Scottish & Southern Electricity Networks

Common Network Asset Indices Methodology (CNAIM)

Secondary Deliverables Rebasing

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1. Introduction

1.1. This document is the summary and commentary supporting the Rebased Network Asset Secondary Deliverables submission for both Scottish Hydro Electric Power Distribution (SHEPD) and Southern Electric Power Distribution (SEPD), trading as Scottish and Southern Electricity Networks (SSEN).

1.2. The Rebased Network Asset Secondary Deliverables covered in this document have been produced using the Common Network Asset Indices Methodology (CNAIM) and applying the relevant asset modelling provided through SSEN's Condition Based Risk Management (CBRM) system. The models are set up specifically for the parameters of CNAIM, based on a data set of 1 April 2015, and produce the required output for this rebasing exercise in the form of the Network Asset Workbook (NAW).

1.3. This document includes details of the methodology for the production of the 1 April 2015 data set in preparation for the submission to Ofgem by 30 December 2016. It has been further updated to reflect the proposed changes to the CNAIM for the 1 February 2017 resubmission and the introduction of a separate Fittings category as directed by Ofgem.

1.4. The outputs of this process are listed below and form the complete submission to Ofgem required for this rebasing submission. However, this document only covers the first three items directly related to the NAW with the 2015/16 items forming a separate submission:

- The Network Asset Workbook (NAW) rebasing of RIIO-ED1 submission based on CNAIM

- Additions and Removals workbook

- Monetised risk workbook

2. Scope

2.1. The scope of this document is to provide a high level overview and commentary of the methodology, process and results produced for the rebased NAW Secondary Deliverables using the CNAIM modelling for both SSEN distribution licence areas.

2.2. The requirements for this rebasing are contained in Standard Licence Condition 51 which sets out the detailed requirements for the licensee to maintain a Network Asset Indices Methodology, and Charge Restriction Condition 5D Part C which sets out the requirements for rebasing the Network Asset Secondary Deliverables (NASD) monetised risk target.

2.3. The exact detail of the requirement for this rebasing exercise were outcomes of the CNAIM approval by Ofgem in their letter of direction on 1 February 2016 and decision to approve modifications to the CNAIM on 21 October 2016.

3. Process

3.1. The summary of the methodology deployed and the processes undertaken are provided in this section which is subdivided into a number of key activities listed below:

- Overview of the process and methodology used to achieve a 1 April 2015 data set

- The process undertaken to produce the Network Asset Workbook rebasing submission

3.2. The methodology to establish the data set for 1 April 2015 is covered in section 4 below and further explained in Appendix A. It was derived based on the roll-back mechanism using the most up to date and accurate data available to SSEN on receipt of the approved modifications from Ofgem in October 2016 and was based on the latest CBRM data set of 30 September 2016.

3.3. The process for the production of the rebased NAW, utilising the 1 April 2015 data set, was to run the specific CNAIM model for the specified asset category, verify the integrity of the volumes processed through the model against those supplied in the data set, and ensure this reflected the reported volumes in the RIGs tables for the 2015/16 start of RIIO-ED1.

3.4. This provided a revised health and criticality indices matrix for the specific asset category which was then evaluated against the Equally Challenging Test (ECT) requirements, section 6 & 7 below, to validate the necessary results.

3.5. SSEN did not utilise the CNAIM Reliability Modifier capability in any of the asset categories during this process in producing the rebased NAW.

3.6. All outputs had associated commentary and documentation produced to summarise and justify the outcome of the tests depending on the results and whether they failed at any stage in the process.

3.7. The resulting health and criticality indices from the models were entered into the appropriate sections of the NAW ready for submission. The Additions and Removals and associated Monetised Risk workbooks were updated from the revised NAW data. The Probability of Failure (PoF) and Consequence of Failure (CoF) have also been updated in the relevant workbooks as a record of the values which have been utilised in the CNAIM.

3.8. The PoF bands used in these submissions are those provided in the PoF Bands – CNAIM spreadsheet supplied to the DNOs through the working group issued to all on 18 November 2016.

3.9. The submission is presented with a single consolidated Monetised Risk workbook.

4. Data set establishment

4.1. This section provides a high level overview of the methodology undertaken to establish the base data set of 1 April 2015 (Yr 0) for the commencement of the RIIO-ED1. The introduction of CBRM into SSEN and in response to the requirements of SLC 51(f), which resulted in a change in the Network Asset Indices Methodology being deployed within the organisation, significant work was undertaken

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during 2015/16 to improve the quality and accuracy of the asset data available to be utilised in the revised methodology.

4.2. On this basis, the best and most accurate data available for both asset definition and condition based information for SSEN was established by taking the 30 September 2016 data set and applying a SSEN roll-back methodology. This firstly established the 1 April 2016 position and by then including additions and removals during 2015/16 an accurate representation of the asset condition was established for 1 April 2015.

 SSEN developed its rollback methodology by considering the following elements:

- Volumes of relevant work in 2015-16

- Investment Drivers

- Impact and limitations of Health Index Movements based on drivers

- Impact and limitations of Criticality Index Movements based on drivers

4.3. Rules associated with these elements were created based on Risk Index category definitions and assumptions on the impacts of Investments on the Risk Index of an asset.

4.4. It was recognised that for low volume/high cost assets that individual assets could be assigned for the roll-back process. For high volume/low costs assets this was more difficult to achieve so a specific tool was developed to provide consistency in applying the roll-back process.

