

Overarching Guidance

Annex 1

Approach to asset maintenance



Approach to Asset Maintenance

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1 Introduction

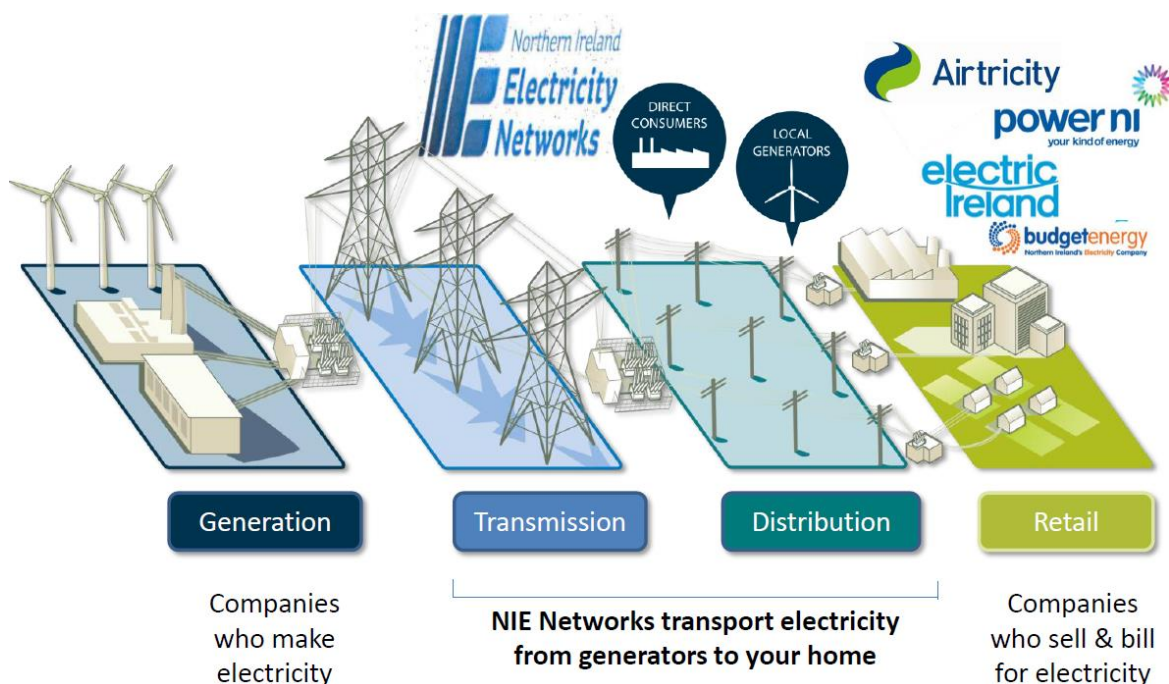
- 1.1. The transmission and distribution of electricity to consumers is an asset intensive process. It requires investment in transmission and distribution networks which connect generators to industrial and domestic consumers. These networks comprise: conductors carried overhead on towers and poles; cables buried underground; switch gear and transformers to control the flow of electricity and step voltages down in stages from 275kV at generating stations to 415/240V at domestic premises; and supply new connections and meters. Investment is also required in indirect assets necessary for the effective management of the system including IT systems, offices, vehicles, maintenance and testing equipment and other facilities.
- 1.2. The transmission and distribution networks have developed over time and almost all properties are served or can be supplied with electricity. While the network will continue to develop to meet new demand, and some strategic reinforcement projects are required, a key demand for current and future investment is asset maintenance investment to maintain the safety and performance of the service and replace assets which are no longer serviceable.
- 1.3. The mix of assets of different types and expected lives require careful assessment to determine the right level of asset maintenance in the medium to long term. If investment is made too early tariffs will rise with little or no benefit to consumers. If investment is made too late, service may deteriorate until an adequate level of investment is restored. Robust asset data and asset maintenance processes are required to ensure that the right level of asset maintenance investment is made at the right time.
- 1.4. In our overall approach to RP6 published for consultation in September 2015 we set out in general terms our requirement for NIE Networks to provide information on its proposals for asset management in its RP6 submissions.
- 1.5. We expect the monopoly service providers we regulate to demonstrate effective long term stewardship of the asset base which has been and continues to be funded by consumers. For RP6, we require NIE Networks to set out the steps it has taken and plans to take to achieve excellence in asset management and to demonstrate how this gives confidence in the company's ability to assess the optimum range of medium term interventions and level of investment required to maintain serviceability and to target future investment effectively.
- 1.6. To demonstrate that robust asset management processes are in place to inform robust business decisions, we require NIE Networks to:
 - provide an assessment of its asset management capability against a recognised asset management methodology and identify any further work required to achieve excellence in asset management planning;
 - provide an assessment of the data they currently use to prioritise current interventions to estimate future level of capital and operational investment in the medium to long term;
 - prepare a plan to improve its asset management capability which sets out how the company will address any weaknesses in its current methodologies

