

Proposed Modification to Network Output Measures Methodology

Report to accompany the submission of Issue 7

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1. As part of RIIO-T1 each TO has a set of Network Replacement Outputs which describe the network risk left on the transmission system on 31 March 2021. These outputs targets are set out in Special Licence Condition 2M. One of the clauses in Special Licence Condition 2M enables trading between these targets to achieve the overall Network Replacement Outputs by under-delivering in some asset types and over-delivering in others.
2. The TOs have developed a mechanism to convert the Network Replacement Outputs targets into monetised risk to facilitate trading. It is proposed to modify the NOMs methodology to include this mechanism. This proposed modification develops the NOMs methodology as set out in Paul Branston's letter (20 June 2014). A work programme for development of the NOMs methodology was agreed with Ofgem on 20 August 2014 (Appendix C) in line with the NOMs principles (Appendix A). To aid the reader a mapping has been provided in Appendix B between the paragraphs in this report to accompany the submission of Issue 7 of the Network Output Measures methodology and the requirements in Special Licence Condition 2L.11.
3. All TOs collaborated via a series of regular workshops and teleconferences to ensure consistency in our approach. We worked with Ofgem in order to understand the requirements, meeting at least once every quarter (with teleconferences and interim meetings as necessary) to present our proposals and confirm that the programme was on track.
4. Throughout the work programme and during quarterly discussions with Ofgem, it was agreed that there would be no proposed changes to the Network Replacement Outputs, as set out in the tables in Special Licence Condition 2M, as a result of this proposed modification. As indicated in the methodology, the specified targets will be converted into monetised risk but this risk value will be equivalent to the Network Replacement Outputs targets.
5. The monetisation approach is achieved by converting the Asset Health Indices into a probability of failure, and by converting criticality into a monetary value to be combined with the cost of recovery. This probability of failure and monetary value is then combined to give a monetary value of risk. This value of risk provides a 'common currency' for trading between asset types to achieve the overall Network Replacement Outputs.
6. The probability of failure is calculated for each asset group and is a function of asset condition dependent on asset type, Asset Health Index and expected future Asset Health Index. It is derived from the asset deterioration curves using an equivalent age approach and is based upon catastrophic failure, as this is the type of failure that we are trying to avoid through asset replacement or refurbishment interventions.

7. The equivalent age approach can be likened to calculating human 'health age' by adding health related factors such as BMI, smoking history, dietary and exercise habits, etc.
8. The monetary values for safety, system, and environmental criticality levels have been determined through external research looking at the impact of events across the world (generally in Western economies). These monetary values reflect the social impact of loss of electricity supply. Where events have occurred in other countries, these have been converted to £GBP at the time of the incident and then inflated to 2015 prices.
9. The principles used to derive the criticality monetisation values are:
 - **Safety criticality:** Value of Statistical Life scaled by fatality, serious injury, reportable injury, and non-reportable injury
 - **Environmental criticality:** Maximum fine from the Environment Agency plus £250k for clean up costs
 - **System criticality:** Derived from vital infrastructure, substation demand and system security
10. There are some circuits and substations that serve sites which could be subject to high impact, low probability (HILP) events. These include nuclear sites, COMAH sites and black start sites. These events are difficult to predict and occur infrequently so are less well understood. When multiplying a probability by consequence for these types of events, the outcome looks very reasonable, but businesses need to treat assets exposed to these sort of events differently.
11. Given the nature of these HILP type events, the proposed approach is that we do not intend to trade assets which might be exposed to HILP events. Assets which fall into this category will be excluded from the trading mechanism.
12. Assets that are in poor condition may fail at any time. Disruptive failures are rare on transmission systems however instances of these failures that have occurred over the past few years. These have been reviewed to identify the costs associated with the cost of recovery (clean up and replacement of failed asset). The financial consequence is based upon the greater of the cost of recovery for the failed asset or the cost to replace the asset.
13. The sum of monetised risk (£) can be compared with the sum of the target monetised risk (£). This enables trading between asset classes and enables the comparison of different investment scenarios.

