Common Network Asset Indices Methodology
Secondary Deliverables Rebasing

SP Energy Networks

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SP ENERGY NETWORKS

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1. INTRODUCTION

On the 21 October 2016, a Common Network Asset Indices Methodology (CNAIM) for assessing condition-based risk for electricity distribution assets was approved by Ofgem. It has been developed by the six GB Distribution Network Operator (DNO) groups in satisfaction of the requirements of Standard Condition 51 (SLC 51) of the electricity distribution licence for RIIO-ED1 (1 April 2015 to 31 March 2023). SPEN provided a forecast of the asset health and criticality profiles 'with' and 'without' intervention.

The CNAIM sets out the overall process for assessing condition based risk and specifies the parameters, values and conditions to be used. The collective outputs of the assessment, used for regulatory reporting purposes, are known as the Network Asset Indices under the CNAIM.

CNAIM requires DNOs to re-align their current processes and practices which are reported utilising the Network Asset Indices Methodology (NAIM) to this new standard. It also requires a re-basing of the Network Risk targets agreed between the DNOs and Ofgem for the RIIO-ED1 period under the provisions of CRC5D of the RIIO-ED1 licence which are contained within the Network Assets Workbook (NAW). This is referred to as "Rebased Network Asset Secondary Deliverables" throughout this document.

SPEN is required to report annually against the targets set using the methodology to calculate the changes achieved.

This document sets out the result of the transition from its Network Asset Indices Methodology (NAIM) to CNAIM) and how SPEN has ensured that it's Rebased Network Asset Secondary Deliverables remain equally as challenging as those set out in the NAW that was applicable at 1 April 2015.

The process by which SPEN has undertaken the rebasing of the risk target using CNAIM to satisfy the requirements of Distribution Standard Licence Condition 51(SLC51) requires:

a) the licensee to maintain a NAIM and to establish and follow an Information Gathering Plan so that there is appropriate information available to enable the assessment of:
   - its Network Assets and Distribution System against the Network Asset Indices and in accordance with the RIGs; and
   - its performance against the Network Asset Secondary Deliverables;
b) the licensee to work with every other Distribution Services Provider to develop a CNAIM;
c) establishment of a process for modifying the CNAIM where that would better facilitate the Network Asset Indices Methodology Objectives;
d) the licensee to keep its NAIM under review and, where necessary, modify it to ensure that it is consistent with the CNAIM; and
e) the establishment of a framework for reporting on the licensee's performance against the Network Asset Secondary Deliverables.

Further to the licensees' requirement SPEN must provide the Authority with a plan (the "Information Gathering Plan") that sets out how SPEN will gather and record information required for its implementation of or revision of the Common Network Asset Indices Methodology. The Information Gathering Plan was submitted to Ofgem in September 2016[1] and remains valid.

This document should be read alongside the Rebased NAW dated 30 December 2016.

[1] Approved by Ofgem on the 19 December 2016

2. SCOPE

In order to complete the implementation of CNAIM, the Network Asset Secondary Deliverables and monetised risk targets must be Rebased in accordance with the new methodology. CNAIM shall be used to determine the health and criticality of the network assets.

The current Network Asset Secondary Deliverables were agreed as part of the RIIO-ED1 process. The purpose of the rebasing is to translate the agreed outputs using CNAIM and not to revise the targets that were originally agreed.

The outputs of the Rebasing process are listed below and form the complete submission to Ofgem by 30 December 2016:

- The 2015/16 Secondary Deliverable reporting pack, based on CNAIM,
- The 2015/16 Secondary Deliverable reporting pack supporting commentary,
- The NAW rebasing, based on CNAIM,
- The NAW supporting commentary (this report),
- The Secondary Deliverables Monetised Risk file (SDMR) rebasing, based on CNAIM,
- Asset additions and removals file rebasing, based on CNAIM.