and data necessary to improve asset maintenance planning, and the timescale over which this will be achieved; and,

- show how a range of top-down and bottom up techniques have been applied during the preparation of its business plan to assess the optimum level of asset interventions and investment over the RP6 period.
- 1.7. In our overall approach to RP6, we noted that we would develop our approach to asset maintenance planning as we complete our information requirements for RP6 and provide a paper for guidance in this area. This paper provides that additional guidance.
- 1.8. This guidance is set out in the following sections:
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| Section 2 | Provides a brief overview of electricity transmission and distribution networks in Northern Ireland and highlights the need for NIE Networks to address this guidance in the context of its current stage of development. |
| Section 3 | Summarises the scope of a Plan for Asset Maintenance which the company should submit as part of its RP6 Business Plan. It goes on to describe the range of asset maintenance techniques which might be applied to assess future asset maintenance investment. We have outlined how we would apply each of these techniques to determine the right level of asset maintenance investment in RP6. |
| Section 4 | Concludes the approach. |

2 Overview of Electricity Transmission and Distribution.

- 2.1. The electricity network in Northern Ireland is owned by Northern Ireland Electricity Networks Ltd (NIE Networks) and is made up of a Transmission and a Distribution component.
- 2.2. In addition, the body responsible for the consistent and reliable transmission of electricity from generation onto the high-voltage transmission grid through to the NIE Networks distribution system, and onto individual homes, farms and businesses via retail supply companies, is the System Operator for Northern Ireland (SONI). SONI is responsible for matching supply and demand for power across Northern Ireland.



- 2.3. These networks comprise:
- conductors carried overhead on towers and poles and cables buried underground;
 - switch gear and transformers to control the flow of electricity and step voltages down in stages from 275kV at generating stations to 240V at domestic premises;
 - supply connections and meters; and
 - indirect assets necessary for the effective management of the system including IT systems, offices, vehicles, maintenance and testing equipment and other facilities.
- 2.4. The network is extensive. NIE Networks estimates that the total length is more than 45,000km, serving 844,399 consumers. While the network has developed over a

long period, an accelerated extension of the network occurred in the late 1950's and the 1960's. This peak in development presents a particular challenge to the company as it continues to assess the right level of asset maintenance investment for the medium term future.

3 Plan for Asset Maintenance

Introduction

- 3.1. NIE Networks should provide a Plan for Asset Maintenance which sets out its approach to asset maintenance planning and explains how it has assessed the changes in operational practice and the investment required to maintain or enhance serviceability to consumers during RP6.
- 3.2. Within its plan for asset maintenance we expect NIE Networks to:
- provide an assessment of its asset management capability against a recognised asset management methodology and identify any further work required to achieve excellence in asset management planning;
 - provide an assessment of the data it currently uses to prioritise asset maintenance interventions and estimate the future level of capital and operational investment for the medium to long term;
 - prepare a plan to improve its asset management capability which sets out how the company will address any weaknesses in its current methodologies and data necessary to improve asset management planning, and the timescale over which this will be achieved; and,
 - show how a range of top-down and bottom up techniques have been applied during the preparation of its business plans to assess the optimum level of asset interventions and investment over the RP6 period.
- 3.3. In the subsequent sections of this guidance we have set out some of the main techniques which might be used to establish a base line for the development of the asset maintenance plan or play a part in assessing the investment necessary to maintain the asset base and the service it delivers. It is for NIE Networks to decide how it can best apply these and other techniques to prepare its plan for asset maintenance taking account of its systems, data and capability. We expect the company's plan to:
- explain its overall approach and how systems and processes are used to inform asset maintenance planning;
 - set out clearly and concisely how it has assessed the changes in operational practice, levels of investment and levels of activity necessary to maintain services;
 - explain how the its proposals link to historic cost and serviceability assessments and the outcome of consumer engagement;
 - provide justification for any proposed changes to current levels of service or expenditure;
 - explain the approach adopted for each area of service or asset type and the factors that influenced the type of assessment adopted;