4.5. This tool uses Extensible Markup Language (XML) to define rules on the Data input files used for the CNAIM Model. Using the rules and logic of the Rollback Methodology the Rollback tool amends the data input files to reflect the changes which occurred in the Network during 2015/16. It identifies assets by looking at the current Risk Score from the CNAIM extract. The data input files are then automatically amended based on the Rollback Methodology to create a 2015/16 Data Set. This amended Data Set forms the basis for the 2015 CNAIM Model, allowing the model to recalculate its Risk Index and ultimately providing a 2015/16 Risk Index output.

4.6. This process is detailed further in Appendix A for the five investment drivers of asset change namely; replacement; refurbishment; reinforcement; faults; and other. The risk index movement associated with the roll-back methodology as well as any reasoning behind the applied change is also detailed.

4.7. This base data set was then used as the Yr 0 position for the required processing by the CNAIM modelling to produce the forward projections for the without and with intervention projections for the mid-point review period of 2019 (Yr 4) and period end review of 2023 (Yr 8).

5. Intervention methodology

5.1. This section describes the intervention methodology deployed by SSEN in the rebasing process and how this has been applied through both the roll-back and forward planning for the production of the

rebased NAW. The detail is only provided for Asset Replacement and Asset Refurbishment as the NAW does not have any Secondary Deliverables for High Value Projects.

5.2. In the case of asset replacement, the general intervention process is that the asset health index is reset to an as 'new condition' of HI1 from whatever health index value it was previously, whether that be HI5, HI4 or even HI3.

5.3. This has always been SSEN's methodology for asset replacement whether under the previous DPCR5 methodology, the RIIO-ED1 Business Plan Data Tables (BPDT) or under the CNAIM process.

5.4. The same however is not the case for refurbishment interventions where historically this has been considered by SSEN as resetting the asset's health index by two health point values, for example HI5 to HI3 or HI4 to HI2.

5.5. With the introduction of CNAIM the same two point movement in asset health index value is unlikely to be achieved without complex multiple interventions. To achieve a two point movement would require the condition improvement of several observed and measured condition data points for an asset. However, this still could have the impact of only a single health index point movement due to other factors such as age and duty.

5.6. On this basis SSEN has declared only a single point reduction on the six asset categories in the rebased NAW where refurbishment interventions are part of the secondary deliverables and therefore reduce its risk point reduction accordingly which it believes is consistent with other DNOs.

5.7. It should be noted that in 2015/16 the refurbishment methodology was still maintained based on the DPCR5 definitions and, as such, any refurbishment was evidenced as a two place Health Index improvement. Therefore in the roll-back process to establish the 1 April 2015 data set all refurbishment was based on a two point degradation and not a single point degradation as is now utilised for forward prediction modelling under CNAIM for Yr 4 and Yr 8 with intervention metrics.

5.8. Where asset data points are not currently available, the CNAIM models in the CBRM System use default values which defer to a conservative position. Where the HI indicates the assets require intervention SSEN's process involves a second stage of detailed analysis of the asset condition (appropriate to the asset type). Should this confirm an intervention is required it is planned and executed.

5.9. SSEN's IGP describes how it will collect data over time and replace the default values with actual values. These may result in HI movements which could alter the indicated interventions.

5.10. During 2017/18, SSEN believes it will collect sufficient data across the asset population to understand the likely impacts. SSEN will assess whether these represent material changes which could impact future intervention plans.

5.11. SSEN has invested in the CNAIM interventions modelling tools in order to predict accurate future intervention modelling parameters. However this functionality was delivered too late in the rebasing process to be utilised at this time with any degree of certainty and therefore assessment of future intervention methodology was managed out with the CBRM system for the rebasing submission.

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5.12. On this basis the intervention process can be summarised into three areas:

5.12.1. Named scheme interventions were predominately utilised in the early years where detailed plans and schemes are identified and known. This generally applies to the 132kV and EHV asset categories where the volumes are low and there is a high certainty on the named scheme being delivered in the short term without trading for another scheme.

5.12.2. Mixed approach where some named schemes have already been identified on known poor condition assets (generally HI5) with the balance on a volumetric approach where the asset quantity has been trued up to the balance of the committed volume, predominantly from assets in HI4 or HI5. This approach applies to the mid volume asset categories like HV switchgear and HV transformers, and LV switchgear.

5.12.3. Statistical volumetric approach where the volume is based on historical trends of typical volumes of assets to equate to the committed volume. This approach has been used in the higher volume HV and LV asset categories, typically poles which also include EHV assets. In these high volume categories identifying the individual assets is possible in the modelling however impractical to detail specifically at this stage in the process for the entire RIIO-ED1 period. These fall into generic work programmes throughout the period whilst targeting specific assets at the time of the programme being produced.

5.13. All interventions are considered to be associated with health index improvement and the criticality of the asset does not directly change for a condition related intervention so no movement in Criticality Index is anticipated.

5.14. SSEN intends to move over to the intervention models for future investment evaluation once it has established the potential intervention classifications for refurbishment and tailored the models to reflect the anticipated health improvement factors associated with each of these intervention points. It is planned to work through these model by model and have them fully operational by December 2017.

5.15. SSEN expects the implementation of the intervention models to result in some material changes in the results which will be reported to Ofgem in the annual RRP returns.

