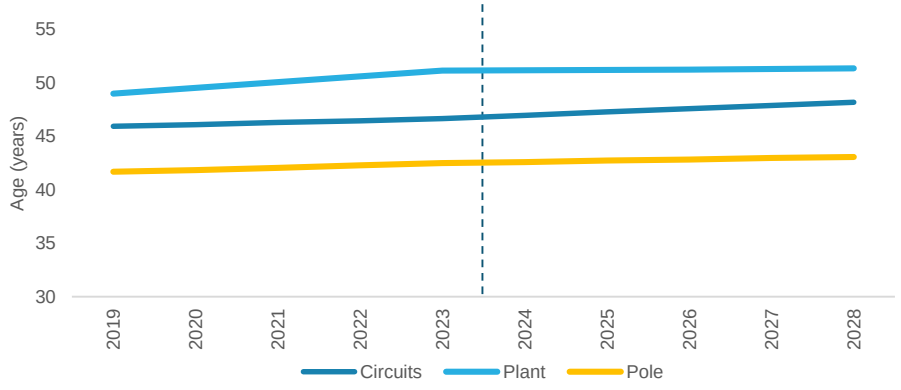
- Non-load Related Capex (NLRC) is a significant proportion of ENWL's totex, making up c. 41% of total ED1 totex spend forecasted by Management. It is composed of NLRC – Asset Replacement and NLRC – Other.
- In ED2, we foresee greater NLRC spend at a level of £118m on average p.a., up from £82m on average p.a. in ED1, owing primarily to increases in asset replacement volumes.
- ENWL employs asset management strategies that are in line with industry best practice and innovation is playing a key role in ensuring cost efficiencies can be borne. Assets are generally maintained in good condition, with a very limited number of assets having high health and criticality indices.
- The table below displays Arup's forecast of replacement and refurbishment volumes for ED2. We forecast 3.7% of ENWL's assets being replaced, and 0.5% being refurbished.
- As can be seen on the figure to the right, weighted average asset age for ENWL assets are broadly stable across ED2, as is the case in the last five years of ED1. The average age is considered appropriate for the asset categories and the figure demonstrates that the forecast capex is suitable for maintaining the network at a consistent standard.

Intervention Type	Volumes	%
Assets Replaced	189,863	3.7%
Assets Refurbished	24,633	0.5%
Total Interventions	**214,497**	**4.2%**
Current Asset Size	5,162,842	

Non load related capex - £m (2012-13 prices)



Weighted Average Age of the 2017/18 ENWL Asset Portfolio



Source: Arup analysis

ARUP

ENWL: Non-load Related Capex Summary

Section 2: Factors Impacting Non-load Related Capex

ARUP

2. Factors affecting NLRC - Asset Management Approach

ENWL's Asset Management Approach effectively combines a balance of providing a reliable network, while ensuring the safety of operators and general public as well as delivering cost efficiencies and affordability to its customers.

Asset Management Approach

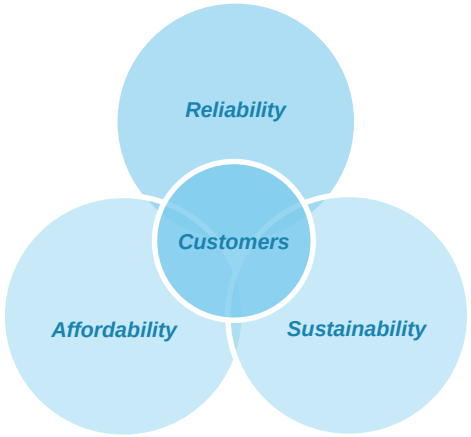
Policy and strategy setting

- ENWL's approach to asset management includes both long term and short term strategies, which are in line with industry good practice:
  - ***Long-term strategy:*** A Strategic Direction Statement (SDS) that highlights the development considerations of the network to 2050 and beyond; and
  - ***Short-term strategy:*** A Strategic Asset Management Plan (SAMP) that focuses on managing the network in the nearer term.
- As part of the short term strategy, ENWL produces and maintains the SAMP as well as an Asset Management Approach. The core principles underlining ENWL's strategy are:
  - Maintain network operation to ensure risk to the network operators and general public is properly managed;
  - The service to customers shall have continuous improvement in order to meet customers' needs and expectations;
  - While remaining consistent with the two points above, the network will be designed, constructed, operated, maintained and dismantled while minimising its whole life cost;
  - Decisions will be informed by the best available asset data held by ENWL and risk assessments carried out in line with the company's risk assessment procedures;
  - The asset management strategy for each major asset type will be incorporated into the annually reviewed Business Plan.

Continuous improvement

- ENWL also focuses on continuous improvement as part of its asset management. One element of this is to take part in stakeholder engagement, feedback from which has helped ENWL iteratively develop and refine the BP and asset management approach.
- In response to the stakeholder expectations, there are four key themes within the BP with customers at the heart of ENWL's priorities.
- The schematic opposite details ENWL's priorities along with a brief description and how the priorities interact with each other.
- Overall, Arup is of the opinion that ENWL displays good industry practice with regards to their asset management approach and in line with other DNOs both in the UK and internationally.

ENWL Priorities



Reliability
- Keeping the lights on and responding quickly to network faults

Affordability
- Providing an affordable, value for money service for all, while helping to address fuel poverty and providing support for vulnerable customers

Sustainability
- Ensuring the network can adapt to future challenges such as a low carbon economy and climate change, while keeping bills affordable

Vulnerable Customers
- Providing excellent customer service to all customers, especially those who are vulnerable or need extra assistance

Source: Arup representation of ENWL Priorities

ARUP

2. Factors affecting NLRC - Asset Management Approach

ENWL has an effective and robust approach to Asset Management. It has demonstrated compliance against the requirements of the internationally recognised standard ISO55001 since 2015.

Asset Management Approach

Asset management system

- The ENWL Asset Management System is integrated with risk, quality, HS&E and financial management system requirements whilst also reflecting the evolving needs of all customers and stakeholders.
- The diagram opposite presents ENWL's management systems; covering business, risk and asset management. In order for operations to support the strategic objectives of the business, interaction between the three systems is necessary and ENWL has demonstrated to Arup that this is in place.
- The graphic demonstrates how ENWL's strategic objectives are passed down throughout the business. The efficacy of this dissemination is a key part of the ENWL's governance framework.

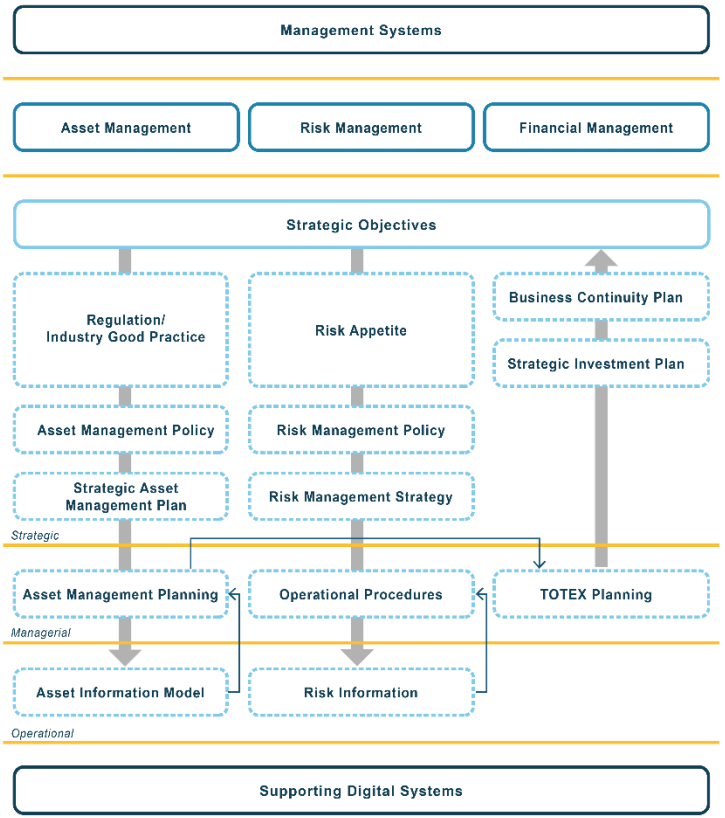
ISO55001 Certification

- ENWL achieved ISO55001 Certification in October 2015 having demonstrated a high-level of compliance and maturity against the International Standard for Asset Management.
- Subsequent annual audits have confirmed ongoing compliance with ISO55001 and demonstrated a continual improvement in Asset Management capability and maturity. The latest audit was in September 2018 and Management has confirmed that there were no major or minor non-conformities noted in the ISO55001 Certificate audit report.

Value of lost load

- In the UK there is an additional commercial measure of Value of Lost Load (VOLL) or dis-benefit to customers of a supply interruption.
- Research commissioned by ENWL (2018) reported that VOLL fails to recognise customer differentiation and may have led to poor investment decisions by DNOs previously. As part of ENWL's investment decisions, this VOLL and its impact on its customers is now taken into account, putting the customer at the heart of network investment decisions helping ENWL optimise against Ofgem allowances.
- Using VOLL as part of investment decisions has recently become standard in the UK, however is not widely used globally. It is considered an effective additional approach to ensuring investment is targeted to improve the network for customers and provide value where needed most.

