

# RIIO-ED1 regulatory instructions and guidance: Annex E – Reinforcement

## Guidance

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### Overview:

RIIO-ED1 is the price control for electricity distribution network operators (DNOs) from 1 April 2015 to 31 March 2023.

This document is part of the regulatory instructions and guidance (RIGs) for RIIO-ED1.

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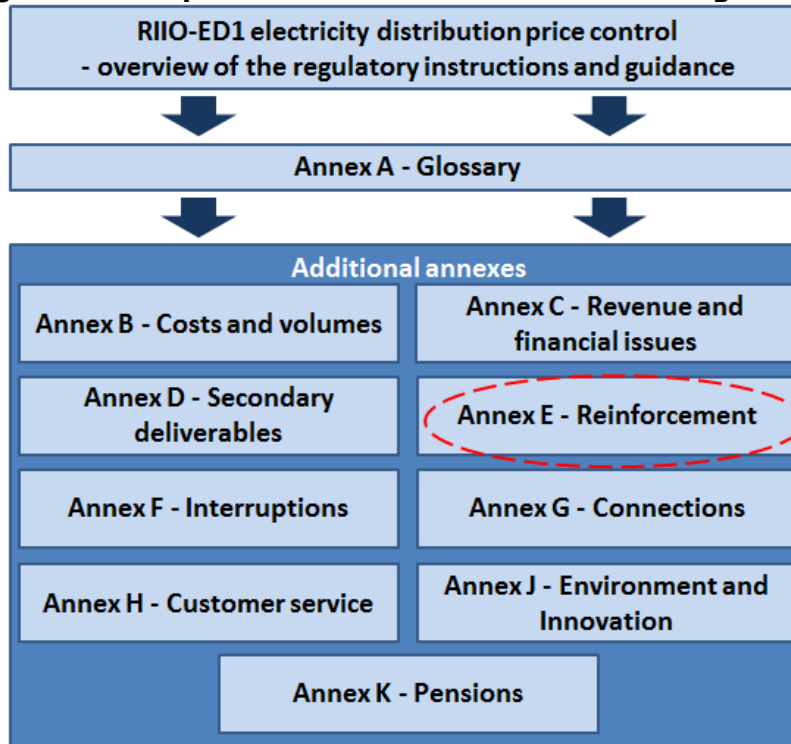
# 1. Introduction

## Scope of this document

1.1. This document is part of the regulatory instructions and guidance (RIGs) for RIIO-ED1. The term RIGs refers to a collection of documents – our instructions and guidance, and the reporting packs and commentaries the electricity distribution network operators (DNOs) have to fill out.

1.2. Figure 1.1 shows all the instructions and guidance documents for the RIIO-ED1 RIGs. This document, circled in Figure 1.1, is one of a series of annexes containing instructions and guidance. It provides DNOs with information on how to fill in the Reinforcement Reporting Pack and Reinforcement Commentary that they are required to submit to us.

**Figure 1.1: Map of the RIIO-ED1 instructions and guidance**



1.3. This document should be read in conjunction with:

- the RIIO-ED1 electricity distribution price control – overview of the regulatory instructions and guidance document
- Annex A – Glossary for the regulatory instructions and guidance
- the associated Microsoft® Excel 2010 reporting pack named “Reinforcement Load Index (LI) Reporting Pack”
- the associated commentary named “Reinforcement Load Index (LI) Commentary”.

## 2. Instructions for completing the Reinforcement Load Index (LI) Reporting Pack

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### Cover Sheet

2.1. This worksheet is to be completed by selecting the relevant DNO from the drop down menu in cell D12 and the relevant regulatory year under report in cell D14. The remainder of the worksheet contains guidance on cell colouring and lists of entries used in the other parts of the reporting pack.

### Navigation

2.2. This worksheet provides links to each of the other worksheets in the reporting pack. No DNO input is required.

### Changes Log

2.3. The Changes Log must be used by the DNOs to record any amendments (formulae or presentation) that are made to the reporting pack, including the date those changes were made. Ofgem will also record any changes made to the reporting pack in this worksheet.

### Summary

2.4. This worksheet summarises the annual volume of substations in each load index band and the resultant load index risk points.

2.5. It allows comparison against the values stated in the DNOs' Business Plan Data Templates that align with the settlement for RIIO-ED1.

### Count

2.6. The number of substations in each load index band for each regulatory year is auto-populated.

### Customers

2.7. The number of customers in each load index band for each regulatory year is auto-populated.

## **Weighted LI Risk Score**

2.8. The weighted LI risk score for each regulatory year is auto-populated.

## **Target LI Risk Score**

2.9. Enter the target LI risk score that corresponds to the forecast position at the end of RIIO-ED1, as stated by DNOs in the RIIO-ED1 Business Plan Data Templates submitted to Ofgem.