2.1.1 Secondary Deliverable Reporting Pack

The Secondary Deliverable reporting pack has been Rebased in accordance with CNAIM. Progress in collective movements in asset health, criticality and monetised risk across all of the asset categories are reported. The revised set of Network Asset Secondary Deliverables takes account of actual data up to and including 31 March 2015 which was not available at the time of the original NAIM.

2.1.2 Rebased Network Asset Workbooks (NAW)

The Rebased NAWs have been Rebased in accordance with CNAIM and include the 'without' intervention profiles at RIIO-ED1 start, mid-period and end.

Any asset category that does not contribute to the overall monetised risk delta has been excluded from the Rebasing. This includes the omission of the Civils Asset Category.

2.1.3 Secondary Deliverables Monetised Risk file (SDMR)

The Rebased SDMR files have been Rebased in accordance with CNAIM and include the same volume of interventions as the Rebased NAW. Average Consequence of Failure (CoF) and Probabilities of Failure (PoF) are utilised to define a monetised risk target for the price control period for each Asset category.

2.1.4 Asset Additions and Removals file

The Asset Additions and Removals file has been Rebased in accordance with CNAIM and include the same volume of interventions as the Rebased NAW. Asset Additions and Removals are reported separately at RIIO-ED1 mid-period and end for asset replacement and asset refurbishment activities.

3. PROCESS

This section provides an overview of the approach used to restate asset health and criticalities over RIIO-ED1 in accordance with CNAIM. This includes the restatement of asset health and criticality as at RIIO-ED1 start, and the 'with' and 'without' interventions positions in 2019 and 2023.

The approach is summarised in Figure 1.

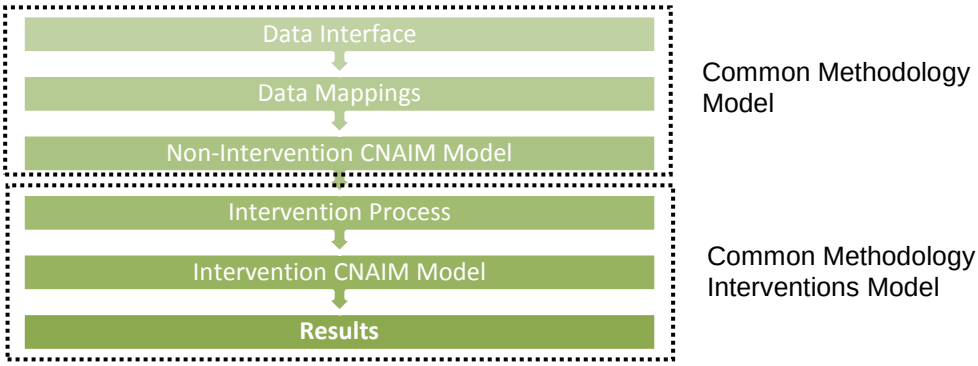

Figure 1. CNAIM implementation approach.

A brief description of each of the six steps is provided below:

1. **Data Interface**: This step refers to the loading of input data prior to any data handling required to feed into the CNAIM models.

2. **Data Mappings**: Input data needs to be adjusted to fit into the formats stipulated within the CNAIM models.

3. **Non-Intervention model**: This is the standard CNAIM model, which implements the CNAIM methodology as approved by Ofgem[2]. The Non-Intervention Consequences of Failure (CoF) are extracted from this model.

4. **Intervention Process**: A two-stage process to define and configure asset intervention activities has been utilised:

   a) Automated Interventions, which are automatically selected according to pre-defined volumes and prioritisation rules. The model assigns a prioritisation ranking to assets based on the level of associated risk which is used to prioritise investments. Automated interventions are used for high volume "Generic Work Programmes" based on a volume target with interventions driven by risk reduction;

   b) Targeted Interventions, which are specific asset interventions used for low volume "Named Schemes" based on our asset management strategy. The condition and performance of the asset base, consequences of failure, deterioration, views of our stakeholders and legal obligation are assessed to identify the most appropriate interventions.