6. Equally challenging testing

6.1. As part of the requirement for the rebasing of the NAW, Ofgem confirmed a common DNO assessment process for the submission. On this basis, it is necessary for each DNO to perform an identical series of tests on the outputs from the process to establish if the application of the CNAIM modelling yields equally challenging results when compared to the original RIIO-ED1 NAW submission.

6.2. The production of this methodology followed a series of meetings involving all DNOs and other interested parties as part of the established Reliability Working Group. The majority of this working group was also represented during the formation of the CNAIM and therefore were best placed to inform the development of the testing process.

6.3. There are three equally challenging tests;

6.4. Test 1 – Statistical test of 'equally as challenging'. To ensure that an equivalent or equally challenging improvement in risk point reduction can be achieved by the rebased asset population based on the planned interventions when compared to the original NAW.

6.5. Test 2 – Volumes of investment test. To ensure the volume of the specific intervention driver is the same volume as was stated in the original NAW.

6.6. Test 3 – Consequential test. To identify if any investment is made in index bands where it would not be expected.

7. Summary of test results

7.1. A summary of the test results from the Equally Challenging Tests (ECTs) is provided in **Table 7.1 to Table 7.6** in a consistent format for the three identified asset investment drivers; Replacement, Refurbishment and High Value Projects (HVPs).

7.2. These three drivers for investment must be provided in a standard format by all DNOs. However, it should be noted that neither SEPD or SHEPD have any asset investments within the original or restated NAW for High Value Projects. **Table 7.3 and Table 7.6** are shown as 'not applicable' (N/A) but remain in this submission for the purpose of transparency and consistency when published for comparison with other DNOs.

7.3. Where a results table has a test 'fail' result additional information can be found in Appendix B documentation.

7.4. SSEN has CNAIM based information on some asset categories which are not part of the original RIIO-ED1 Network Asset Secondary Deliverables. The guidance clearly states that the rebasing approach followed should '*not […] revise the targets that were originally agreed*'. Therefore SSEN has not populated any additional areas of the NAW from that published by Ofgem in February 2015.

7.5. SSEN is collecting further health and criticality data under the Information Gathering Plan (IGP) in addition to that already available and used to populate CNAIM models. This ultimately will allow population of these further asset categories.

7.6. The NAW used as the original, published by Ofgem, is a modified version of a file dated 3 February 2015. This was further developed in conjunction with Ofgem but never published. It reflects further discussion on missing PoF details on subsea cable assets for licence areas, an alteration in volumes in EHV Transformers for SEPD and the length of subsea cable for SHEPD. This has been acknowledged by Ofgem in the lead up to this submission and SSEN believes it will be noted in the consultation process.

7.7. The updated Monetised Risk workbooks are directly populated from the revised NAW. SSEN has also provided an 'Additions & Replacements' workbook reflecting the movement of all asset volumes

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across the asset categories based on the changes shown as replacements and net positions of movement, requested to complete the submission in line with the guidelines.

7.8. The treatment of overhead line support interventions in RIIO-ED1 differs from DPCR5 in that some interventions regarded as refurbishment are now classified as inspection and maintenance. This has directly led to the failure of test 1 for refurbishment interventions on LV overhead line supports, HV overhead lines supports, EHV overhead line support – poles.

7.9. For SHEPD fluid filled cables most assets fail test 1 and 3 due to lack of leak condition data in the CNAIM model. However SSEN's current approach to asset management for fluid filled cables collects and utilises a more comprehensive data set to assess health and impact. More detail on this is provided in Appendix B. Furthermore, when we completed the equally challenging test the cable lengths did not correspond exactly to the length in our original submission as a result we fail the test 2 for SHEPD. The named schemes account for an overall length of 21.162km which was recorded as 21.0km in the original NAW. SSEN is proposing to replace 0.162km more cable than previously stated.

7.10. SHEPD HV transformers failed test 3 for asset replacement and test 3 for asset refurbishment. The HV Transformer replacement programme is based on a volumetric approach. The IGP is committed to gathering all necessary data points through ongoing inspection cycles by December 2017. While some CNAIM condition data points are not currently available for all assets this asset category fails on test 3 where 89 HI2 assets have been identified on age alone until further condition information is gathered. The RIIO-ED1 Business Plan commitment on HV transformer refurbishment for SHEPD should not have been submitted. SSEN had considered a policy of refurbishment early on in the business plan submissions, but these proposals were discounted on the grounds of not being economic for HV transformers. SSEN discussed this with Ofgem at the 2015/16 Cost Visit and proposed further discussion to make a proportionate investment in an alternative asset category in order to achieve an equivalent risk reduction. This needs to be explored further after this submission is approved. Currently, volumes have been included within the rebasing process as per the RIIO-ED1 Final proposals.

7.11. SEPD 132kV OHL Fittings (Tower Lines) failed test 1 based on this specific asset category not being separated out within the Original NAW. SSEN's original submission for Conductor and Fittings was based on conductor only as the unit measure was km. On this basis the rebased NAW has no equivalent NAW Fittings reference to compare against and has been compared against the combined one which is effectively conductor only and fails the test. SSEN policy is to replace all fittings when reconductoring existing circuits based on efficiency in delivery and reduced potential subsequent failure. These are all named conductor schemes and as such believe this is still justified.