- explain how the assessments undertaken for individual areas have been combined to determine the overall assessment; and,
- identify any areas where asset maintenance systems and data quality limit the company's ability to adopt a forward looking risk based approach and its plans for addressing these issues.

Asset Maintenance Techniques

- 3.4. In the following section we outline a range of techniques which can be used to either establish an asset maintenance baseline or estimate future asset maintenance need. We have provided guidance on the information we expect NIE Networks to provide in respect of each of these techniques and outlined how we would use them when assessing asset maintenance investment. It is for the company to consider which of these techniques or other techniques best meet its needs when estimating future asset investment and provide robust supporting data and commentary. Where possible the Utility Regulator will use a range of techniques to estimate or validate future asset maintenance projections before triangulating to a reasonable estimate for the Price Control determination.
- 3.5. The generic techniques outlined below are:
- Asset maintenance planning capability assessment.
 - Projection of historical expenditure.
 - Asset inventory and valuation.
 - Assessment of historical serviceability trends.
 - Assessment of asset condition and performance.
 - Specific asset maintenance plans.
 - Forward looking risk based assessments.

Asset maintenance planning capability assessment

- 3.6. NIE Networks should prepare and submit a structured assessment of its asset maintenance planning capability as part of its asset maintenance plan.
- 3.7. There are a range of standard processes available to assess asset planning capability such as BS ISO 55001. However, we have concluded that we should not dictate a particular methodology which all companies should adopt. The company should adopt a recognised methodology it considers relevant and useful for its on-going business needs. The company should describe how its preferred methodology will inform the RP6 Business Plan and drive asset management excellence in delivery.
- 3.8. NIE Networks should prepare and submit a critical assessment of its asset maintenance planning capability against the methodology it has adopted for asset management planning. It should identify any gaps in the data, systems and processes in place to support its plan for asset maintenance and show how it has addressed these gaps when it assessed the level of asset maintenance investment

required in RP6. The company should set out a plan for closing the gaps in data, systems and processes identified in its asset maintenance planning capability assessment including the timescale over which these gaps will be closed. We will take account of the company's assessment of its asset maintenance planning capability when determining the confidence we can place on the various techniques the company has used to prepare its plan for asset maintenance.

- 3.9. The process of developing industry standard capability assessments normally includes independent assurance by external experts. We expect NIE Networks to set out its approach to independent assurance of its capability assessment and provide a copy of the assurance brief and the latest assurance reports as part of its submission. We will take account of the scope and quality of independent assurance reports and how the company is responding to any recommendations made when forming our views on the company's assessment and plans.

Projection of historical expenditure

- 3.10. The projection of historical expenditure provides a basic methodology for assessing medium term asset maintenance investment. It assumes that:
- the level of investment required to maintain a mixed portfolio of assets will be broadly constant in the medium term; and,
 - historical asset maintenance investment has been adequate and delivered efficiently.
- 3.11. NIE Networks should provide an assessment of historical asset maintenance expenditure as part of its assessment of future asset maintenance investment. The assessment should be broken down by different asset types which should reflect the natural division of distribution assets and the categories of assets used when projecting future expenditure. Information should be provided by year and for as far back as reliable data exists. Projected historical expenditure should be provided in the same format for each year of RP6. The company should comment on the quality of its information including any allocation systems used to prepare the data.
- 3.12. NIE Networks should demonstrate why future asset maintenance costs are different from the past. The company should show how it has explored opportunities to reduce asset maintenance costs through improved planning techniques and efficient delivery as well as identifying drivers for increased cost.
- 3.13. We will use projections of historical expenditure as a starting point for assessing future expenditure taking account of the potential for future efficiencies. We will carefully assess explanations provided by the company for any increase in future investment over historical investment. In doing so, we will take account of the quality of the information provided and techniques used in making these assessments. We may seek further breakdowns of historical and projected expenditure where this would improve the quality of our analysis.
- 3.14. In RP6 we will consider extending and standardising asset maintenance investment reporting taking account of the company's submissions of historical and projected expenditure.