Asset Management Approach



Source: Arup Effective Management Systems

ARUP

2. Factors affecting NLRC - Asset Management Approach

ENWL's Asset Management Approach combines a balance of providing a reliable network, while ensuring the safety of operators and general public as well as delivering cost efficiencies and affordability to its customers.

Overview

Planning and decision making

- ENWL has three levels of asset management to achieve the best returns for stakeholders:

Real Time	• System faults • Third party damages • Natural phenomena
Non-load Related	• Replaced due to deterioration • Fix on fail
Load Related	• Increased capacity - organic growth • Increased capacity - customer requirement

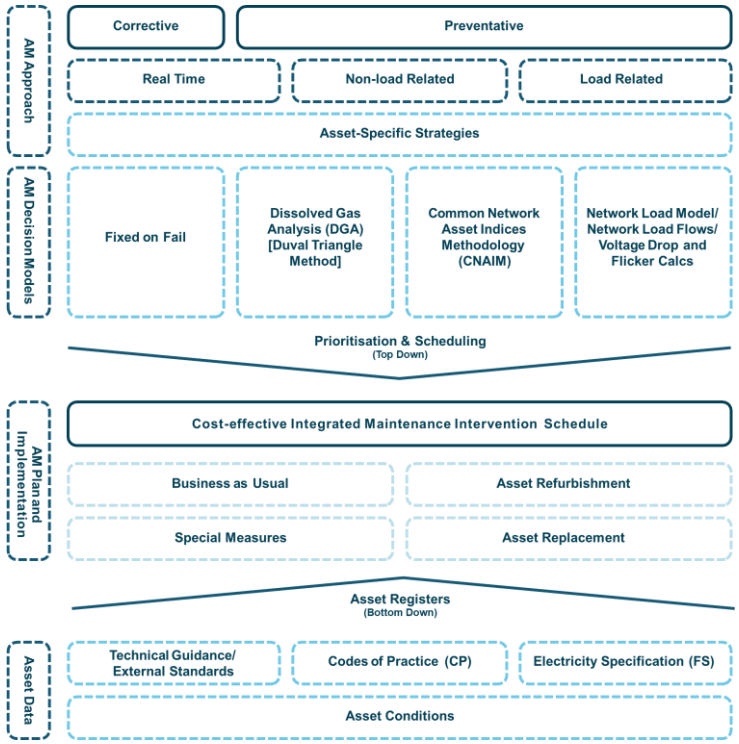
Asset management process

- The three levels that form ENWL's approach to asset management allow the operations and maintenance teams to determine when and how to intervene on the assets during their lifetime.
- Asset condition and integrity information from the ENWL Asset Registers is also utilised as an input into the intervention schedule having been collected from on-site inspections.
- The diagram opposite shows how the combination of a top-down and bottom-up approach has been used to develop the cost-effective, integrated maintenance intervention schedule for the assets. This combination is considered good industry practice.

The role of Operational IT

- ENWL uses a combination of software and hardware to aid in the company's asset management and continue to seek opportunities where IT can improve operations.
- While the majority of ENWL systems are hosted in-house across two dedicated data centres owned and operated by ENWL, the business also takes advantage of cloud solutions to provide some of it's services such as the Call Management System (STORM), Service Management Tool (Avanti) and Company website.
- The organisation is implementing a new Network Management System (NMS) to replace the legacy Thales based Customer Relationship Management Software (CRMS) system. This new system will improve the integration of services as well as enhance network automation.
- Arup considers the operational IT systems to be in line with other DNOs both in the UK and internationally.

ENWL Asset Management Process



Source: Arup representation of ENWL Priorities

ARUP

2. Factors affecting NLRC - Asset Management Approach

ENWL utilises the industry recognised CNAIM framework to provide a risk-based approach to prioritisation of intervention tasks associated with critical asset systems.

Asset Management Approach

Maintenance approach

- A number of asset-specific strategies have been developed by ENWL to document the specific requirements by asset type.
- These more detailed strategies help to define ENWL's practices with regards to routine maintenance, inspection activities and targeted interventions.
- Asset inspections also play an important role in managing the health of the ENWL network and are split into three main types:
  - Condition Data Capture;
  - Safety and Security;
  - High Risk.

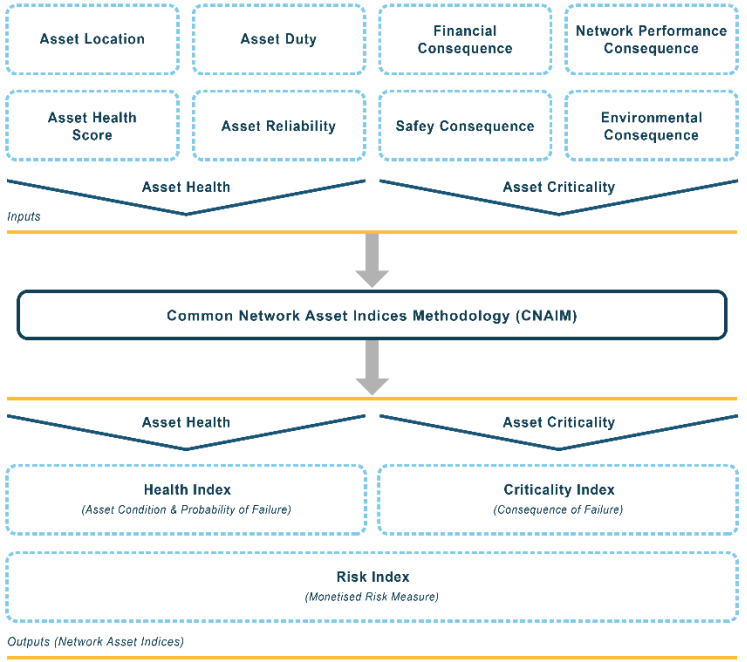
Asset decision support tool

- ENWL adopts the Common Network Asset Indices Methodology (CNAIM) as a common framework used across all UK DNO for the assessment, forecasting and regulatory reporting of Asset Risk. The process used to calculate the Network Asset Indices is briefly described in the adjacent chart. ENWL has implemented this process and maintain full records of the indices per asset category.
- Through CNAIM, ENWL monitors and predicts asset performance and behaviour, allowing the design of cost-effective intervention strategies which deliver enhanced performance and capacity at the most effective whole life cost.
- Condition-based risk is assessed in satisfaction of the requirements of Standard Condition 51 (SLC 51) of the electricity distribution licence for RIIO-ED1.
- For each asset, the Probability of Failure (PoF) per annum and overall Consequence of Failure (CoF) in £GBP are calculated based on various factors and combined to produce a monetised asset risk value, which considers the likelihood and consequential cost associated with any failures. The PoF and CoF values are also mapped to associated Health Index (HI) and Criticality Index (CI) values and used to produce risk matrices for all asset classes on an annual basis.
- An example is shown below, which displays the risk matrix for HV transformers.
- Those assets with the highest health and criticality indices are considered to pose the highest risk to the network. These are therefore prioritised as part of ENWL's non-load related capex (replacement and refurbishment) planning and contribute to ENWL's forecasting for upcoming regulatory control periods, as described further in the next section of this report.
- Further information about the health and criticality indices are provided on the following page.

	HI1	HI2	HI3	HI4	HI5	Total
C1	2,426	214	108	1	28	2,777
C2	10,714	856	419	19	70	12,078
C3	1,446	172	95	5	11	1,729
C4	41	1	27	-	1	70
Total	14,627	1,243	649	25	110	16,654

Source: ENWL Management Information

Common Network Asset Indices Methodology (CNAIM)



Source: Arup representation of Ofgem CNAIM

ARUP

2. Factors affecting NLRC - Asset Management Approach

The health and criticality index bands are recorded for each asset category block forming the risk matrices. These are used by ENWL to support their short term investment planning.

Health and Criticality Index Bands

Health index

- The PoF is associated with the Health Index. There are five Health Index Bands and a typical value of PoF is assigned to all assets within the same Health Index Band.
- The Health Index Bands and banding criteria are shown in the adjacent top right chart.

Criticality index

- The assets are categorised into Criticality Index Bands based on their CoF. There are four Criticality Index Bands (C1 – Low criticality, C2 – Average criticality, C3 – High criticality, C4 – Very High criticality).
- For each asset category, the Average Overall CoF is multiplied by a factor to determine the CoF for each Criticality Index Band as shown in the adjacent bottom right chart.

Risk metrices and monetised risk

- Matrices are developed to show the population of assets within a given asset category that have the same Health Index and Criticality Index.
- The monetised risk is calculated by multiplying the number of assets under each risk category with the associated asset risk value. The asset risk value can be calculated by multiplying the PoF with the CoF for each asset category.
- The Monetised Risk movements for each asset category over the RIIO-ED1 period are recorded and monitored against the targets.
- As discussed in the previous pages, ENWL utilises the risk matrices to support their short term investment planning, focusing their investments on those assets which are considered to have a poor health and criticality score. The approach that ENWL applies is in line with the methodology set out by Ofgem.
- When selecting assets that require intervention, ENWL can either replace or refurbish equipment, which ensures that ENWL is managing their assets under the most cost effective approach.