7.12. The Ofgem tests are presented in Table 7.1 to Table 7.6 below.

Table 7.1 – Ofgem criteria test summary - Asset Replacement SHEPD

Licence Area	CNAIM model number and asset category	Test 1 Pass / Fail	Test 2 Pass / Fail	Test 3 Pass / Fail	Evidence
	LV Network				
SSEH	CM3 LV Switchgear and Other	Pass	Pass	Pass	
SSEH	CM2 LV UGB	N/A	N/A	N/A	Not in NAW
SSEH	CM1 LV OHL Support	Pass	Pass	Pass	
	HV Network				
SSEH	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SSEH	CM6 HV Distribution Switchgear	Pass	Pass	Pass	
SSEH	CM7 HV Distribution Transformers	Pass	Pass	Fail	Appendix B
SSEH	HV UG Cable	N/A	N/A	N/A	No Model
SSEH	CM4 HV OHL Support - Poles	Pass	Pass	Pass	
	EHV Network				
SSEH	CM16 EHV Switchgear (GM)	Pass	Pass	Pass	
SSEH	CM17 EHV Transformers	Pass	Pass	Pass	
SSEH	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not in NAW
SSEH	CM14 EHV UG Cable (Oil)	Fail	Fail	Fail	Appendix B
SSEH	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not in NAW
SSEH	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not in NAW
SSEH	CM8 EHV OHL Support - Poles	Pass	Pass	Pass	
SSEH	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not in NAW
SSEH	CM10 EHV OHL (Tower Lines) Conductor	N/A	N/A	N/A	Not in NAW
	132kV Network				
SSEH	CM24 132kV Circuit Breakers	N/A	N/A	N/A	No Assets
SSEH	CM25 132kV Transformers	N/A	N/A	N/A	No Assets
SSEH	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No Assets
SSEH	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No Assets
SSEH	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	No Assets
SSEH	CM20 132kV OHL Support - Tower	N/A	N/A	N/A	No Assets
SSEH	CM18 132kV OHL Fittings	N/A	N/A	N/A	No Assets
SSEH	CM19 132kV OHL (Tower Lines) Conductor	N/A	N/A	N/A	No Assets
	Other				
SSEH	CM15 Submarine Cables	Pass	Pass	Pass	

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Table 7.2 – Ofgem criteria test summary - Asset Refurbishment SHEPD

Licence Area	CNAIM model number and asset category	Test 1 Pass / Fail	Test 2 Pass / Fail	Test 3 Pass / Fail	Evidence
	LV Network				
SSEH	CM3 LV Switchgear and Other	N/A	N/A	N/A	Not in NAW
SSEH	CM2 LV UGB	N/A	N/A	N/A	Not in NAW
SSEH	CM1 LV OHL Support	Fail	Fail	N/A	Appendix B
	HV Network				
SSEH	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SSEH	CM6 HV Distribution Switchgear	N/A	N/A	N/A	Not in NAW
SSEH	CM7 HV Distribution Transformers	Pass	Pass	Fail	Appendix B
SSEH	HV UG Cable	N/A	N/A	N/A	No Model
SSEH	CM4 HV OHL Support - Poles	Fail	Fail	N/A	Appendix B
	EHV Network				
SSEH	CM16 EHV Switchgear (GM)	Pass	Pass	Pass	
SSEH	CM17 EHV Transformers	Pass	Pass	Pass	
SSEH	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not in NAW
SSEH	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not in NAW
SSEH	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not in NAW
SSEH	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not in NAW
SSEH	CM8 EHV OHL Support - Poles	Fail	Fail	N/A	Appendix B
SSEH	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not in NAW
SSEH	CM10 EHV OHL (Tower Lines) Conductor	N/A	N/A	N/A	Not in NAW
	132kV Network				
SSEH	CM24 132kV Circuit Breakers	N/A	N/A	N/A	No Assets
SSEH	CM25 132kV Transformers	N/A	N/A	N/A	No Assets
SSEH	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No Assets
SSEH	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No Assets
SSEH	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	No Assets
SSEH	CM20 132kV OHL Support - Tower	N/A	N/A	N/A	No Assets
SSEH	CM18 132kV OHL Fittings	N/A	N/A	N/A	No Assets
SSEH	CM19 132kV OHL (Tower Lines) Conductor	N/A	N/A	N/A	No Assets
	Other				
SSEH	CM15 Submarine Cables	N/A	N/A	N/A	Not in NAW

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Table 7.3 – Ofgem criteria test summary - High Value Projects (HVP) SHEPD