14. For example, the table below shows the total network risk target set at the end of the RIIO-T1 period (31 March 2021) using dummy data:

Asset Categories	Target (31 March 2021) Monetised Risk
Switchgear	£73,000,000
Transformer	£126,000,000
Underground Cables	£92,000,000
Overhead Line	£1,040,000,000
Total	£1,331,000,000

15. An investment scenario (i.e. combination of interventions) is presented below (Scenario 1) and shows an example of under-delivery compared with the target above. The table on the left shows the monetised risk at 31 March 2021 and the right hand table shows the comparison between the declared monetised risk and the target. The total monetised risk is higher than the target, hence the TO has under-delivered.

Asset Categories	Scenario 1 (31 March 2021) Monetised Risk
Switchgear	£72,000,000
Transformer	£127,000,000
Underground Cables	£91,000,000
Overhead Line	£1,050,000,000
Total	£1,340,000,000

Asset Categories	Calculation: Target minus Scenario 1
Switchgear	£1,000,000
Transformer	-£1,000,000
Underground Cables	£1,000,000
Overhead Line	-£10,000,000
Total	-£9,000,000

16. An alternative scenario is shown below (Scenario 2) showing an example of over-delivery compared with the target. The total monetised risk is lower than the target, hence the TO has over-delivered.

Asset Categories	Scenario 2 (31 March 2021) Monetised Risk
Switchgear	£72,000,000
Transformer	£123,000,000
Underground Cables	£94,000,000
Overhead Line	£1,032,000,000
Total	£1,321,000,000

Asset Categories	Calculation: Target minus Scenario 2
Switchgear	£1,000,000
Transformer	£3,000,000
Underground Cables	-£2,000,000
Overhead Line	£8,000,000
Total	£10,000,000

17. There will be a number of different combinations of interventions that can achieve the same level of network risk.
18. The primary purpose of the modification to the methodology was to propose a trading mechanism for the Network Replacement Outputs and, as such, the TOs have focused on the mechanics of trading. A proposed spreadsheet model (using dummy data) has been presented with the methodology to demonstrate how the trading would work in principle.
19. The TOs ran a public consultation on the proposed methodology between 16 October 2015 and 13 November 2015. We provided a written summary statement outlining the proposed changes (specifically providing an explanation of how the mechanism would work, as above) and a copy of the proposed methodology for review and comment. We presented our proposals at two identical workshops in Glasgow (28 October 2015) and London (4 November 2015).
20. A series of questions (as agreed with Ofgem) were posed during consultation to elicit responses surrounding the trading mechanism. Importantly, the consultation also sought response on the methodology development in line with the Network Output Measures principles (Appendix A).
21. A workshop was held on 30 October 2015 (and another more recently on 14 January 2016) with the DNOs, GDNs and GTOs in order to understand the development of their respective NOMs methodologies. During the consultation period, we also presented our proposals at the IET Asset Management Conference on 25 and 26 November 2015.
22. A presentation was given to Ofgem on 2 December 2015 outlining the responses from stakeholders. Responses were received from utility companies, equipment manufacturers, government organisations, academia and other organisations (some of whom attended

workshops and others responded to the questions posed). Written responses have been forwarded to Ofgem and are included in Appendix D.

23. As a result of consultation, the following changes were made to the proposed NOMs methodology:
 - a. Additional narrative or commitments to further work according to Ofgem's note of 18 November 2015 (following the meeting on 16 November 2015):
 - i. Improve structure and clarity of document, and review use of language
 - ii. Develop process maps to show how the NOMs are used within the businesses
 - iii. Further explanation of how redundancy is currently incorporated into criticality
 - iv. Further explanation on how monetised risk is calculated and how Replacement Priorities are translated into monetised risk
 - v. Further information on how sites are designated as high impact, low probability and how intervention decisions are made for these sites
 - vi. Incorporate stakeholder comments where applicable
 - b. Commitment to further development work as agreed with Ofgem on 2 December 2015
 - c. Further narrative to explain how uncertainties in assessing asset condition and deterioration have been addressed following stakeholder feedback
 - d. A commitment to review the proposed environmental criticality monetisation values following stakeholder feedback
24. The proposed methodology states, as far as possible in terms of including common business processes across the TOs, how investment decisions are made and how the Network Replacement Outputs were set.
25. The development of the trading mechanism will clarify the treatment of over- and under-delivery of the Network Replacement Outputs secondary deliverables as defined in Special Licence Condition 2M. This will enable the Authority to assess the licensee's performance in relation to the development, maintenance and operation of an efficient, co-ordinated and economical system of electricity transmission as defined in Licence Condition 2L.3.
26. The stakeholder consultation events as well as the written summary document of the proposed methodology were designed to engage fully with the TOs stakeholders, ensuring the communication of relevant information about the licensee's Transmission System to the Authority and other interested parties in an accessible and transparent manner.