5. **Intervention Model**: The 'with' intervention health and criticality positions are obtained by combining the Non-Intervention CNAIM model with data generated during the Intervention Process.

6. **Results**: Results comprise 5 x 4 health and criticality risk matrices. 'Without' intervention results are calculated during step 3 of the process while 'with' intervention results are derived at step 5. Such matrices constitute the basis of the Rebased NAW.

[2] DNO Common Network Asset Indices Methodology, Health and Criticality – Version 1.0, 1 August 2016, Ofgem

4. DATA SET ESTABLISHMENT

SPEN has been working closely with EA Technology as the software supplier to create 2015 datasets and models in line with the Common Methodology. In order to create a dataset that represents the state of the SPEN networks as at 31 March 2015, datasets representative of 18 September 2016 were taken and the following actions undertaken:

1. Remove all assets that were commissioned on or after 1 April 2015,
2. Remove all test results that were undertaken on or after 1 April 2015, including:

    a. Switchgear timing tests,
    b. Ductor tests for switchgear,
    c. Partial discharge results,
    d. Oil analysis for transformers and switchgear,
    e. Dissolved Gas Analysis (DGA) for transformers,
    f. Furan results for transformers,
    g. Oil leakage results for cables,
    h. Residual Strength Value results for poles,
    i. Cormon results for OHL conductor.

3. All asset condition data was retained in the dataset apart from that associated with any refurbishment activity undertaken on or after 1 April 2015.
4. The models then had their “current date” set to 1 April 2015 and were rolled forward to forecast deterioration to the end of RIIO-ED1.

5. INTERVENTION METHODOLOGY

SPEN worked closely with the CNAIM application provider, EA Technology, to develop Intervention Models for all the relevant assets. The Intervention Models allow the user to apply planned asset replacements and refurbishments to the 2015 starting position and they then calculate the impact of such interventions on the health and criticality

The interventions utilised in the models are either the complete replacement of the asset or a refurbishment. There are a number of refurbishment types set up in the models depending on the type of asset.

As an example, two variants have been introduced for primary switchgear:

1. On-site refurbishment including the operating mechanism, and
2. Replacement of the moving portion, i.e. retrofit.

Within each Intervention Model, the effect of every type of intervention was simulated. This informs the model of the impact on each data point. For example, the age of the asset is set to zero and condition data set to “as new” for asset replacement interventions.

Every intervention planned during RIIO-ED1 was categorised as either asset replacement or refurbishment and set up accordingly within the Intervention Models. Every intervention was attributed a forecast year.

The effect of the interventions and the investment plan were overlaid to provide a health and criticality forecast. The Intervention Models forecast health and criticality for each year of RIIO-ED1 ‘with’ and ‘without’ intervention. The output of the Intervention Models was subsequently inputted into the Rebased NAW.

6. EQUALLY CHALLENGING TEST

As part of the Rebasing of the NAW it is essential that a series of tests are performed on the output from the above process to establish if CNAIM creates an equally challenging target when compared to the original NAW. To facilitate this requirement Ofgem published the Network Asset Secondary Deliverables rebasing requirements and assessment methodology following a series of meetings involving all DNOs as part of the Reliability Working Group.

The document is available on the Ofgem website via the following link:

https://www.ofgem.gov.uk/publications-and-updates/reliability-working-group

7. SUMMARY OF TESTS

The equally as challenging test results are outlined in section 7.1 and 7.2 below.

There is no change to the volumes of interventions in the Rebased plans and therefore all volume tests pass. Where the rebasing has not passed the consequential or risk point tests, results are explained in Appendix A.