Health Index Banding Criteria

Health Index Band	Health Index Banding Criteria		Health score to be used to derive Average PoF
	Lower Limit of Health Score	Upper Limit of Health Score	
HI1	≥0.5	<4	4
HI2	≥4	<5.5	4.75
HI3	≥5.5	<6.5	6
HI4	≥6.5	<8	7.25
HI5	≥8	≤15	10

Criticality Index Banding Criteria

Criticality Index Band	Criticality Index Banding Criteria		
	Lower Limit of Overall CoF (as % of Average Overall CoF for the Asset Category)	Upper Limit of Overall CoF (as % of Average Overall CoF for the Asset Category)	Criticality Index Band
C1	-	< 75%	70%
C2	>= 75%	< 125%	100%
C3	>= 125%	< 200%	150%
C4	>= 200%	-	250%

Source: Management information

ARUP

2. Factors affecting NLRC - Asset Management Approach

The CNAIM framework is used for the monitoring of key assets. Where this methodology is not appropriate ENWL uses suitable and relevant alternatives.

Asset Management Approach

Risk-based approach

- The adjacent table highlights how CNAIM is utilised by ENWL throughout their asset portfolio as part of the asset management decision-making process.
- Where it is not possible to use CNAIM (e.g. where asset condition information is particularly hard to attain) the method used by ENWL has been provided within the table.

Spares management

- Minor consumables are held as spare parts, such as contacts and springs. There are also production spares held to facilitate ENWL's capital programme, such as joints and overhead line components.
- The consumables and production stock level held is sufficient to cover any maintenance and fault requirements across the network.
- To add resilience to the operation, dedicated equipment containers with legacy materials are available to allow a quick failure response and repair effort.
- These containers help to mitigate against the impact of severe weather events, e.g. allowing for quick remediation work to be carried out on older design overhead lines.

Asset Systems

Asset System	CNAIM	Commentary
Underground Solid Cables	n/a	Report commissioned to inform next steps to assess condition of cables
Fluid-filled Cables	✓	CNAIM used for prioritising Fluid Filled Cables removal
Service Cables & Terminations	n/a	Maintenance and refurbishment requirement covered in the Code of Practice
Rising & Lateral Mains (RLM)	n/a	Inspection and management has been completed to inform remediation
Switchgear	✓	CNAIM adopted for all switchgear types
Transformers	✓	CNAIM model also uses the results of oil analysis and partial discharge
Wood Pole Overhead Lines - Fitting & Conductors	n/a	Intervention programme is based on ongoing inspection of the lines
Wood Pole Overhead Lines - Structures	✓	CNAIM is used for the wood pole structures but not fittings and conductors
Steel Tower Overhead Lines	✓	CNAIM models are well developed for Steel Tower lines
Protection Systems	n/a	Interventions based on results of inspection and maintenance
Substations	n/a	Condition reports used to produce prioritised list for remedial work

Source: ENWL Asset Information

ARUP

2. Factors affecting NLRC - Asset Characteristics and Condition

The rate of undergrounding across the ENWL network stands at a level of 78% which is high in comparison to other UK DNOs.

Overview

- The physical properties and characteristics of key equipment owned and operated by ENWL are detailed below.
- Overall, the age and condition data for the network is generally very well known, with almost 100% of the network age reported.
- Assets are generally maintained in good condition, with a very limited number of assets having high health and criticality indices, which indicate a high monetised risk.
- A very limited number of assets are assigned simultaneously a high health index and a high criticality index. All of those assets considered as 'high risk' are included in ENWL's wider capex plan for asset replacement or refurbishment.

Power lines and poles

- The network comprises 132kV, EHV, HV and LV lines, which are either overhead lines or underground cables.
- The adjacent figures show the split between voltage levels for overhead lines and underground cables.
- Currently, 93% of the LV network length and 64% of the HV network length is cabled (underground). The combined underground cabling rate of the whole network is 78%.
- The rate of undergrounding across the network is high in comparison to other UK DNOs. It has the second highest rate of underground cables after the London Power Network (LPN).

Substations

- The network consists of grid, primary and secondary substations, with a total of 34,706 transformers, the majority of which are on the HV network.
- The HV transformers are split relatively evenly between being included as part of Ground Mounted (GM) substations and Pole Mounted (PM).

Grid substations

- Grid substations connect ENWL's network to the National Grid Transmission Network and are the main source of ENWL's connection to the wider UK electricity network.
- There are 17 grid substations on the ENWL network, which are equipped with 275/132kV transformers.

Bulk substations

- Bulk substations connect to the ENWL 132kV network. They are typically equipped with 2 transformers and are either 132/33kV or 132/11kV substations.
- Across the 81 bulk substations, the most common capacity is 117 MVA, which accounts for 50% of all substations.

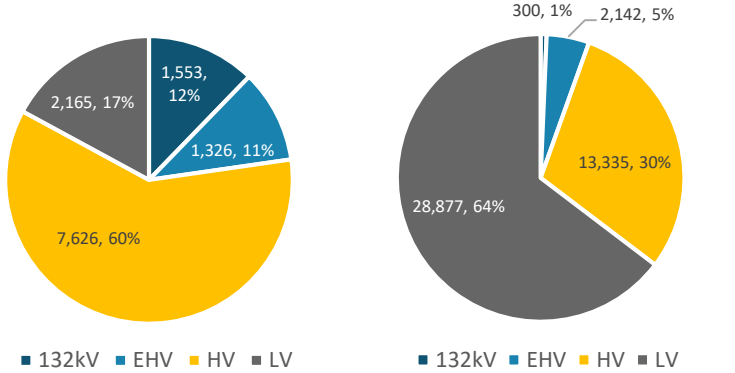
Primary substations

- Primary substations connect the EHV lines to the HV lines and distribute electricity to HV customers. They are either 33/11kV or 33/6.6kV substations.
- ENWL appears to have three primary substation designs that are used on a regular basis, with specific capacities of 17.5 MVA (8%), 20.5 MVA (5%) and 22.9 MVA (27%).

Secondary substations

- Secondary substations are either PM (51%) or GM (49%). They are equipped with either 11kV/LV or 6.6kV/LV transformers and they distribute electricity to LV customers.

Proportion of Overhead Lines and Underground Cables on the network (km, %)



Overview of asset age profile

Asset	Age Profile
LV	A high proportion of the LV network was built during the 1950s and 1960s, which is typical for a UK DNO.
HV	A large proportion of the network was built in the 1950s and 1960s. Additionally, a relatively high proportion of HV transformers and switchgear has been installed this century, indicating that the HV network is relatively young.
EHV	A high proportion of the EHV network was built during the 1960s and 1970s.
132 kV	The 132kV network age profile shows that the network has a varied age profile. These assets can be refurbished as opposed to replaced, which is why there is a relatively high level of older assets across the network.

Source: Management information and Arup analysis

ARUP

2. Factors affecting NLRC - Asset Characteristics and Condition

The risk matrices show a very low number of LV assets with high health index band and high criticality index resulting in a low risk to the network. Additionally, the fault rates are considered low.

Low Voltage Assets

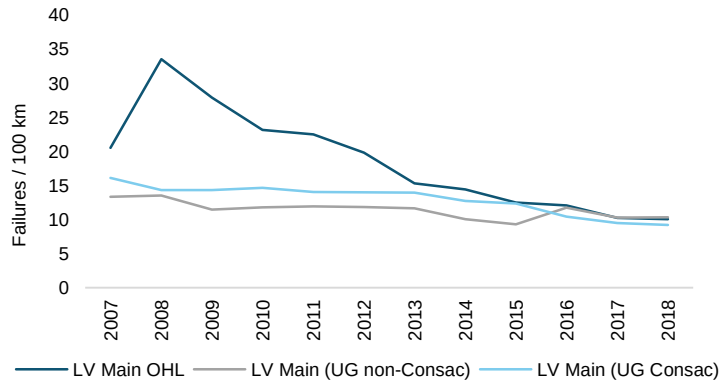
- The LV (0.4kV) network consists of LV overhead lines (OHL) and underground (UG) cables alongside LV switchgear, and LV services, which are identified as the final cabling (OHL or UG) between the LV network and the customers.
- The majority (81%) of the LV cables are paper insulated, with the remainder plastic. However, the type of insulation is typically determined by the installation date, i.e. ENWL ceased to install paper insulated cables in 1989, therefore the more modern cables use plastic.
- The LV OHL network is entirely supported by wood poles, which is typical for LV distribution networks.
- The LV switchgear across the network varies between circuit breakers and localised customer fuses.
- As can be seen on the adjacent risk matrix, the number of assets that are considered as high risk are very low when compared against the total number of assets on the network. This level of risk would be expected, particularly for the LV network where there is very little infrastructure that would be considered as critical.
- The fault rates for the LV network are on a reducing trend, particularly in the more recent years. This indicates that the LV network does not pose a risk to the functionality of the network. This ties in with ENWL's Customer Interruptions (CI) performance, which is one of the key metrics calculated as part of the UK DNOs incentive schemes. CI represents the number of customers interrupted per year and is directly impacted by the number of faults on the network. ENWL is ranked 3rd in the UK for CI performance, which indicates that faults are relatively low.
- The ENWL capex replacement plan for ED1 takes into consideration any higher risk assets and those with a poor health index score. Additionally, ENWL has deployed the Sapient technology, developed under its innovation programme to reduce the number of transient cable faults.