Licence Area	CNAIM model number and asset category	Test 1 Pass / Fail	Test 2 Pass / Fail	Test 3 Pass / Fail	Evidence
	LV Network				
SSEH	CM3 LV Switchgear and Other	N/A	N/A	N/A	N/A
SSEH	CM2 LV UGB	N/A	N/A	N/A	N/A
SSEH	CM1 LV OHL Support	N/A	N/A	N/A	N/A
	HV Network				
SSEH	CM5 HV Switchgear (GM) - Primary	N/A	N/A	N/A	N/A
SSEH	CM6 HV Distribution Switchgear	N/A	N/A	N/A	N/A
SSEH	CM7 HV Distribution Transformers	N/A	N/A	N/A	N/A
SSEH	HV UG Cable	N/A	N/A	N/A	No Model
SSEH	CM4 HV OHL Support - Poles	N/A	N/A	N/A	N/A
	EHV Network				
SSEH	CM16 EHV Switchgear (GM)	N/A	N/A	N/A	N/A
SSEH	CM17 EHV Transformers	N/A	N/A	N/A	N/A
SSEH	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	N/A
SSEH	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	N/A
SSEH	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	N/A
SSEH	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	N/A
SSEH	CM8 EHV OHL Support - Poles	N/A	N/A	N/A	N/A
SSEH	CM9 EHV OHL Fittings	N/A	N/A	N/A	N/A
SSEH	CM10 EHV OHL (Tower Lines) Conductor	N/A	N/A	N/A	N/A
	132kV Network				
SSEH	CM24 132kV Circuit Breakers	N/A	N/A	N/A	No Assets
SSEH	CM25 132kV Transformers	N/A	N/A	N/A	No Assets
SSEH	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	No Assets
SSEH	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	No Assets
SSEH	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	No Assets
SSEH	CM20 132kV OHL Support - Tower	N/A	N/A	N/A	No Assets
SSEH	CM18 132kV OHL Fittings	N/A	N/A	N/A	No Assets
SSEH	CM19 132kV OHL (Tower Lines) Conductor	N/A	N/A	N/A	No Assets
	Other				
SSEH	CM15 Submarine Cables	N/A	N/A	N/A	N/A

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Table 7.4 – Ofgem criteria test summary - Asset Replacement SEPD

Licence Area	CNAIM model number and asset category	Test 1 Pass / Fail	Test 2 Pass / Fail	Test 3 Pass / Fail	Evidence
	LV Network				
SSES	CM3 LV Switchgear and Other	Pass	Pass	Pass	
SSES	CM2 LV UGB	N/A	N/A	N/A	Not in NAW
SSES	CM1 LV OHL Support	Pass	Pass	Pass	
	HV Network				
SSES	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SSES	CM6 HV Distribution Switchgear	Pass	Pass	Pass	
SSES	CM7 HV Distribution Transformers	Pass	Pass	Pass	
SSES	HV UG Cable	N/A	N/A	N/A	No Model
SSES	CM4 HV OHL Support - Poles	Pass	Pass	Pass	
	EHV Network				
SSES	CM16 EHV Switchgear (GM)	Pass	Pass	Pass	
SSES	CM17 EHV Transformers	Pass	Pass	Pass	
SSES	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not in NAW
SSES	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not in NAW
SSES	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not in NAW
SSES	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not in NAW
SSES	CM8 EHV OHL Support - Poles	Pass	Pass	Pass	
SSES	CM9 EHV OHL Fittings	Pass	N/A	N/A	
SSES	CM10 EHV OHL (Tower Lines) Conductor	Pass	Pass	Pass	
SSES	**132kV Network**				
SSES	CM24 132kV Circuit Breakers	Pass	Pass	Pass	
SSES	CM25 132kV Transformers	Pass	Pass	Pass	
SSES	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	Not in NAW
SSES	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	Not in NAW
SSES	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not in NAW
SSES	CM20 132kV OHL Support - Tower	N/A	N/A	N/A	Not in NAW
SSES	CM18 132kV OHL Fittings	Fail	N/A	N/A	Appendix B
SSES	CM19 132kV OHL (Tower Lines) Conductor	Pass	Pass	Pass	
	Other				
SSES	CM15 Submarine Cables	N/A	N/A	N/A	Not in NAW

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Table 7.5 – Ofgem criteria test summary - Asset Refurbishment SEPD