7.1 SP Distribution

SPD Asset Replacement					
Licence Area	CNAIM model number and asset category	Test 1 Risk Point Pass / Fail	Test 2 Volume Pass / Fail	Test 3 Consequential Pass / Fail	Evidence
	LV Network				
SPD	CM1 LV OHL Support	Pass	Pass	Pass	
SPD	CM2 LV UGB	N/A	N/A	N/A	Not reported in ED1
SPD	CM3 LV Switchgear and Other	N/A	N/A	N/A	Not reported in ED1
	HV Network				
SPD	CM4 HV OHL Support - Poles	Pass	Pass	Pass	
SPD	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Fail	Section 8.2.2
SPD	CM6 HV Distribution Switchgear	Pass	Pass	Fail	Section 8.2.1
SPD	CM7 HV Distribution Transformers	Pass	Pass	Pass	
SPD	HV U/G Cable	N/A	N/A	N/A	Not reported in ED1
SPD	Civil HI Primary / Sw Stations - Overall Health Index	N/A	N/A	N/A	Removed category
SPD	Civil HI Primary Sw / Stations- Worst Component Health Index	N/A	N/A	N/A	Removed category
	EHV Network				
SPD	CM8 EHV Poles	Pass	Pass	Pass	
SPD	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not reported in ED1
SPD	CM10 EHV OHL (Tower Line) Conductor	N/A	N/A	N/A	Not reported in ED1
SPD	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not reported in ED1
SPD	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not reported in ED1
SPD	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not reported in ED1
SPD	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not reported in ED1
SPD	CM16 EHV Switchgear (GM)	Pass	Pass	Fail	Section 8.2.3
SPD	CM17 EHV Transformers	Pass	Pass	Pass	
SPD	Civil HI 33kV - Overall Health Index	N/A	N/A	N/A	Removed category
SPD	Civil HI Grid - Worst Component Health Index	N/A	N/A	N/A	Removed category
	132kV Network				
SPD	CM18 132kV OHL Fittings	N/A	N/A	N/A	No asset population
SPD	CM19 132kV OHL (Tower Line) Conductor	N/A	N/A	N/A	No asset population
SPD	CM20 132kV Tower	N/A	N/A	N/A	No asset population
SPD	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No asset population
SPD	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	No asset population
SPD	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No asset population
SPD	CM24 132kV Circuit Breakers	N/A	N/A	N/A	No asset population
SPD	CM25 132kV Transformers	N/A	N/A	N/A	No asset population
	Other				
SPD	CM15 Submarine Cables	N/A	N/A	N/A	Not reported in ED1

Table 1. Ofgem Criteria Test Summary - Asset Replacement (SPD)

SPD Asset Refurbishment					
Licence Area	CNAIM model number and asset category	Test 1 Risk Point Pass / Fail	Test 2 Volume Pass / Fail	Test 3 Consequential Pass / Fail	Evidence
	LV Network				
SPD	CM1 LV OHL Support	N/A	N/A	N/A	No planned work
SPD	CM2 LV UGB	N/A	N/A	N/A	Not reported in ED1
SPD	CM3 LV Switchgear and Other	N/A	N/A	N/A	Not reported in ED1
	HV Network				
SPD	CM4 HV OHL Support - Poles	N/A	N/A	N/A	No planned work
SPD	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SPD	CM6 HV Distribution Switchgear	Pass	Pass	Pass	
SPD	CM7 HV Distribution Transformers	N/A	N/A	N/A	No planned work
SPD	HV U/G Cable	N/A	N/A	N/A	Not reported in ED1
SPD	Civil HI Primary / Sw Stations - Overall Health Index	N/A	N/A	N/A	Removed category
SPD	Civil HI Primary Sw / Stations- Worst Component Health Index	N/A	N/A	N/A	Removed category
	EHV Network				
SPD	CM8 EHV Poles	N/A	N/A	N/A	No planned work
SPD	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not reported in ED1
SPD	CM10 EHV OHL (Tower Line) Conductor	N/A	N/A	N/A	Not reported in ED1
SPD	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not reported in ED1
SPD	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not reported in ED1
SPD	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not reported in ED1
SPD	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not reported in ED1
SPD	CM16 EHV Switchgear (GM)	N/A	N/A	N/A	No planned work
SPD	CM17 EHV Transformers	Pass	Pass	Fail	Section 8.2.4
SPD	Civil HI 33kV - Overall Health Index	N/A	N/A	N/A	Removed category
SPD	Civil HI Grid - Worst Component Health Index	N/A	N/A	N/A	Removed category
	132kV Network				
SPD	CM18 132kV OHL Fittings	N/A	N/A	N/A	No asset population
SPD	CM19 132kV OHL (Tower Line) Conductor	N/A	N/A	N/A	No asset population
SPD	CM20 132kV Tower	N/A	N/A	N/A	No asset population
SPD	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No asset population
SPD	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	No asset population
SPD	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No asset population
SPD	CM24 132kV Circuit Breakers	N/A	N/A	N/A	No asset population
SPD	CM25 132kV Transformers	N/A	N/A	N/A	No asset population
	Other				
SPD	CM15 Submarine Cables	N/A	N/A	N/A	Not reported in ED1