Comparative econometric analysis of asset maintenance expenditure

- 3.15. Econometric modelling can be used to compare historical levels of expenditure by different companies using explanatory factors to establish reasonable, efficient levels of investment to maintain a level of service.
- 3.16. Econometric analysis assumes that the circumstances of the different companies compared are broadly similar and that limited special factor adjustments can be made to compensate for material differences.
- 3.17. NIE Networks may wish to submit econometric analysis in support of its asset maintenance plans. Any such submission should include detailed information on the source data, how differences in circumstance have been addressed, a statement and appraisal of the methodology used and the resulting equations.
- 3.18. We will assess any econometric modelling provided by the company to support its estimates of future asset maintenance investment. We will consider using econometric benchmarking based on historical and projected expenditure when determining future asset maintenance investment. We will also explore unit cost comparisons to challenge costs on the basis of efficient delivery.
- 3.19. Following our review of RP6, we will consider whether it is appropriate to develop standard reporting of costs and explanatory factors to support future econometric comparison of asset maintenance investment.

Asset inventory and valuation

- 3.20. Depreciation of a modern equivalent asset valuation can provide an estimate of medium to long term asset maintenance investment. Over the long term, maintenance costs should be broadly equivalent to current cost depreciation, provided a modern equivalent asset approach is used to estimate current cost depreciation.
- 3.21. The data used to estimate asset maintenance need is the same data used to estimate the current cost depreciation of the assets:
 - The replacement value of the assets.
 - The residual life of the assets.
- 3.22. The replacement cost of the assets should be assessed on a modern equivalent asset basis. The 'modern equivalent asset' is the asset which would be installed today to deliver the same service and takes account of new technologies, new materials and current design standards.
- 3.23. The residual asset life used in the analysis is often based on one of the following: the installation date of the asset and a nominal asset life; expert judgement following site surveys; or it is inferred from other observations such as condition and performance grades. The quality of the analysis is dependent to the quality of the residual life estimate.
- 3.24. The assessment brings together asset information (type, size and age of the assets) with cost data for construction or replacement of the assets. Both are core

information sets which we would expect the company to maintain to allow it to manage its assets effectively. As part of its plan for asset maintenance, we expect NIE Networks to provide a critical appraisal of its asset inventory and costing data, identify any gaps in the information and to set out a plan to address those gaps.

- 3.25. Where part or all of future asset maintenance investment is estimated using replacement values and residual asset lives, we would expect the company to provide clear information on how its assessment which relates to its asset inventory and asset valuation. A clear explanation should be provided of how the residual lives or replacement dates used in the analysis have been assessed and how this links to asset failure data, service impact and cost.
- 3.26. Where future asset maintenance need is estimated on the basis of asset value and residual life, we will review and challenge the estimate as appropriate to understand the quality of the underlying data on asset value and residual life. Where possible we will benchmark unit costs for individual asset types.
- 3.27. Following our review of RP6, we will consider whether it is appropriate to develop asset inventory, asset valuation current cost depreciation reporting where this would allow us to better assess future projections of asset maintenance investment.