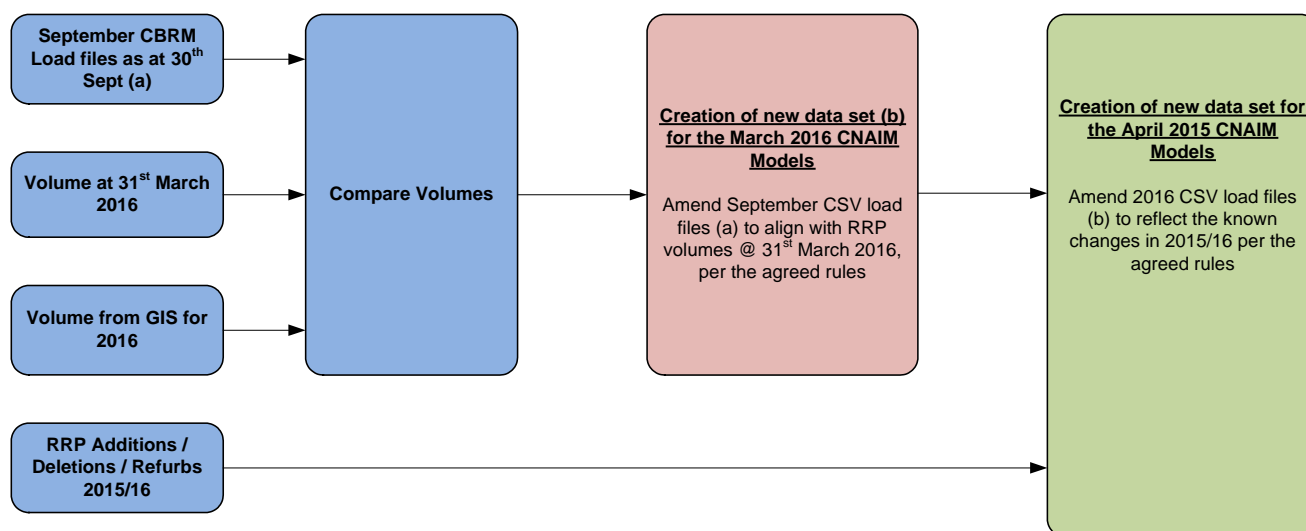| Licence Area	CNAIM model number and asset category	Test 1 Pass / Fail	Test 2 Pass / Fail	Test 3 Pass / Fail	Evidence
	LV Network				
SSES	CM3 LV Switchgear and Other	N/A	N/A	N/A	Not in NAW
SSES	CM2 LV UGB	N/A	N/A	N/A	Not in NAW
SSES	CM1 LV OHL Support	Fail	Fail	N/A	Appendix B
	HV Network				
SSES	CM5 HV Switchgear (GM) - Primary	Pass	Pass	Pass	
SSES	CM6 HV Distribution Switchgear	N/A	N/A	N/A	Not in NAW
SSES	CM7 HV Distribution Transformers	N/A	N/A	N/A	Not in NAW
SSES	HV UG Cable	N/A	N/A	N/A	No Model
SSES	CM4 HV OHL Support - Poles	Fail	Fail	N/A	Appendix B
	EHV Network				
SSES	CM16 EHV Switchgear (GM)	N/A	N/A	N/A	Not in NAW
SSES	CM17 EHV Transformers	Pass	Pass	Pass	
SSES	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	Not in NAW
SSES	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	Not in NAW
SSES	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not in NAW
SSES	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	Not in NAW
SSES	CM8 EHV OHL Support - Poles	Fail	Fail	N/A	Appendix B
SSES	CM9 EHV OHL Fittings	N/A	N/A	N/A	Not in NAW
SSES	CM10 EHV OHL (Tower Lines) Conductor	N/A	N/A	N/A	Not in NAW
SSES	**132kV Network**				
SSES	CM24 132kV Circuit Breakers	N/A	N/A	N/A	Not in NAW
SSES	CM25 132kV Transformers	Pass	Pass	Pass	
SSES	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	Not in NAW
SSES	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	Not in NAW
SSES	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	Not in NAW
SSES	CM20 132kV OHL Support - Tower	N/A	N/A	N/A	Not in NAW
SSES	CM18 132kV OHL Fittings	N/A	N/A	N/A	Not in NAW
SSES	CM19 132kV OHL (Tower Lines) Conductor	N/A	N/A	N/A	Not in NAW
	Other				
SSES	CM15 Submarine Cables	N/A	N/A	N/A	Not in NAW

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Table 7.6 – Ofgem criteria test summary - High Value Projects (HVP) SEPD

Licence Area	CNAIM model number and asset category	Test 1 Pass / Fail	Test 2 Pass / Fail	Test 3 Pass / Fail	Evidence
	LV Network				
SSES	CM3 LV Switchgear and Other	N/A	N/A	N/A	N/A
SSES	CM2 LV UGB	N/A	N/A	N/A	N/A
SSES	CM1 LV OHL Support	N/A	N/A	N/A	N/A
	HV Network				
SSES	CM5 HV Switchgear (GM) - Primary	N/A	N/A	N/A	N/A
SSES	CM6 HV Distribution Switchgear	N/A	N/A	N/A	N/A
SSES	CM7 HV Distribution Transformers	N/A	N/A	N/A	N/A
SSES	HV UG Cable	N/A	N/A	N/A	No Model
SSES	CM4 HV OHL Support - Poles	N/A	N/A	N/A	N/A
	EHV Network				
SSES	CM16 EHV Switchgear (GM)	N/A	N/A	N/A	N/A
SSES	CM17 EHV Transformers	N/A	N/A	N/A	N/A
SSES	CM12 EHV UG Cable (Gas)	N/A	N/A	N/A	N/A
SSES	CM14 EHV UG Cable (Oil)	N/A	N/A	N/A	N/A
SSES	CM13 EHV UG Cable (Non Pressurised)	N/A	N/A	N/A	N/A
SSES	CM11 EHV OHL Support - Towers	N/A	N/A	N/A	N/A
SSES	CM8 EHV OHL Support - Poles	N/A	N/A	N/A	N/A
SSES	CM9 EHV OHL Fittings	N/A	N/A	N/A	N/A
SSES	CM10 EHV OHL (Tower Lines) Conductor	N/A	N/A	N/A	N/A
SSES	**132kV Network**				
SSES	CM24 132kV Circuit Breakers	N/A	N/A	N/A	N/A
SSES	CM25 132kV Transformers	N/A	N/A	N/A	N/A
SSES	CM21 132kV UG Cable (Gas)	N/A	N/A	N/A	N/A
SSES	CM23 132kV UG Cable (Oil)	N/A	N/A	N/A	N/A
SSES	CM22 132kV UG Cable (Non Pressurised)	N/A	N/A	N/A	N/A
SSES	CM20 132kV OHL Support - Tower	N/A	N/A	N/A	N/A
SSES	CM18 132kV OHL Fittings	N/A	N/A	N/A	N/A
SSES	CM19 132kV OHL (Tower Lines) Conductor	N/A	N/A	N/A	N/A
	Other				
SSES	CM15 Submarine Cables	N/A	N/A	N/A	N/A

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Appendix A   Data set process for 1 April 2015

A1   Roll-back process

A2   Risk Index movement rules

A2.1   Move from March 2016 to April 2015

2.2.1.   The following sections list the rules of Risk Index movement due to interventions from the 31 March 2016 to the 1 April 2015.