27. Additionally, the TOs worked collaboratively to understand our own and our colleague’s transmission networks to consider the comparative analysis of performance over time between:
- a. geographic areas of, and Network Assets within, the licensee’s Transmission System;
 - b. the licensee’s Transmission System and other Transmission Systems forming part of the National Electricity Transmission System.
28. The TOs also fully engaged with other sectors, the DNOs and GDNs, running workshops and invited them to stakeholder events in order to undertake the comparative analysis of performance over time between:
- a. the National Electricity Transmission System and Distribution Systems within Great Britain.
29. Further work on the methodology following feedback from Ofgem is ongoing. At the 5th quarterly update meeting on 2 December 2015, a programme of work was agreed to further develop the NOMs methodology through ‘Stage 2’:

End Jan-16	Stage 1: Updated methodology, sent to Ofgem for approval, with commitment to further development work.
End Feb-16	Stage 2: Develop ‘working copy’ of methodology with new structure and placeholders for new sections – sent to Ofgem for comment
End Mar-16	Stage 2: Update Ofgem with understanding of common elements between business processes (identify what is common, what is specific but can go into public domain and what is confidential)
End Jun-16	Stage 2: Bring common elements from specific appendices into methodology
	Stage 2: Develop justification for trade-offs
	Stage 2: Detailed explanation of process for managing assets and trade-off with monetised risk
End Sep-16	Stage 2: Further work on redundancy
	Stage 2: Further work on High Impact Low Probability events (in conjunction with other sectors)
End Dec-16	Stage 2: Testing of T1 trade-off with real data
	Methodology submitted for Ofgem for approval to go out stakeholder consultation
End Mar-17	Stakeholder consultation completed (start consultation process in Jan 17)
	Methodology submitted to Ofgem for approval including stakeholder feedback

30. Stage 2 of the development work will test the trading mechanism using real data. There are three elements to the testing:
- a. Calibration
 - i. Calibration of condition: the TOs will compare our asset condition information. It is expected that assets in the same condition with the same history, operating regime, operating environment and duty, would have the same Asset Health Indices for all TOs.

- ii. Calibration of criticality: criticality scoring will be compared across the TOs. Where it is possible to compare criticalities these would be expected to have the same score for the same criteria.
 - b. Validation
 - i. Validation of the methodology will involve confirmation that the number of assets that are expected to be replaced or refurbished during the RIIO-T1 period are consistent with the TOs' plans for asset intervention.
 - c. Testing
 - i. An independent expert will be appointed to check the spreadsheet and provide assurance that its internal calculations are correct, verifying that the models perform according to the methodology.
- 31. Data, and other relevant information, used within the trading mechanism will be provided following calibration, validation and testing with the next issue of the methodology.
- 32. Once the modification to the methodology has been approved, the TOs will be able to report in line with it. It is the intention that following successful testing of the methodology, the TOs will report monetised risk for the RRP on 31 July 2017. During the Stage 2 development work, the TOs intend to work with Ofgem to develop the RRP tables required to facilitate this reporting.
- 33. Issue 7, submitted to Ofgem on 29 January 2016, contains a commitment to incorporate all elements stated in Stage 2 of the work programme within the next issue. The TOs have also committed to meeting with Ofgem every two months (instead of every quarter) to discuss progress on all stages of the work and will also present a 'working copy' of the methodology at each update meeting. Ofgem are also invited to attend the TO development meetings.