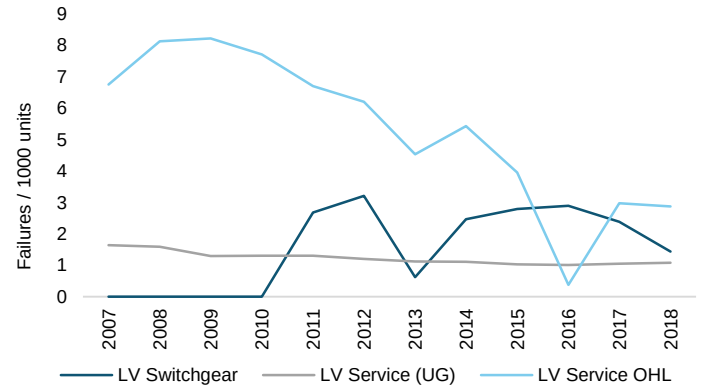
Risk Matrix - LV Network

	HI 1	HI 2	HI 3	HI 4	HI 5	Total
C1	4,817	532	90	34	13	5,486
C2	43,203	34,598	1,318	1,486	1,742	82,347
C3	1,568	689	35	52	8	2,352
C4	109	52	2	4	1	168
Total	49,697	35,871	1,445	1,576	1,764	90,353

Source: ENWL Management information and Arup analysis

LV Network Fault Rates





Source: ENWL Management information and Arup analysis

ARUP

2. Factors affecting NLRC - Asset Characteristics and Condition

The risk matrices show a very low number of HV assets with high health index band and high criticality index resulting in a low risk to the network. Additionally, the fault rates are considered low.

High Voltage Assets

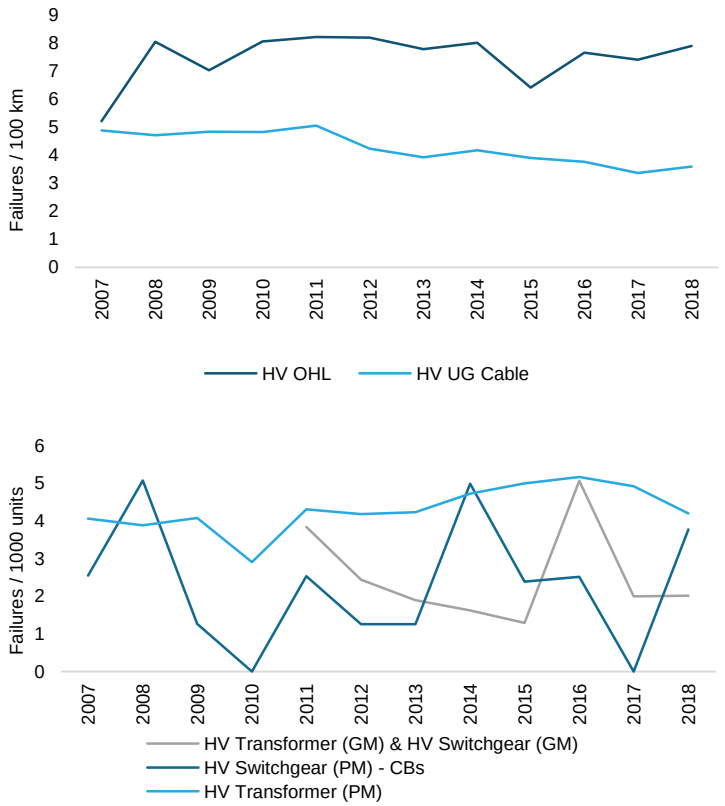
- The HV (6.6kV to 33kV) network consists mainly of HV OHL and UG cables as well as secondary substations, secondary transformers and switchgear.
- The highest proportion of OHLs on the ENWL network are incorporated as part of the HV assets, which amounts to 7,626km. Across the whole ENWL network, the conductor type of overhead lines varies significantly depending on the application. The most common conductor type is hard-drawn copper conductor (i.e. more than 50% of the total overhead line length).
- Similar to the LV network, the HV OHLs are predominantly supported by wood poles, which is also in line with what be expected for networks at this voltage level.
- The HV network secondary substations typically consist of secondary transformers and switchgear. The transformers are almost 50/50 split between pole mounted and ground mounted, which is reflective of ENWL's mixture of rural network, which would typically have pole mounted transformers, and urban, with ground mounted transformers.
- The below risk matrix shows a very low number of HV assets having simultaneously a high health index band and a high criticality index, particularly when compared with the high number of assets on the network. The majority of assets (84%) show a high health index of HI1 or HI2, which indicates that the network is maintained to a good condition.
- The network fault rates have been relatively steady throughout the reported period, shown in the adjacent charts. These rates are relatively low, particularly taking into consideration the network CI performance compared with other UK DNOs, as discussed on the previous page.
- The ENWL capex replacement plan takes into consideration any higher risk assets and those with a poor health index score. This is understood to maintain the network to support the continued low failure rates.

Risk Matrix - HV Network

	HI 1	HI 2	HI 3	HI 4	HI 5	Total
C1	2,426	214	108	1	28	2,777
C2	57,138	44,093	11,197	4,901	3,976	121,305
C3	11,587	9,245	2,024	378	342	23,576
C4	127	54	28	-	2	211
Total	71,278	53,606	13,357	5,280	4,348	147,869

Source: ENWL Management information and Arup analysis

HV Network Fault Rates



Source: Management information and Arup analysis

ARUP

2. Factors affecting NLRC - Asset Characteristics and Condition

The risk matrices show a very low number of EHV assets with high health index band and high criticality index resulting in a low risk to the network. Additionally, the fault rates are considered low.

Extra High Voltage Assets

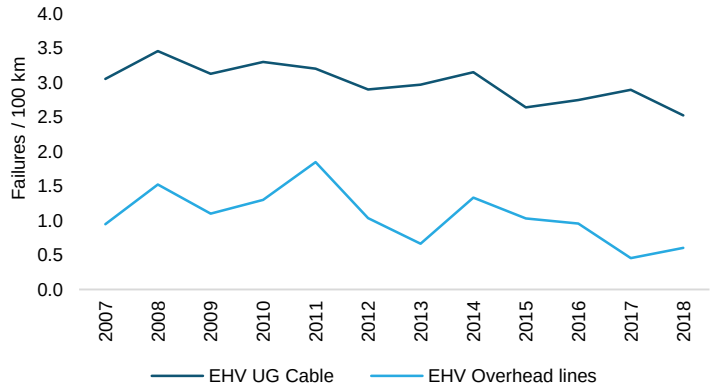
- The EHV (33kV) network consists of OHL and UG cables and equipment predominantly associated with the primary substations, i.e. primary transformers and ground mounted EHV switchgear.
- The EHV OHL network is predominantly supported by wood poles, at around 94%, which is typical for this voltage level in distribution networks.
- There are a total of 719 33kV primary transformers on the network. These transform down to 11kV, which then supplies the HV network.
- The switchgear on the EHV network is a combination of predominantly gas or oil insulated with some air insulated switchgear.
- The below risk matrix for the EHV network shows that there are very few assets having simultaneously a high health index band and a high criticality index, particularly when compared with the high number of assets on the network. Similarly to the HV network, the majority of EHV assets (i.e. 79%) are assigned a health index band of either HI1 or HI2 (new asset or with very good health score).
- The adjacent fault rate charts demonstrate that the fault rates are either declining or remaining relatively steady throughout the reported period.
- The ENWL capex replacement plan takes into consideration any higher risk assets and those with a poor health index score. This is understood to maintain the network to support the continued low failure rates.

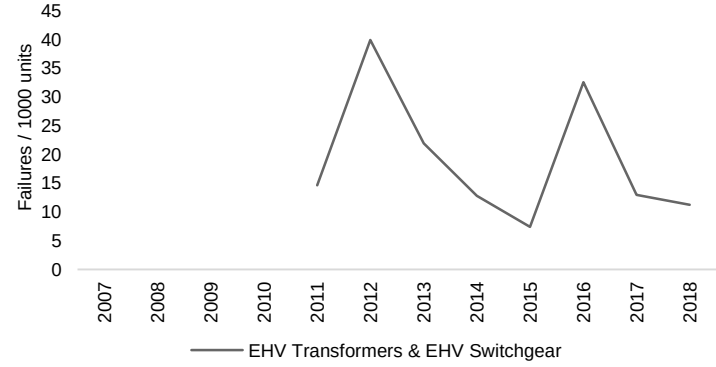
Risk Matrix - EHV Network

	HI 1	HI 2	HI 3	HI 4	HI 5	Total
C1	450	289	112	138	90	1,079
C2	9,074	4,228	1,948	695	596	16,542
C3	131	133	217	27	8	516
C4	118	60	10	7	2	197
Total	9,773	4,710	2,288	867	695	18,333

Source: ENWL Management information and Arup analysis

EHV Network Fault Rates





Source: ENWL Management information and Arup analysis

ARUP

2. Factors affecting NLRC - Asset Characteristics and Condition

The 132kV network comprises a low number of high capacity assets, therefore by nature these are more critical to the network. Those assets which are considered of highest risk are included as part of the current capex plan.