Table 2. Ofgem Criteria Test Summary - Asset Refurbishment (SPD)

7.2 SP Manweb

SPM Asset Replacement					
Licence Area	CNAIM model number and asset category	Test 1 Risk Point	Test 2 Volume	Test 3 Consequential	Evidence
		Pass / Fail	Pass / Fail	Pass / Fail	
	LV Network				
SPM	CM1 LV OHL Support	Pass	Pass	Pass	
SPM	CM2 LV UGB	N/A	N/A	N/A	Not reported in ED1
SPM	CM3 LV Switchgear and Other	N/A	N/A	N/A	Not reported in ED1
	HV Network				
SPM	CM4 HV OHL Support - Poles	Pass	Pass	Pass	
SPM	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SPM	CM6 HV Distribution Switchgear	Pass	Pass	Pass	
SPM	CM7 HV Distribution Transformers	Pass	Pass	Pass	
SPM	HV U/G Cable	N/A	N/A	N/A	Not reported in ED1
	EHV Network				
SPM	CM8 EHV Poles	Pass	Pass	Pass	
SPM	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not reported in ED1
SPM	CM10 EHV OHL (Tower Line) Conductor	N/A	N/A	N/A	Not reported in ED1
SPM	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not reported in ED1
SPM	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not reported in ED1
SPM	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not reported in ED1
SPM	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not reported in ED1
SPM	CM16 EHV Switchgear (GM)	Pass	Pass	Pass	
SPM	CM17 EHV Transformers	Pass	Pass	Pass	
SPM	Civil HI 33kV - Overall Health Index	N/A	N/A	N/A	Removed category
SPM	Civil HI Grid - Worst Component Health Index	N/A	N/A	N/A	Removed category
	132kV Network				
SPM	CM18 132kV OHL Fittings	N/A	N/A	N/A	Not reported in ED1
SPM	CM19 132kV OHL (Tower Line) Conductor	Fail	Pass	Fail	Previously reported under 132kV OHL Fittings and Conductors (Tower Lines) Section 8.2.5 Section 8.1.3
SPM	CM20 132kV Tower	Fail	Pass	Pass	Section 8.1.1
SPM	CM21 132kV UG Cable (Gas)	Pass	Pass	Pass	
	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not reported in ED1
SPM	CM23 132kV UG Cable (Oil)	Fail	Pass	Pass	Section 8.1.4
SPM	CM24 132kV Circuit Breakers	Pass	Pass	Pass	
SPM	CM25 132kV Transformers	Pass	Pass	Pass	
SPM	Civil HI 132 and Grid- Overall Health Index	N/A	N/A	N/A	Removed category
SPM	Civil HI 132 and Grid - Worst Component Health Index	N/A	N/A	N/A	Removed category
	Other				
SPM	CM15 Submarine Cables	N/A	N/A	N/A	Not reported in ED1

Table 3. Ofgem Criteria Test Summary - Asset Replacement (SPM)