2.2.2.   These rules have been used in instances where it may not be practicable to identify particular assets and their retrospective condition information. The rules vary dependant on investment driver and asset type.

2.2.3.   The roll-back process selected assets based on their HIs and rolled them back from September 2016 to April 2015. This was done with the appropriate shift in HI, to match the asset HI profile of each asset class both before and after roll-back. At that point, the criticality was calculated based on the average CoF at April 2015 (which was then fixed).

2.2.4.   The automated process used for the data roll-back took into account the Health Index (HI) score of the assets as at 30 September 2016. This enabled the process to evaluate the data roll-back changes needed, based on the rules below. The original intent had been to fix the rolled back asset criticalities to match those found in September 2016 and this was successful for all but seven categories. Where the criticalities mapped like for like, this was because the populations were concentrated around C2 in the 2016 data set. For the seven exceptions the process selected

assets based only on the HI in 2016. The CBRM software calculated the criticality relative to the 2015 asset population by applying the model's CoF average.

2.2.5. Where the CNAIM Risk Index matrix might not have enough assets in a particular Health or Criticality band to apply the rules as set out in **Table A1.1**, the next highest Risk asset will be considered.

2.2.6. The rules are based on the following **Table A1.1** below:

Table A1.1 – Rules for Risk Index Movements

No	Investment Driver	Risk Index Movement (31 March 2016 to 1 April 2015)	Reasoning
1	Asset Replacement	Health Index movement: HI1 to HI5	As part of proactive Asset Replacement, works would normally be involve replacing an end of life asset (HI5) with a brand new asset (HI1)
2	Refurbishment (Secondary Deliverable Impact)	Health Index movement: HI3 to HI4	As part of refurbishment works, work would involve refurbishing assets that are materially deteriorated (HI4) to either a good condition (HI2) or deteriorated but requires assessment and monitoring (HI3). For this exercise the movement with the least impact i.e. HI4 to HI3, has been chosen
3	General Reinforcement	Health Index movement: HI1 to HI3	As part of reinforcement works, work would involve disposing of assets across a range of Health Index bands. However, the rule used for these purposes takes into account the movement with the lowest impact i.e. HI3 to HI1, with the assumption that the asset being reinforced would have been in service for at least the majority of its expected life, in addition to being deteriorated and needing assessment.
4	Fault	Health Index movement: HI1 to HI5 for replacement due to fault HI3 to HI4 for refurbishment due to fault	A fault activity would involve replacing an end of life asset (i.e. HI5 to HI1), refurbishing a deteriorated asset (HI4 to HI2 or HI3) or repairing an asset (no change). For the purpose of rebasing this method takes the movement with a low impact on refurbishment (i.e. HI4 to HI3 for refurbishment).
5	"All Other" activity	Health Index movement: HI1 to a HI2, HI3, HI4 and HI5 assets using CNAIM current spread	These activities include any activities other than those listed above. These range from legal or statutory requirements due to changes in legislation, which may include Safety driven requirements through to network connection activities. As part of these works assets might be replaced, added or disposed of. Given the diversity of works within this investment driver, the intention is to maintain the risk of the Network while ensuring that these activities are counted. In order to do so, movements associated with these works will follow the same spread as that of SSEN's CNAIM asset specific Risk Index as of the 30 September 2016.

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Appendix B   Equally challenging results

As detailed in section 7 above, this appendix explains the reason for the failed equally challenging test results and clarifies whether these were either anticipated due to changes since the original NAW submission, or due to specific reasons.

Four asset categories 'failed' Equally Challenging Tests as detailed below.

- Refurbishment of Overhead lines at all voltage classifications – LV, HV and EHV on the basis of the definition of SDI compared to this work previously under DPCR5.

- HV Transformers on replacement volume and refurbishment where a change in policy should have led to not including the refurbishment volumes in the original NAW.

- Fluid filled cables (Oil) on the investment being on HI1 assets due to SSEN's policy of repair after relatively small volume of loss fluid and test 3 due to a minor difference in volume from the original NAW.

- 132kV OHL Fittings (Tower Lines) where this has been separated out from the Original NAW combined Conductor and Fittings asset category due to there being no previous reference to compare against.

Overhead Lines

Refurbishment for Overhead Lines 'Fail' for SSEN under new definitions

Licence Area	CNAIM model number and asset category	Intervention	Test 1	Test 2	Test 3
			Pass / Fail	Pass / Fail	Pass / Fail
SSEH	LV OHL Support-Poles	Refurbishment	**Fail**	**Fail**	N/A

Licence Area	CNAIM model number and asset category	Intervention	Test 1	Test 2	Test 3
			Pass / Fail	Pass / Fail	Pass / Fail
SSEH	HV OHL Support-Poles	Refurbishment	**Fail**	**Fail**	N/A

Licence Area	CNAIM model number and asset category	Intervention	Test 1	Test 2	Test 3
			Pass / Fail	Pass / Fail	Pass / Fail
SSEH	EHV OHL Support Poles	Refurbishment	**Fail**	**Fail**	N/A

The treatment of overhead line support interventions in RIIO-ED1 differs from DPCR5 in that some interventions regarded as refurbishment are now classified as inspection and maintenance. This has directly led to the failure of test 1 for refurbishment interventions on LV overhead line supports, HV overhead lines supports, EHV overhead line support – poles.