132kV Assets

- The 132kV network supports ENWL's connections to the National Grid transmission network and comprises of a relatively low number of high capacity assets, including OHLs and a small volume of UG cables as well as grid transformers and 132kV switchgear.
- Around 91.5% of the EHV OHL network conductors are supported by steel towers, which is typical for the UK at this voltage level.
- Similar to the EHV network, the switchgear is a combination of predominantly gas or oil insulated with some air insulated switchgear.
- As the 132kV assets are low in volume but high in capacity, they are by nature more critical to the network. This is reflected in the below risk matrix, which shows that 27 132kV assets have simultaneously health index band HI5 and criticality index C4. The 27 assets within the highest risk category are primarily fluid-filled cable lengths and are included within the current planned replacement programme for ED1.
- ENWL prioritise future interventions based on the monetised risk approach and seek to implement the most cost effective solution to these high risk assets through an innovative mix of refurbishment, reconfiguration and selective replacement.

Risk Matrix – 132kV Network

	HI 1	HI 2	HI 3	HI 4	HI 5	Total
C1	59	16	7	7	2	91
C2	1,743	745	6,130	1,029	432	10,078
C3	111	8	79	41	44	284
C4	10	17	33	19	27	106
Total	1,923	786	6,248	1,096	506	10,559

Source: ENWL Management information and Arup analysis

ARUP

2. Factors affecting NLRC - Innovation

Ofgem identifies innovation as the key to test and transform new technological, commercial and operational ideas into Business As Usual (BAU). ENWL's innovation strategy forms an integral part of the business plan.

Overview

- Ofgem identifies innovation as the key to test and transform new technological, commercial and operational ideas into future BAU practices within network operators.
- Ofgem started incentivising innovation via the Low Carbon Networks Fund (LCNF) during DPCR5, making £500m available to DNOs for small and large innovation projects.
- The RIIO Framework incentivises innovation through in-price-control funding (Network Innovation Allowance (NIA) and Innovation Rollout Mechanism (IRM)) and competition funding (Network Innovation Competition (NIC)).
- ENWL has embraced innovation as a cornerstone of its business and has invested extensively to continue operating a reliable and efficient network. The figure opposite summarises ENWL's innovation lifecycle strategy.
- ENWL has a proven track record of developing and deploying innovative technical and commercial techniques to consistently outperform regulatory allowances.
- In DPCR5 (2010-2015), the business developed a range of technologies to allow it to improve asset lives, deliver better customer service and significantly reduce costs for customers. This trend has continued in RIIO-ED1 with ENWL developing significant technical and commercial solutions across its operating portfolio.
- These innovation projects have delivered a host of business benefits including:
  - Reduced asset replacement costs through asset life extension and risk management;
  - Investment programme optimisation techniques to allow lowest overall cost to deliver the regulatory contract;
  - Improved customer service through management of LV transient faults;
  - Reduced Customer Interruptions and Customer Minutes Lost through network automation;
  - Reduced reinforcement and connection costs through flexible capacity mechanisms and through asset capacity enhancement; and
  - Improved safety and environmental impact.
- This following page provides an overview of the ENWL's innovation projects relating to NLRC.

ENWL Innovation Lifecycle

Source: ENWL

ARUP

2. Factors affecting NLRC - Innovation

The below innovation projects have been approved by Ofgem and there is currently funding in place to support them in ED1. The efficiency savings shown below have been included in the BP going forward.

Combined Online Transformer Monitoring (NIA)

Timescales: September 2014 – September 2022

Efficiency: n/a/ implicitly included

Scope:

- This project applies the online dissolved gas analysis (DGA) and partial discharge (PD) monitoring equipment to assess the condition of the transformers, to extend its life span by up to 25 years.
- The main aim is to validate and calibrate the collected data against theoretical research results to help prove that oil regeneration can be used to extend the operating life of a transformer in a safe, reliable, and cost-effective manner.

***Current progress:* On track**

- The dashboard and decision tool to be used by ENWL was completed in April 2016 (Phase 1).
- Data visualisation of the results as well as further research into validating and calibrating the data from the installed monitoring equipment are currently under process.
- The efficiency from this project has become BAU and accounted for in ED1 and future price controls.

Value of Lost Load (NIA)

Timescales: October 2015 – September 2019

Efficiency: n/a implicitly included

Scope:

- This project aims to deliver a comprehensive understanding of value of lost load (VoLL) through a diverse range of customer engagement (i.e. meetings, interviews, surveys).
- The project shows how customers can benefit via more intelligent targeting of investment in areas of greater need.

***Current progress:* On track**

- This work identified the need to increase investment in fuel poor and rural areas. It also points to the need to improve supply reliability as customers increasing adopt low carbon technologies (LCT) such as EVs.
- ENWL is leading work with Ofgem on how VoLL can be incorporated into the investment modelling techniques used to set investment allowances, however, the clear direction of travel from VoLL indicates the need to increase network investment.
- Efficiencies included implicitly in BP post ED1.

Optimisation of Oil Regeneration (NIA)

Timescales: February 2016 – February 2022

Efficiency: £1.5m p.a.

Scope:

- This project aims to explore and understand the optimum point that oil regeneration can be applied in the life cycle of a transformer to maximise its life span and avoid de-rating based on age. Moreover, it investigates if oil regeneration applied to the mid-life of the transformer can reduce the rate of paper degradation.
- The process is conducted by installing monitoring equipment on 13 mid-life transformer sites to allow comparison of their oil condition and determine the theoretical life extension over time. Results are then fed into data visualisation software for consistent comparison. The project has been expanded to 46 sites.

***Current progress:* On track**

- 10 sites out of 46 completed in FY16 - 18, therefore the benefit is set to rise significantly. Data analysis is to be completed by February 2022.
- The project efficiencies are applied from ED2 onwards.

Avatar (NIA)

Timescales: October 2016 – December 2019

Efficiency: £150k p.a.

Scope:

- The project quantifies how customers' attitudes, behaviours, needs and expectations are likely to change in the future.
- Based on customer and stakeholder engagement meetings and customers' opinions, by utilising Artificial Intelligence, this project aims to identify a range of innovative technological solutions that can best meet customers' servicing expectations and assist DNOs to better plan their investment strategy.
- The project will also support ENWLs customer satisfaction upwards.

***Current Progress:* On track**

- Contextual understanding of current and future customer needs following key customer depth interviews have been completed.
- The project is on programme and is expected to be completed by December 2019.
- The project efficiencies are applied from ED2 onwards.

Source: Arup analysis and Management information

ARUP

ENWL: Non-load Related Capex Summary

Section 3: Forecast Non-load Related Capex Methodology & Calculations

ARUP

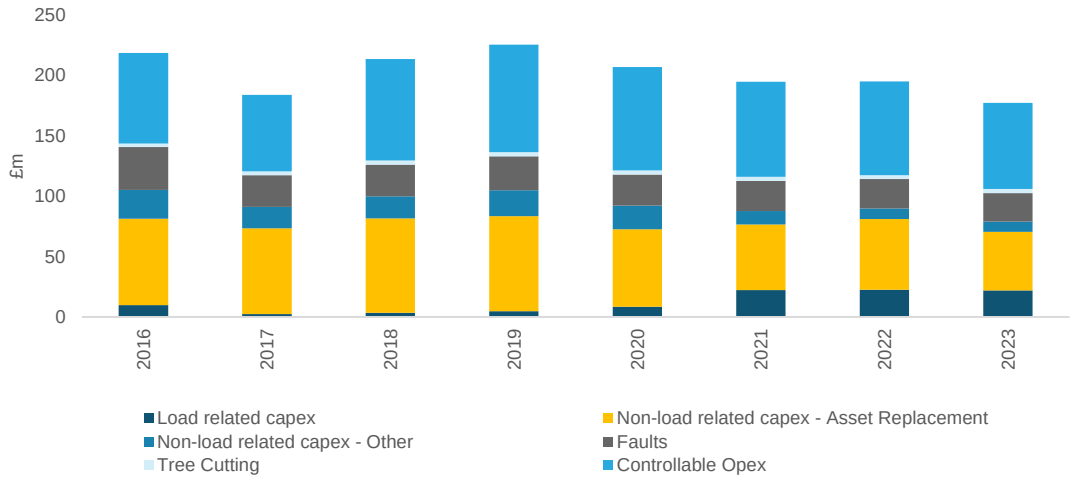
3. NLRC Methodology and Forecasts – ED1

Non-load related capex is a significant proportion of ENWL's ED1 totex owing to asset replacement investment initiatives. This category makes up c. 40% of the total ED1 totex spend forecast by Management.

ED1 Totex Breakdown

- In ENWL's latest BP, management are forecasting totex across ED1 of c. £1,704m, against an updated and adjusted allowance of c.£1,867, including pension costs. This represents c.£163m underspend and 8.7% totex outperformance against allowances.
- The figure to the right demonstrates the evolution of ENWL's totex over ED1. Figures up to 2018 are actuals and from 2019 onwards are based on ENWL's forecast totex as reported in the latest company business plan CBP19.
- Costs are forecast to reduce over the second half of ED1 as a result of a conscious management decision – ENWL has invested heavily in the earlier years of ED1 with a view to building on that investment to drive overall ED1 totex outperformance, especially in relation to asset replacement.
- As a result, management forecasts strong cost efficiencies in the later years of the price control.
- It can be seen that non-load related capex makes up a significant proportion of ENWL's totex, averaging £82m p.a. across ED1, equivalent to c. 40% of totex on average.
- The NLRC costs are further broken down on the following pages.