SPM Asset Refurbishment					
Licence Area	CNAIM model number and asset category	Test 1 Risk Point Pass / Fail	Test 2 Volume Pass / Fail	Test 3 Consequential Pass / Fail	Evidence
	LV Network				
SPM	CM1 LV OHL Support	N/A	N/A	N/A	No planned work
SPM	CM2 LV UGB	N/A	N/A	N/A	Not reported in ED1
SPM	CM3 LV Switchgear and Other	N/A	N/A	N/A	Not reported in ED1
	HV Network				
SPM	CM4 HV OHL Support - Poles	N/A	N/A	N/A	No planned work
SPM	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SPM	CM6 HV Distribution Switchgear	Pass	Pass	Pass	
SPM	CM7 HV Distribution Transformers	N/A	N/A	N/A	No planned work
SPM	HV U/G Cable	N/A	N/A	N/A	Not reported in ED1
	EHV Network				
SPM	CM8 EHV Poles	N/A	N/A	N/A	No planned work
SPM	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not reported in ED1
SPM	CM10 EHV OHL (Tower Line) Conductor	N/A	N/A	N/A	Not reported in ED1
SPM	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not reported in ED1
SPM	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not reported in ED1
SPM	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not reported in ED1
SPM	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not reported in ED1
SPM	CM16 EHV Switchgear (GM)	N/A	N/A	N/A	No planned work
SPM	CM17 EHV Transformers	Pass	Pass	Fail	Section 8.2.4
SPM	Civil HI Primary - Overall Health Index	N/A	N/A	N/A	Removed category
SPM	Civil HI Primary - Worst Component Health Index	N/A	N/A	N/A	Removed category
	132kV Network				
SPM	CM18 132kV OHL Fittings	N/A	N/A	N/A	Not reported in ED1
SPM	CM19 132kV OHL (Tower Line) Conductor	N/A	N/A	N/A	No planned work
SPM	CM20 132kV Tower	Fail	Pass	Pass	Section 8.1.2
SPM	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No planned work
SPM	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not reported in ED1
SPM	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No planned work
SPM	CM24 132kV Circuit Breakers	N/A	N/A	N/A	No planned work
SPM	CM25 132kV Transformers	Pass	Pass	Pass	
SPM	Civil HI 132 and Grid- Overall Health Index	N/A	N/A	N/A	Removed category
SPM	Civil HI 132 and Grid - Worst Component Health Index	N/A	N/A	N/A	Removed category
	Other				
SPM	CM15 Submarine Cables	N/A	N/A	N/A	Not reported in ED1

Table 4. Ofgem Criteria Test Summary - Asset Refurbishment (SPM)

8. APPENDIX A – EQUALLY AS CHALLENGING TEST RESULTS

A summary of justification for each equally as challenging asset test that has not been passed is outlined below.

8.1 Risk Point Test

8.1.1 132kV Towers – Asset Replacement (SPM)

The Rebased plan includes 244 towers (BH/DF circuit) in line with the original plan.

The BH/DF route has been identified for modernisation in RIIO-ED1 due to age and condition.

The 244 towers associated with the BH/DF circuit have failed the equally as challenging test because of minor changes in the criticality of some towers following the rebasing.

The strategy for the 132kV overhead line distribution network on the SPM network aims to address the current volume of assets at or approaching end of life. An optimum level of investment will be delivered following a prioritised and project specific approach that will improve resilience and reliability of these strategic assets.

This is necessary to effectively manage an increasing risk, ensure cost-efficient investment and continue the long term sustainability and resilience of such key assets.

The investment strategy focuses on the replacement of conductors, insulators and fittings, and the refurbishment or replacement of steel towers which are at or approaching end of life.

The programme is prioritised in conjunction with further asset modernisation programmes such as 132kV substation replacement and reinforcement projects in order to enable efficient delivery and optimise network security.

8.1.2 132kV Towers – Asset Refurbishment (SPM)

The Rebased plan includes 350 towers in line with the original plan in accordance with the strategy to address the current volume of assets at or approaching end of life.