HV OHL Poles fails the Equally Challenging Tests for Refurbishment since SSEN do not propose any Refurbishments associated with Secondary Deliverables.

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HV Transformers

HV Transformers (SHEPD) 'Fail' due to incorrect volumes included in the original business plan

Test 3 - Replacement

Submission Type	Proportion of Interventions (Asset Replacement) across HI1, HI2 and HI3 (original) and across HI 1and HI2 (rebased NAW)
Original NAW	0%
Rebased NAW	23%
Result	Fail

Test 3 - Refurbishment

Submission Type	Proportion of Interventions (Asset Replacement) across HI1, HI2 and HI3 (original) and across HI 1and HI2 (rebased NAW)
Original NAW	0%
Rebased NAW	82%
Result	Fail

SHEPD HV transformers failed test 3 for asset replacement and test 3 for asset refurbishment.

The HV transformers failed replacement test 3 based on volumes due to the planned volumetric statistical approach. This is a consequence of full condition information not presently being available for all requirements of the CNAIM data points. On this basis 89 HI2 assets are currently included in the replacement volumes causing a test 3 failure. As the condition data is gathered details of any resulting material change will be provided through SSEN's annual submission.

The RIIO-ED1 Business Plan commitment on HV transformers for SHEPD should not have been submitted. Previously the policy was to recycle the assets but this has been discontinued for HV transformers on economic grounds. SSEN made reference to this with Ofgem at the 2015/16 Cost Visit and suggested the need for further discussion to make a proportionate investment in an alternative asset category in order to achieve an equivalent risk reduction. This alternative needs to be explored further after this NAW rebasing submission is approved. Currently, volumes have been included within the rebasing process as per the RIIO-ED1 Final proposals.

Fluid filled Cables (Oil)

Oil Filled Cables (SHEPD) 'Fail' due to differences in condition assessment process from CNAIM requirements.

For SHEPD fluid filled cables most assets fail test 1 and test 3 due to lack of leak condition data in the CNAIM model. However SSEN's current approach to asset management for fluid filled cables collects and utilises a more comprehensive data set to assess health and impact.

Test 2, when we completed the equally challenging test the cable lengths did not correspond exactly to the length in our original submission as a result we fail the test 2 for SHEPD. The named schemes account for an overall length of 21.162km which was recorded as 21.0km in the original NAW. SSEN is proposing to replace 0.162km more cable than previously stated.

Submission Type	Metric 1 (Proposed Intervention Risk Reduction Points/ Maximum Intervention Risk Reduction Points) Independent Test and Sequential Test
Original NAW	95%
Rebased NAW	61%
Result	Fail

Submission Type	Volumes of Intervention (Asset Replacement)
Original NAW	21.000
Rebased NAW	21.162
Result	Fail

Submission Type	Proportion of Interventions (Asset Replacement) across HI1, HI2 and HI3 (original) and across HI1 and HI2 (rebased NAW)
Original NAW	0%
Rebased NAW	47%
Result	Fail

The SSEN policy on replacement of fluid filled cables applies an evidence based approach to recorded leakage over time which is more stringent than that applied by CNAIM. SSEN has considerable experience of operating these cables under the policy and believes it has, as a result, seen network integrity and the environment appropriately protected. It believes that the planned replacement of the identified fluid filled cables is justified.

SSEN will now consider whether this policy difference can be accounted for utilising the CNAIM Reliability Modifier mechanism with suitable justification or seek to review and propose refinement of the CNAIM for this asset group further.

132kV OHL Fittings (Tower Lines)

As there was no separate asset category for fittings in the Original NAW, this testing does not have an asset specific condition category to reference against for fittings alone in the ECT. SSEN's policy and methodology deployed in the Original NAW was based on our current reconductoring policy where it is traditionally recognised as more efficient to carry out replacement fittings at the same time as the reconductoring work as the highest cost associated with the work is deploying the labour and achieving the access to carry out the work at the same time. Therefore SSEN's policy is to always replace all fittings along a circuit route at the same time as the conductor is replaced.

On this basis the original submission for Fittings & Conductors as a NAW category was based around the conductor condition only and the fitting replacements effectively were a sub component of this work. SSEN have therefore used this 'Conductor' Original NAW category as the reference for the fitting replacement as it forms part of the named schemes submitted as per the original Business Plan. In this ECT test requirement for 132kV Fittings only 'fails' the test 1, although the conductor for these same circuits 'pass' the test.

SSEN did not include for or believe it has any previous allowance for the associated Risk Points for Fittings in the Original NAW submission as the measure for 'Conductors and Fittings' was per km and was not included for in the combined category.

The table below indicates a comparison between the Original NAW with SSEN's conductor only submission, the conductor only ECT, the Fittings only ECT, and a combined ECT when you consider both the Conductors and Fittings together for the named circuits under the CNAIM modelling.

Submission Type	Metric 1 (Proposed Intervention Risk Reduction Points/ Maximum Intervention Risk Reduction Points) Independent Test
Original NAW (SSEN view - Conductor only)	**72%**
Rebased NAW – Conductor only	79%
Rebased NAW – Fittings only	49%
TOTAL Rebased NAW - Combined	**62%**
Result	**Fail**