ED1 Totex Breakdown - £m (2012-13 prices)



Source: Arup analysis

ARUP

3. NLRC Methodology and Forecasts – ED1

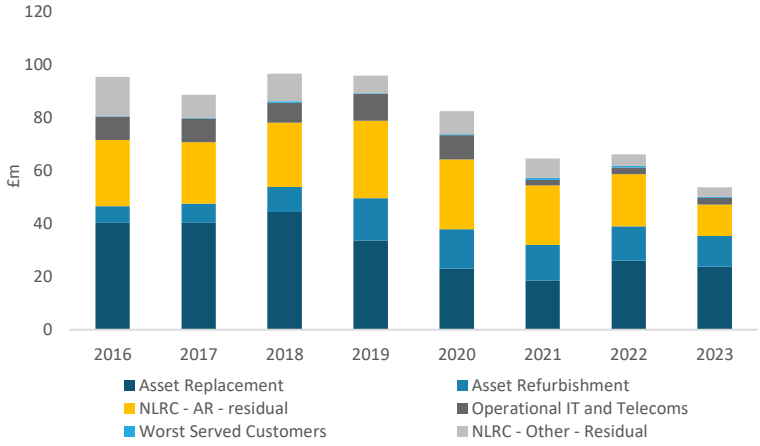
Asset Replacement and refurbishment make up 53% of NLRC spend in ED1 on average. Management expect to save c. £50m in ED1 by refurbishing rather than replacing assets.

Non-Load Related Capex Components

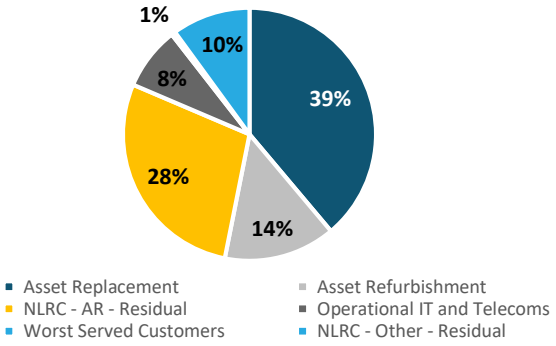
- As assets age, the likelihood of them failing increases over time, requiring them to ultimately be either refurbished or replaced. Investment in replacement and refurbishment ensures stability in network performance.
- Refurbishing equipment can increase equipment's age by up to 25 years and in some cases, this refurbishment can take place multiple times throughout an asset's lifetime. In the ENWL Well Justified Business Plan (WJBP), Management state they expect to save c.£50m in ED1 by refurbishing rather than replacing assets and therefore optimising the technical life of assets. These cost savings as a result of refurbishment were reflected in the ED1 allowances and do not represent outperformance.
- Non-load related capex is composed of "non-load related capex (asset replacement)" and "non-load related capex (other)". A full breakdown of the sub-categories from the company BP which we attribute to non-load related capex is shown in the below table.
- Both asset replacement and refurbishment sit within the NLRC – asset replacement cost category, and together make up 53% of NLRC spend on average over ED1. This can be seen on the pie chart below.
- The NLRC - AR - Residual, which is 28% of NLRC is made up of a collection of smaller works, as shown in the table below. The largest cost items in this category include civil works, diversions and quality of supply, which make up 55%.
- NLRC – Other costs are primarily driven by Operational IT and Telecoms expenditure, which represent costs incurred in real-time control, monitoring, management and restoration of the ENWL network. This makes up 8% of NLRC, and c.41% of NLRC – Other.
- As the costs associated with NMS were largely front-loaded in ED1, the Operational IT and Telecoms costs exhibit a downward trend, as can be seen in the figure to the right.

Category	Sub-category	Items contained
Non-load related capex – Asset Replacement	Asset Replacement	
	Refurbishment	Refurbishment SDI; Refurbishment no SDI
	NLRC – AR - Residual	Civil Works Condition Driven; Diversions (Excluding Rail Electrification);QoS; Legal & Safety; Rising and Lateral Mains; Flood Mitigation; Overhead Line Clearances; Losses; Blackstart; Environmental Reporting; Diversions (Rail Electrification); Physical Security; IRM – Smart Street
Non-load related capex - Other	Operational IT and Telecoms	
	Worst Served Customers	
	NLRC – Other - Residual	IT and Telecoms (Non-Operational); Vehicles and Transport (Non-Operational); Visual Amenity; Small Tools and Equipment; Property (Non-Operational); BT21CN; Deduct: Cash proceeds from sales of assets and scrap

ED1 Non-load Related Capex Breakdown - £m (2012/13 prices)



Non-load Related Capex Breakdown (Average Spend over ED1)



Source: ENWL Internal Business Plan CBP19

ARUP

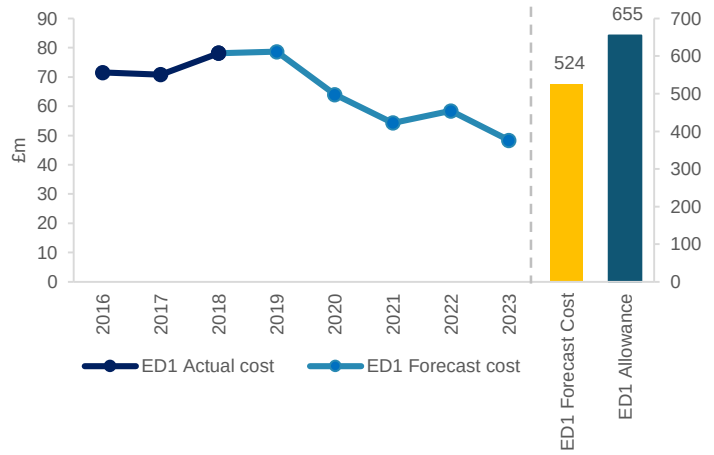
3. NLRC Methodology and Forecasts – ED1

Management are forecasting significant outperformance against asset replacement allowances. We consider this achievable as elements of the investment programme are anticipated to be delivered more efficiently.

Non-load Related Capex (Asset Replacement)

- NLRC – Asset Replacement, which includes asset replacement, refurbishment and residual costs, as shown on the table on the previous page, makes up over 30% of ENWL's total costs over the eight year price control.
- Management expect to incur c.£524m against an allowance of c.£655m for this cost category, representing a cost outperformance of 20% over the period. This has been achieved by applying the capital effectively while continuing the maintain a strong network performance.
- This category makes up the majority of ENWL's forecast totex outperformance (c.£130m pre-tax and pre-sharing) and is largely the result of two main initiatives (which will be offset by some cost underperformance).
- Firstly, Management has reviewed and adapted its investment programme in response to an updated Network Asset Secondary Deliverables (NASD) target. This new strategy has resulted in a more optimised and effective balance of interventions that allows ENWL to meet its target at a lower cost. Under this asset management approach, which is in line with industry best practice, ENWL increasingly uses the Common Network Asset Indices Methodology to asses asset health and criticality indices as a measure of network condition rather than just asset age.
- Consequently, plans to deliver the Network Output Measures (NOMs) related element of the replacement programme are now expected to come in at a lower cost than originally planned, resulting in c.£58m of cost efficiencies over the ED1 period.
- Secondly, ENWL has reassessed its approach to civils solutions and has reduced the extent of bespoke work within those solutions. Furthermore, the civils function was in-sourced in 2017 which is expected to yield further efficiencies.
- Whilst a significant proportion of these costs relate to asset replacement, ENWL has demonstrated effective asset management techniques that have yielded significant cost efficiencies as discussed in the Asset Management section of this report.
- We consider these forecasts to be sensible and in line with Management's strategy of front-loading investment in the first half of ED1, to allow for strong cost efficiencies in the second half of the price control.

Non-load Related Capex (Asset Replacement) Forecast ED1 Spend (2012-13 Prices)



Source: ENWL Internal Business Plan CBP19

ARUP

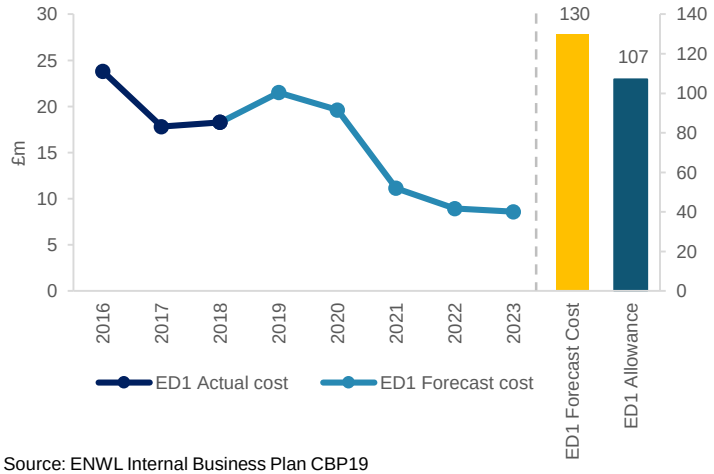
3. NLRC Methodology and Forecasts – ED1

ENWL expects to overspend on non-load related capex – other, due to significant investment in the operational IT programme, which will position ENWL well for the industry-wide transition to the DSO model.