Appendix A - Network Output Measures Principles

The NOMs methodology will be based on the following key principles:

1. Compliance: Ensuring that the measures comply with the law
 - a. The NOMs outputs must be compatible with existing legal obligations, ensuring that statutory duties are not compromised.
2. Measurable: Enable Ofgem to assess whether the NOMs objectives have been achieved and whether the targets have been met.
 - a. The methodology will demonstrate how the NOMs objectives are achieved.
 - b. Allow Ofgem to assess TO performance in relation to the development, maintenance and operation of their networks and in assessing future network expenditure.
 - c. Develop a framework for the evaluation of the NOMs targets:
 - i. Independent assessment of TO performance.
 - ii. Determine whether over or under-delivery is justifiable.
 - d. Develop network risk trade-off mechanism:
 - i. Incorporate health, criticality, risk and overall network risk
 - ii. Describe current asset deterioration as well as future expected deterioration.
 - iii. Include probability of failure (state requiring replacement) with respect to asset condition.
 - iv. Explore options such as monetisation of criticality and utility function.
 - e. Describe how levels of redundancy/backup are incorporated into criticality assessments.
 - f. Devise method for assessing impact of load-related investment.
 - g. Develop testing mechanism for independent assessment of NOMs objectives, principles and against targets.
 - h. Consider framework for next price control period.
3. Consistency: Develop a common approach to ensure that the measures are consistent and comparable.
 - a. Common approach to Network Output Measures developed by all TOs.
 - b. Ensure consistency as far as practicable between UK regulated sectors (DNO, GDN).
 - c. Engagement with GDNs and DNOs to ensure concepts of health, criticality, risk are common across all sectors.
 - d. Common terminology (definitions of health, risk, criticality, intervention).
 - e. Commentary and analysis of practices in other industries and internationally.

4. Transparency to Stakeholders: Ensure that consumers are getting value for money - minimising the burden on current customers without creating unnecessary costs for future customers.
 - a. To provide a known level of network risk for consumers, demonstrating that the TOs are investing consumers' money wisely in their networks.
 - b. To provide transparency that the TOs are investing in our existing assets appropriately.
 - c. Stakeholder Engagement

5. Applicability: Ensure that the TOs' stewardship of their assets is appropriate and proportionate.
 - a. Used internally within each business to enhance current Asset Management processes.
 - b. Understanding business drivers.
 - c. Licensee should have full control over performance against the NOMs outputs.
 - d. Methodology should ensure that the TOs can innovate.

6. Objectivity: Providing data/information for Ofgem to enable evaluation of performance and for TOs to manage their assets.
 - a. Specify details about the type and quantity of data held by each TO.
 - b. Data assumptions/limitations, the level of confidence and how uncertainties can be quantified.

Appendix B – Extract from Special Licence Condition 2L

This report is produced to accompany the submission of issue 7 of the Network Output Measures methodology as stated in Special Licence Condition 2L.10. The extract below guides the reader to the appropriate paragraph(s) of the report where we feel each of the matters listed in paragraph 2L.11 of this condition have been addressed.

Special Licence Condition 2L.11	Paragraph(s)
a. a statement of the proposed modification to the NOMs Methodology;	2
b. a full and fair summary of any representations that were made to the licensee pursuant to paragraph 2L.10(a) of this condition and were not withdrawn;	3, 19, 20, 21, 22, Appendix D
c. an explanation of any changes that the licensee has made to its modification proposal as a consequence of representations;	23
d. an explanation of how, in the licensee’s opinion, the proposed modification, if made, would better facilitate the achievement of the NOMs Methodology Objectives;	2, 24, 25, 26, 27, 28
e. a presentation of the data and other relevant information (including historical data, which should be provided, where reasonably practicable, for a period of at least ten years prior to the date of the modification proposal) that the licensee has used for the purpose of developing the proposed modification;	14, 15, 16, 18, 30, 31
f. a presentation of any changes to the Network Replacement Outputs, as set out in the tables in Special Condition 2M (Specification of Network Replacement Outputs), that are necessary as a result of the proposed modifications to the NOMs methodology; and	4
g. a timetable for the implementation of the proposed modification, including an implementation date (which must not be earlier than the date on which the period referred to in paragraph 2L.12 of this condition would expire).	29, 32

Appendix C – work programme 20 August 2014

Appendix provided separately.

Appendix D – consultation responses

Appendix provided separately.