The test has been failed due to changes in criticality associated with the reduction of the probability of a coincident fault per hr from 1% to 0.05%.

8.1.3 132kV OHL (Tower Line) Conductor – Asset Replacement (SPM)

The Rebased plan includes the replacement of 331km of conductor in line with the original plan.

The replacement strategy targets conductors through a prioritised and project specific approach to entire circuits. This is the lowest cost optimum approach for overhead line circuits. However not every section in a circuit has the same health index due to fault repairs and connections activity.

132kV OHL Conductors have marginally failed the equally as challenging test because CNAIM rebasing has resulted in a number of sections being assigned to different heath index and criticality bands from the original plan because more emphasis is placed on asset age in the common methodology compared to SPEN's original plan.

HI profiles highlight the differences between the RIIO-ED1 submission and CNAIM. Asset age has become more influential on the HI using the CNAIM model than it was in SPEN's previous methodology.

8.1.4 132kV Cable (Oil) – Asset Replacement (SPM)

The Rebased plan includes the replacement of 10.9km (Kirkby to Bootle circuit) of oil filled cable in line with SPEN's original plan.

The oil filled cable between Kirkby and Bootle has failed the equally as challenging test because of minor changes in the criticality of some sections of the circuit following the rebasing.

The oil filled cable between Kirkby and Bootle has been identified for modernisation in RIIO-ED1 because it is exhibiting a random cumulative leakage rate consistent with an end of life characteristic.

The proactive strategy is to replace 132kV underground cables when the condition and performance result in unacceptable risk to reliability or the environment. 132kV cable is a critical asset and essential to provide SPEN's customers with reliable electricity supplies.

Replacing 132kV cable in city centres is a significant undertaking requiring road closures with disruption to residents and commuters and requiring careful management.

The cable programme is essential to maintain a reliable network and is fundamental to reducing oil leaks through the replacement of poorly performing 132kV cable.

8.2 Consequential Assets Test

8.2.1 HV Distribution Switchgear - Asset Replacement

SPD has marginally failed the test primarily due to switchboards with differing HI categorisations. These switchboards comprise of two oil switches and one oil circuit breaker. The oil circuit breakers are HI2, and the oil switches are HI5. It is not economically viable to change or upgrade the switches, therefore SPEN plans to replace the whole switchboard with a modern equivalent.

Of the 2,717 asset interventions only 9 are consequential, and SPEN will replace these assets in line with its strategy to reduce the risk of failure. SPEN has a refurbishment programme for this asset class, however it is not appropriate for these units as it is not economically viable to replace only parts of the switchboard.

The asset profiles broadly align after rebasing; however there are a higher number of HI1 assets due to CNAIM HI banding.

An example of the specific equipment type is South Wales multi panel switchboards shown below in Figure 2 with two oil switches HI5 categorisation, and a circuit breaker with a HI 2 categorisation. The oil switches have a bushing degradation issue resulting in oil loss from the main oil switch tank.

Figure 2 shows a SWS 3 panel switchboard with two IF4X oil switches (HI5) and a C4X oil circuit breaker (HI2) and Figure 3 shows an AEI 3 panel switchboard with two IB4 oil switches (HI5) and a BVP17 oil circuit breaker (HI2).

Figure 2.

Figure 3.

8.2.2 HV Primary Switchgear - Asset Replacement

SPD has failed the test but only by 1 asset and this is the result of a switchboard with a differing HI categorisation. In order to accommodate new network activity such as reinforcement and new connections, switchboards have been extended. The result is that legacy HI 5 circuit breakers and newer HI2 circuit breakers are connected to the same common busbar. It is not economically viable to change or upgrade the circuit breakers; therefore SPEN will replace the whole switchboard with a modern equivalent.

The plan is to replace 343 units in total, 1 of which is a consequential asset which will be replaced.