Assessment of historical serviceability trends

- 3.28. 'Serviceability' is a measure of the capability of an asset to provide a service. In practice it is assessed by trending a series of defined asset performance indicators (such as the frequency of reactive repairs or parts replacement) and service indicators (such as the frequency of interruption to supply or unwanted customer contact relating to defects). Data trends are used to determine whether asset serviceability is stable, improving, deteriorating or marginal. The approach focuses attention on how the asset delivers service to consumers.
- 3.29. We expect NIE Networks to consider and report on the relationship between historical expenditure and serviceability in its assessment of future asset maintenance need. The company should identify asset performance indicators and service indicators it believes are useful in monitoring the serviceability of the assets, targeting asset maintenance investment and projecting future asset maintenance need. We would expect the company to base its estimate of future asset maintenance investment on the need to maintain serviceability. If the company believes that there is a need to further enhance serviceability to improve service to consumers, this investment should be identified separately and the company should be able to demonstrate consumer support for the improvements relative to the estimated cost of the improvement.
- 3.30. We will consider the company's views of appropriate serviceability indicators and the quality of its assessment of the link between asset maintenance investment and the need to maintain stable serviceability when determining asset maintenance investment for RP6. We will consider developing the serviceability indicators used by the company to assess asset maintenance investment as outputs for the RP6 period.
- 3.31. Following our review of RP6, we will consider whether it is appropriate to develop serviceability to monitor the delivery of asset maintenance investment and provide a basis for assessing future asset maintenance investment.

Assessment of asset condition and performance

- 3.32. Asset condition and performance grading has been used in some utilities as a primary asset observation to assess asset maintenance outcomes and inform future asset maintenance investment.
- 3.33. Condition and performance grades are often defined as composite measures which combine asset characteristics relating to probability of failure, consequence of failure, operational efficiency and residual asset life.
- 3.34. In the past, attempts have been made to link condition and performance grade to residual asset life. In practice, this can lead to complex analysis which gives less confidence than an analysis of direct asset observations. Experience has shown that it is difficult to replicate condition and performance grading over time to establish trends and link these to the timing of asset maintenance interventions. Material changes in grading have often been attributed to changes in methodology, changes in the sample surveys and changes in staff employed in the surveys. Because the surveys can be difficult to replicate the results cannot necessarily be used with confidence. More recent asset maintenance practice tends to focus on direct asset observations which provide a more robust link to residual asset lives.
- 3.35. While we have some reservations about the use of condition and performance grading, we will consider any assessment of condition and performance grade provided by NIE Networks as part of its asset maintenance plan. If it relies on condition and performance grade in its assessment, we would expect the company to demonstrate how these have been used to assess the residual life of the assets. We would expect the company to demonstrate that any condition and performance grade assessment is used and useful in its current asset maintenance assessments and can be applied consistently in future asset maintenance assessments.

Specific asset maintenance plans

- 3.36. NIE Networks may opt to prepare specific asset maintenance plans which identify current issues and use expert judgement to assess future asset replacement and investment needs.
- 3.37. An advantage of this approach is that it identifies specific asset maintenance interventions. However, while current issues can be identified, it is more difficult to identify the timing of future interventions for assets which are currently serviceable. The use of expert judgement to fill this gap can only provide limited confidence on the estimates of residual life and the timing of future interventions.
- 3.38. We will assess any specific asset maintenance plans which the company submits in its Business Plan to support future asset maintenance investment. We recognise that it may be necessary for the company to continue to use expert judgement where existing data is insufficient to support a more rational analysis of asset maintenance needs. If this is the case, the company should demonstrate how asset observations have been used to inform expert judgement on residual asset lives. The company should demonstrate the steps it will take and the timescale required to move to a forward looking risk based approach to provide an economic assessment of asset maintenance investment.
- 3.39. The interventions identified through specific asset maintenance plans are often assumed to be in addition to the historical level of investment. In the absence of

other evidence, we would expect the company to prioritise specific investment plans within the overall asset maintenance budget derived from historical trends or econometric analysis. It is for the company to explain why this would not be the case.

- 3.40. We will assess the unit cost efficiency of specific asset maintenance plans.
- 3.41. In the absence of robust information to support expert judgement we will take a prudent but conservative approach in our determination. Where we accept specific asset maintenance plans we will consider including specific outputs in the determination to monitor delivery and manage any subsequent change.