Non-load Related Capex (Other)

- Non-load related capex – other represents around 8% of ENWL's forecast total ED1 costs. Despite a falling cost profile, over the duration of the price control, Management is forecasting to overspend its 'non-load related capex – other' allowance by c.£23m, resulting in cost underperformance of c.21%.
- Costs associated with operational IT and telecoms specifically are forecast to exceed the ED1 allowance by c.£12m. Management advises that this overspend is partially the result of its ED1 allowances being set at a significant reduction to its BP submission.
- Furthermore, the delivery of the NMS project has resulted in significant overspend in the early years of the price control which is not expected to be recovered in the second half of ED1. It is considered that this project will also allowed for more efficient totex delivery.
- This project remains ENWL's key strategic operational IT programme, and is currently in delivery, with key phases of the project going live in 2018 and 2019. These costs are related to the industry-wide transition from the DNO to the DSO model, which is pivotal to ENWL being DSO-ready before ED2.
- Management is also forecasting to overspend its non-operational IT and telecoms allowances. This is due to ENWL making a strategic decision to not seek allowances to cover IT-enabled business change in ED1 as investment in this area is expected to lead to efficiencies in other parts of the business, and 'improved customer performance'.
- Despite forecast overspend in this cost category, we consider that ENWL is well placed to manage the transition to the DSO model, and will face reduced ED2 costs as a result of upfront IT investment in ED1.

Non-load Related Capex (Other) Forecast ED1 Spend (2012-13 Prices)



Source: ENWL Internal Business Plan CBP19

ARUP

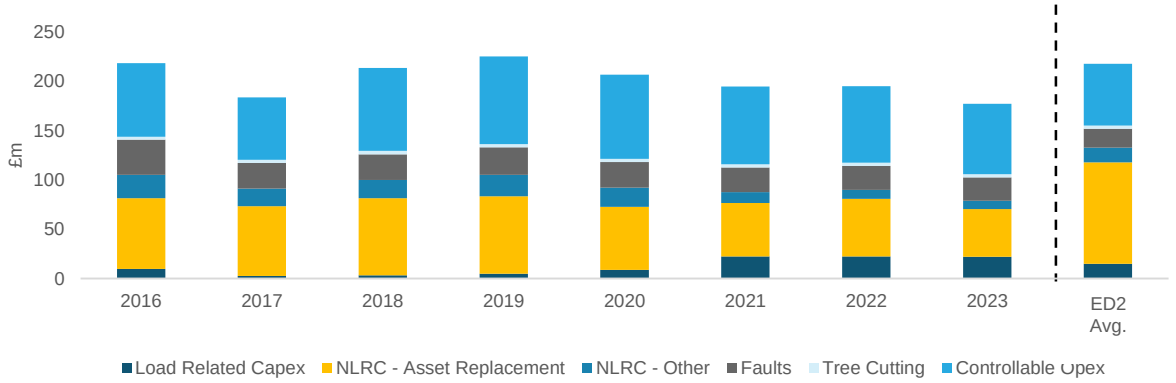
3. NLRC Methodology and Forecasts – ED2

From Arup's independent totex analysis, Asset Replacement makes up the majority of totex spend from 2024 onwards, driven by an increase in replacement volumes.

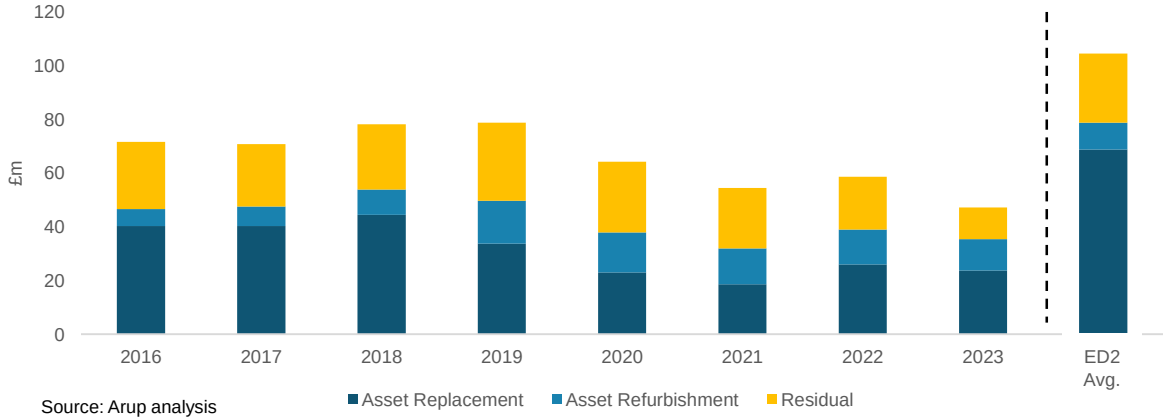
ED2 Totex breakdown

- Arup has carried out an independent bottom-up analysis of ENWL's totex, including the NLRC. There are indicative figures based on information provided.
- The upper chart shows Arup's forecast of ENWL's expenditure up to the end of ED1 and the average over ED2. The bottom chart displays a breakdown of the NLRC – Asset Replacement category (excluding innovation efficiency savings as these are applied at a less granular level) over the same period.
- Average totex p.a. stands at a level of £217m in ED2, increasing from an average of £202m p.a. in ED1. NLRC similarly increases to £118m p.a. average, from £82m p.a. in ED1.
- NLRC – Asset Replacement makes up the largest proportion of totex in ED2 and increases significantly in average p.a. terms between ED1 and ED2. This is due to the expected increase in replacement volumes; it can be seen on the second chart that replacement costs make up the bulk of spend in NLRC – Asset Replacement.
- This jump assumes replacing or refurbishing around 4.2% of the asset base in ED2. The approach Arup has taken in estimating replacement costs, discussed further on the following pages, is based on the one used by ENWL in the 'Strategic Direction Statement 2017'. However, Arup's approach uses the updated asset register from 2018 and makes some adjustments to percentage volumes replaced, based on improvements made in ENWL's asset management approach in ED1 including efficiencies through innovation projects. We consider that the approach we have taken is sensible as it uses the most up to date information from ENWL.
- Focussing on asset health more than age allows ENWL to drive replacement and refurbishment efficiencies and select the most critical assets for the investment programme.
- Average NLRC – Asset Replacement – Residual costs also increase between the two periods, this is due to the inclusion of a Smart Street cost allowance in ED2.

ED1 to ED2 Totex Breakdown - £m (2012-13 prices)



*ED1 to ED2 NLRC – Asset Replacement Breakdown - £m (2012-13 prices)**



Source: Arup analysis

*Note: excluding innovation savings as these are applied at a PCFM category level.

ARUP

3. NLRC Methodology and Forecasts – ED2

The asset replacement capex forecasts are based on increased volumes compared to ED1, which we have derived through a plan build-up, using age as a proxy for condition for some asset types.

Methodology

1. NLRC – Asset Replacement (Asset Replacement and Refurbishment)

a) Unit Cost

- In determining forecast asset replacement and refurbishment costs, we use unit costs for each individual asset type (around 100 types) as listed in the ENWL asset register.
- We derived ENWL's unit costs for each asset type starting with Ofgem's view on efficient unit costs at ED1 and uplifting those by 7.58% to take into account the slightly higher costs that ENWL faces compared to the unit costs benchmarks. The uplift is based on the weighted average difference between ENWL and Ofgem unit costs during the ED1 price control review. ENWL has slightly higher units costs than the benchmark as it is smaller than the other DNO groups, which affects its contract sizes, economies of scale and geography.
- We have taken a similar approach for determining forecast asset refurbishment costs, while applying a lower unit cost (25% of replacement unit costs) based on industry data.

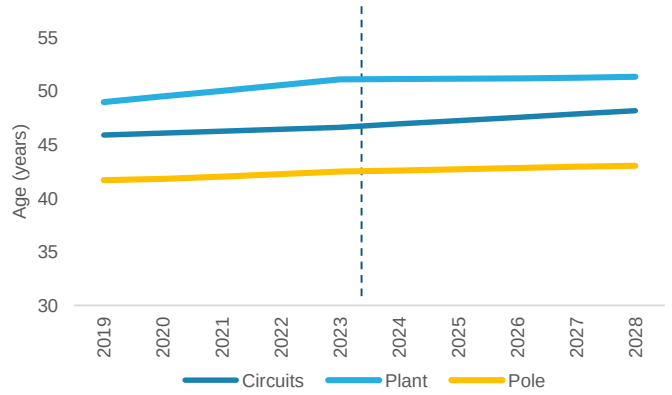
b) Volumes

- In practice, ENWL would base its asset renewal strategy on condition and VoLL.
- For the purposes of modelling, it is difficult to forecast asset condition far into the future but ENWL's empirical evidence shows that for plant assets (transformers, switchgear and their protection) condition and age are correlated. We therefore use asset age as a proxy criterion for replacement rates of plant assets, particularly when assessing longer term replacement forecasts, i.e. beyond ED1.
- ENWL has found, however, that this relationship does not hold for circuit assets (OHL, cables, poles). Hence, an increase in asset age does not necessarily lead to lower performance that would require renewal. Therefore, it is acceptable to see an increasing age profile of circuit assets and a lower rate of replacement of cable assets compared to plant, as shown in the bottom adjacent figure.
- Keeping these factors in mind, we have built up our replacement and refurbishment volumes based on a methodology similar to the one ENWL used for SDS 2017.
- The methodology uses the asset register as a starting point and then sets percentage volumes to be replaced in each price control for 24 asset categories.
- Replacement rates (%) are driven by ENWL's view based on historical analysis for fault rates, condition and overall risk from intimate knowledge of the assets. We have reviewed ENWL's rationale for increasing these replacement rates from ED1 and consider it reasonable.
- We have sense-checked these assumptions against age profiles (shown on the adjacent figure) for the assets where this is appropriate. Our replacement volumes have therefore been modelled to keep the asset age sufficient to ensure that ENWL can maintain a well performing network (this differs for circuits, plant and poles).
- We assume that where ENWL replaces OHLs, they will also replace the poles/towers and fittings related to them.