SPEN plans to continue with its strategy to reduce the risk of poorly performing equipment by replacement. SPEN has a programme of retrofit and refurbishment for this asset class, however, it is not appropriate for this type of unit.

The rebasing asset profile broadly aligns after rebasing, however, there a higher number of HI1 assets due to CNAIM HI banding.

Replacing the whole switchboard with a new containerised substation is the lowest cost optimum solution for the substation, and is in line with the CBRM approach to risk management.

Figure 4 shows a HV Primary switchboard extension for legacy South Wales C4X circuit breakers.

Figure 4.

8.2.3 EHV Switchgear - Asset Replacement

SPD has failed this test marginally, primarily as a result of new network activity such as reinforcement and new connections. Legacy switchboard busbars have been extended in the past to accommodate such connections. The result is that legacy poor HI5 circuit breakers and newer HI circuit breakers are connected to the same common busbar. It is not economically viable to change or upgrade the legacy circuit breakers in the plan; therefore SPEN will replace the whole switchboard with a modern equivalent.

Of the SPD plan to replace 108 units in total, 15 are consequential assets which will be replaced.

SPEN plan to continue with its strategy to reduce the risk of poorly performing equipment by replacement.

The rebasing review is consistent with the original submission for HI5 assets however CNAIM has triggered a change in the distribution of HI2/3/4 assets and in addition a higher number of HI1 assets.

Figures 5 & 6 show an example of EHV switchgear consequential assets for a SWS E01 circuit breaker (HI5) and a HSS HG36 circuit breaker (HI1), which share the same common busbar.

Figure 5.

Figure 6.

8.2.4 EHV Transformer – Asset Refurbishment

SPD and SPM have failed the consequential test for transformer refurbishment by only 10 units. This is due to the transition from SPEN methodology to CNAIM which has reclassified these assets into lower HI bands. This is partly due to CNAIM reducing the impact of acidity and moisture on the health of the asset compared to SPEN's methodology. This reduced factor combined with a marginal age parameter trigger has tipped the HI into a lower category.

SPEN plans to refurbish 126 units in total, 10 of which are consequential. SPEN will continue to refurbish these consequential transformers as external condition warrants intervention and the internal oil analysis confirms that the windings have sufficient remaining life.

The rebasing of the transformer fleet has resulted in a higher number of HI1 assets in each Licence.

SPD plan to refurbish 82 units, 3 of which are consequential assets.

SPM plan to refurbish 44 units, 7 of which are consequential assets.

SPEN will deliver the transformers selected for refurbishments as planned, as the external condition warrants intervention based on on-site condition assessment. Figure 7 shows an EHV transformer which SPEN assessed as a HI4 refurbishment candidate. However CNAIM assessed as a HI2.

Figure 7.

8.2.5 132kV OHL (Tower Line) Conductor - Asset Replacement (SPM)

The Rebased plan includes the replacement of 331km of conductor in line with SPEN's original plan.

The replacement strategy targets conductors through a prioritised and project specific approach to complete circuits. This approach is the lowest cost optimum solution for overhead line circuits. Some individual sections of an overall circuit will have different heath index due to previous fault repairs and new connections activity.

The 132kV OHL Conductor has marginally failed the consequential assets test because the CNAIM rebasing has resulted in sections of conductor being classed in different heath index and criticality bands to SPEN's original plan. Some sections of consequential conductor are included in the programme to complete entire routes utilising the same conductor.

Of the 331km being replaced there are 18km of consequential assets.

The replacement of some limited consequential assets as part of overall circuits is required in order to remove compression joints improving resilience and reliability of these strategic assets.

The strategy for the existing 132kV overhead line distribution network on the SPM network aims to address the current volume of assets at or approaching end of life, through an optimum level of investment, delivered through the continuation of a prioritised and project specific approach that will improve resilience and reliability of this strategic assets.

This is necessary to effectively manage an increasing business risk, ensure cost-efficient investment and continue the long term sustainability and resilience of these key assets.