Forward looking risk based assessment

- 3.42. A forward looking risk based assessment of asset maintenance investment is a rational, evidence based assessment taking account of:
- asset failure rates and rates of deterioration;
 - the on-going cost of repairs;
 - the escalation of operating cost with age (for example increasing repair costs);
 - the probability of service failure following asset failure;
 - the consequential cost of service failure, including direct costs to the company and wider social costs such as environmental impact or traffic disruption;
 - the costs of the potential interventions available to improve asset serviceability;
 - consumer willingness to pay to avoid service failure.
- 3.43. The approach provides a rational basis for establishing the economic life of assets which balances the costs of continuing to operate the existing assets with the costs and benefits of replacing the asset or maintaining the service by other means.
- 3.44. The assessment requires robust data covering asset information, asset failure, service impact and the way this deteriorates over time. There is a risk that inadequate data and complex processes can generate misleading answers. We expect NIE Networks to use practical, targeted and transparent methodologies which can be tested and developed as information improves over time.
- 3.45. Assessments should take account of the criticality of the asset and its likely impact on service. This would include taking account of time to repair, the time from asset failure to service failure, the provision of stand-by plant and the availability of critical spares either in-house or through the supply chain. For non-critical assets a reactive maintenance policy based on run-to-failure may be the appropriate response. Management interventions to reduce asset criticality, including work order management, spares management and asset monitoring should be considered as part of the asset management plan.

- 3.46. Assessments should include the opportunity to identify and replace the worst performing assets first to reflect the detailed assessment of interventions which will be carried out in practice. Assessments based on 'average' performance will over-estimate actual need. The assessment should consider how interventions assumed in the asset maintenance plan will be identified in practice. Where necessary the frequency and cost of interventions should allow for the investigation, trial excavations and testing required to identify interventions.
- 3.47. As wide a range of solutions as possible should be considered in the assessment to reflect the range of solutions which are considered in practice. If the analysis favours a particular outcome which does not reflect the balance of work normally carried out, this should be questioned and the reason the analysis suggests a change in practice should be established and tested.
- 3.48. A detailed assessment of the performance and risk can identify better ways of managing the assets to prolong their useful life. For example monitoring temperature, vibration or oil quality can allow companies to better understand asset performance and provide indicators for intervention. The company should demonstrate how it has considered these opportunities, drawing on innovations developed by other DNOs and utility companies and identify opportunities in changes in working practice and the cost savings which will arise.
- 3.49. The company should be able to demonstrate that the analysis it carries out for the Business Plan has direct links to asset management delivery. An approach which is used and useful has the advantage of being credible and provides a basis for feedback and learning which will ensure continuous improvement of asset management techniques and inform future asset maintenance plans.
- 3.50. A forward looking risk based assessment taking account of the factors described above would provide a strong economic test for end of life replacement and support for a business case for other replacements.

4 Conclusion

- 4.1. The RP6 Business Plan submission provides an opportunity for NIE Networks to set out its approach to asset management planning and provide a well supported plan for future asset maintenance investment.
- 4.2. We expect the company to provide a critical assessment of its asset management planning capability against recognised industry methodologies and set out a plan for closing gaps in data and processes to improve its capability.
- 4.3. We expect the company to provide a clear assessment of the right level of future asset maintenance investment. We have set out a range of techniques which NIE Networks might consider adopting when developing the economic case for investment. It is for the NIE Networks to decide what techniques are appropriate in its particular circumstances and which can be best supported by the data and processes it has in place.
- 4.4. Whatever techniques are used to support future plans for asset maintenance investment, the assessment of the residual economic life of different assets will be a key issue to consider. We expect the company to provide robust information on residual economic life to identify economic asset replacement.
- 4.5. We will continue to challenge activity levels and unit costs through benchmarking to ensure efficient delivery of asset maintenance investment. We would encourage the company to make these comparisons in its own assessments.
- 4.6. We will carefully consider the quality of data and processes in our assessment. Where it is necessary for us to make decisions in the absence of robust information and analysis, we will adopt an approach to funding which is prudent but conservative until NIE Networks can provide robust information based on sound data and analysis.
- 4.7. We will continue to develop our approach to asset maintenance during RP6 in the light of our review of the Business Plan submissions including the development of asset maintenance outcomes and future monitoring.

5 Version Control

| Version | Date | Description | Applicable Year |
|---------|-------------|-----------------------------|-----------------|
| 0.03 | 15 Dec 2015 | Draft issued for discussion | |
| 1.0 | 20 Jan 2016 | No material changes | |
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