Non-load related capex sub-categories

Category	Sub-category
Non-load related capex – Asset Replacement	Asset Replacement
	Refurbishment
	NLRC – AR - Residual
Non-load related capex - Other	Operational IT and Telecoms
	Worst Served Customers
	NLRC – Other - Residual

Weighted Average Age of the 2017/18 Asset Portfolio



Source: Arup analysis

ARUP

3. NLRC Methodology and Forecasts – ED2

We assume around 215k separate interventions between 2024 and 2028. Our capex forecasts are within 0.5% of those presented by ENWL in SDS 2017.

Methodology (continued)

- In certain cases, we have made adjustments to the replacement rates assumed by ENWL to take into account updates in approach:
    - Increased for LV services – to take into account increasing connection of LCTs;
    - Decreased for EHV transformers – which is offset by an increase in refurbishment volumes as recent ENWL studies find that these transformers lend themselves well to new refurbishment techniques (ENWL014 and ENWL004 innovation projects); and
    - Increased for LV switchgear – to maintain a stable or reduce asset age, which is a proxy for condition on plant.
- We have also used the 2018 asset register, instead of the 2013 asset register that SDS 2017 is based on.
- We have assumed refurbishment extends asset life by 25 years for transformer and EHV/132kV OHL pole lines as advised by Management based on the latest findings of innovation projects. We assume life extension of 20 years for the rest of the asset categories. In our average weighted asset age calculation shown on the previous page, refurbishment therefore effectively reduces age by this amount, whereas in the asset register, the asset will continue to have the original installation date.
- Replacement effectively returns an asset's age to zero. We note some asset types are not suitable for refurbishment.
- It should be noted that efficiencies that were realised during ED1 have been taken into account as part of our bottom-up estimations for ED2.

c) Results

- The adjacent table shows the replacement and refurbishment volumes requirement. This results in 3.7% of ENWL's assets being replaced, and 0.5% of ENWL's assets being refurbished between 2024 and 2028. This equates to around 214,497 separate interventions.
- Based on this methodology we have forecast an expected asset replacement and refurbishment capex which is within 0.5% of the estimates ENWL presents in SDS 2017.

2. NLRC – Asset Replacement (residual)

- For a number of additional residual costs included in the asset replacement category, we simply rolled forward the average ED1 cost on an annual basis as these are expected to remain constant.

3. NLRC – Other

- In calculating forecast non-load related capex – other costs, we have largely rolled forward the average annual cost over ED1. The majority of the costs are non-operational costs and thus not expected to change in relation to the size of the network.

Modelled Replacement and Refurbishment Volumes (2024-2028)

Intervention Type	Volumes	%
Assets Replaced	189,863	3.7%
Assets Refurbished	24,633	0.5%
Total Interventions	**214,497**	**4.2%**
Current Asset Size	5,162,842	

Source: ENWL Asset Information

ARUP

3. NLRC Methodology and Forecasts – ED2

Indicatively, we forecast considerable growth in non-load related capex, driven by increased investment in asset replacement and refurbishment.

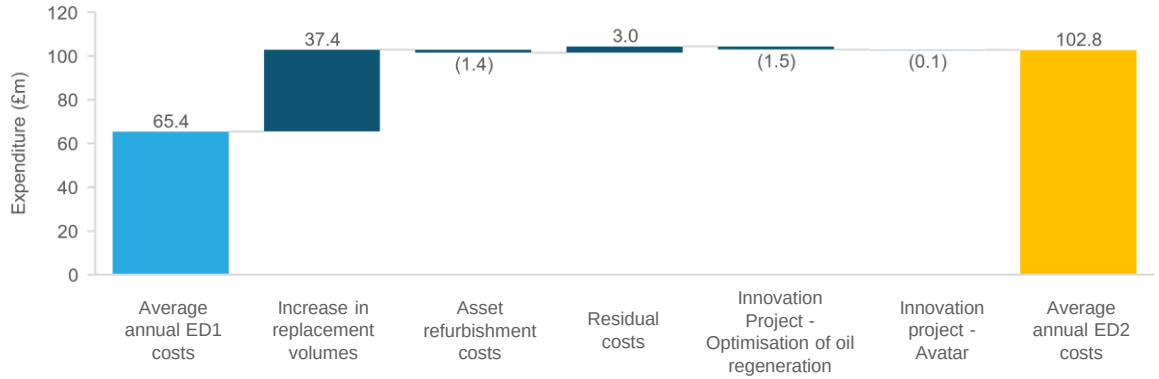
Non-load Related Capex (Asset Replacement) Forecast

- Asset replacement costs make up a significant proportion of ENWL's forecast totex. We anticipate that NLRC – Asset Replacement spend will increase from an average of £65.4m p.a in ED1 to £102.8m p.a. in ED2.
- Growth in forecast asset replacement capex is driven by an increase in assumed replacement and refurbishment volumes. These volume assumptions have been formed following an assessment of a combination of condition and age based investment planning, informed by ENWL's CNAIM approach described earlier as well as the latest asset register.
- As shown in the chart to the right, the increase in replacement costs between ED1 and ED2 is driven primarily by a jump in asset replacement rather than refurbishment.

Innovation assumptions

- We have applied annual efficiencies resulting from ENWL's innovation initiatives that are expected to reduce this cost category on top of ED1 BAU efficiencies.
- We have applied an annual efficiency of £1.5m a year, from ED2 onwards, for the 'Optimisation of oil regeneration' project, and £0.1m a year for project 'Avatar'. Please refer to the previous Section for more information on innovation projects.

Forecast Non-load Related Capex (Asset Replacement) Movement Between ED1 and ED2 (2012-13 prices)



Source: Arup analysis.

ARUP

3. NLRC Methodology and Forecasts – ED2

We anticipate that non-load related capex – other will remain broadly flat going forwards as ENWL continues to invest in maintaining its operational IT systems.

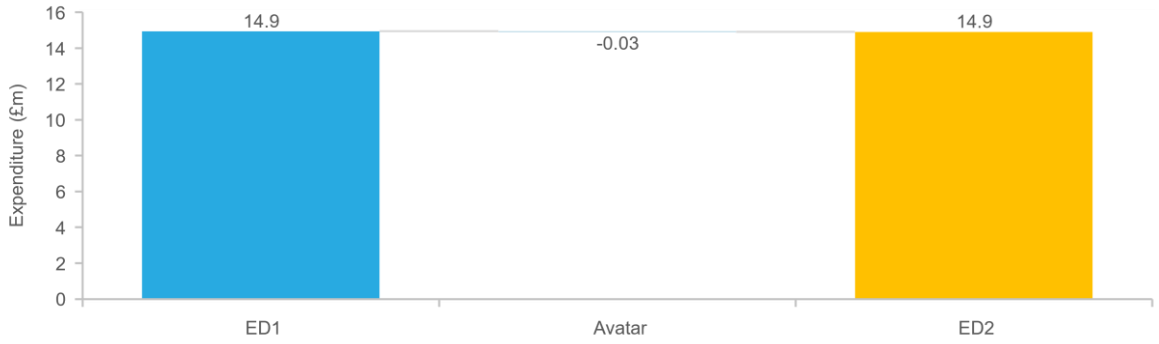
Non-load Related Capex (Other) Forecast

- Non-load related capex – other followed a downward trend over ED1, as the operational IT costs associated with NMS were largely front-loaded in the price control. We have assumed that future costs will remain broadly flat from ED2 onwards at £14.9m per annum.
- These costs are driven largely by IT and telecoms costs, and while the costs associated with NMS are expected to reduce over time, we anticipate that IT system upgrades and costs for new IT systems will rise in the future.
- ENWL has already indicated for example that the NMS system will need to be updated at some point in ED2, when Schneider release the next software update. While these costs will be more cost efficient that than investing in a new system, it will still represent a significant capital outlay.
- In calculating forecast non-load related capex – other costs, we have largely rolled forward the average annual cost over ED1. The majority of the costs are non-operational costs and thus not expected to change in relation to the size of the network.

Innovation assumptions

- Upon determining the forecast Non-load related capex – other costs, we have then applied annual efficiencies resulting from ENWL's innovation initiatives that are expected to reduce this cost category.
- We have applied an annual efficiency of circa £26k a year resulting from project 'Avatar'.

Forecast Non-load Related Capex (Other) Movement Between ED1 and ED2 (2012-13 prices)



Source: Arup analysis.