## **LI – Substations yyyy; LI – Substation Groups yyyy**

2.10. There are eight worksheets for recording data related to substations and eight worksheets for recording data related to substation groups. Each worksheet captures annual data for each regulatory year in RIIO-ED1.

2.11. The purpose of these worksheets is to capture data that will:

- calculate the current load index ranking and load index risk points
- enable tracking of changes over the RIIO-ED1 period
- enable categorisation of expenditure so that it can be compared to the cost and volume data in worksheet 'CV1 – primary reinforcement' in the Costs and Volumes Reporting Pack.

2.12. The data may also be used for cost benchmarking, but it is recognised that simple mathematical calculations may not provide a valid comparison. Cost differences may arise for reasons other than delivery efficiency and therefore analysis will need to be supplemented by additional considerations.

2.13. The following guidance is equally applicable to substations and substation groups. Where differences exist, these are highlighted within the guidance.

2.14. These worksheets are subdivided into four sections:

- Demand group description
- Load Index Current: current loading of the substations with the calculation of Load Index (LI) ranking and LI risk points
- P2 compliance<sup>1</sup>: derogation information
- Intervention detail: details of the interventions carried out during the regulatory year.

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<sup>1</sup> The current version of Engineering Recommendation P2 Security of supply is version 6 (ER P2/6). The reporting requirements relate to this version and any future versions.

## **Demand group description**

### *Substation/Substation Group*

2.15. In the 'LI – Substations yyyy' worksheets, this column should be populated with a unique name for each primary substation, excluding substations that are solely for a single customer.

2.16. Some DNOs operate an interconnected network of geographically dispersed single transformer primary substations that are interconnected on the low voltage side of the transformers so as to operate in a similar manner to an individual multi-transformer substation. These groups of multiple single transformer substations, that normally operate interconnected on the low voltage side of the substations, shall be reported as if they are a single individual substation with all the substation names listed. These will be reported in the 'LI – Substations yyyy' worksheets.

2.17. In the 'LI – Substation Groups yyyy' worksheets, this column should be populated with a unique name for a group of substations which are assessed together. This unique name should include a name for the group and include the names of the substations which make up the group. The individual substations that make up the group should also be included in the 'LI – Substations' worksheets.

2.18. Due to the number of ways substation groups can be assessed, DNOs are only required to report Load Index information for substation groups where there is an identified issue and expenditure is planned or in progress. As a starting point, DNOs should include all the substation groups specified in the 'CV102 Reinforcement' worksheet within the RIIO-ED1 Business Plan Data Template they submitted to Ofgem. For the avoidance of doubt, the full list should be used even if expenditure is no longer planned.

2.19. Where a substation/substation group has been included in the worksheets in a previous year, the same name should be used (unless the substation name has changed) and the associated data should be entered in the same row of the worksheets. This is important to ensure that consistent data is linked through to the multi-year tracker worksheets.

### *Substation/Substation Group primary voltage*

2.20. This column should be populated with the highest voltage in operation at the substation/substation group.

### *Substation/Substation Group secondary voltage*

2.21. This column should be populated with the lowest voltage in operation at each substation/substation group.

*No. of customers*

2.22. This column should be populated with the number of customers supplied from the substation/substation group.

**Load index – current**

*Substation/Substation Group firm capacity immediately available under single circuit outage conditions*

2.23. This column should be populated with the load index firm capacity as defined in Annex A – Glossary.

2.24. The firm capacity data should correspond to the season of most onerous demand.

2.25. For multi-transformer substations, the firm capacity value shall only include capacity that will be available through automatic processes (eg parallel operation of transformers, hard-wired switchover schemes, automatic SCADA initiated changeover schemes) or manually initiated SCADA changeover schemes. The changeover schemes that can be included are those which reconfigure running arrangements at primary voltages and changeover supplies to primary substation switchboards. This excludes any activities requiring switching downstream of primary substation switchboards which can be either initiated by SCADA or through manual intervention.

2.26. For single-transformer substations, the firm capacity value shall include the capacity that will be available through both automatic processes and manual processes, provided the manual processes can be carried out within the time constraints specified in Engineering Recommendation P2. This approach avoids single transformer primary substations being assigned an LI ranking of LI5, due to the absence of immediately available alternative capacity.

2.27. The firm capacity value should not include any adjustments for, demand side response's (DSR) or distributed generation's (DG) contribution to security of supply. These are recorded separately.

*Available DSR adjustment*

2.28. This is the capacity (in MVA) that is released through DNO DSR contracts. These commercial arrangements allow DNOs to request that demand is reduced or disconnected. The available DSR adjustment should only include those DSR arrangements that can reduce demand within the time constraints specified in Engineering Recommendation P2.

2.29. The adjustment that is made should be carried out in line with the recommendations of engineering technical recommendation ETR130.

*Assessed contribution towards security supply from DG adjustment*

2.30. This is the capacity (in MVA) that is released through the contribution of DG to security of supply compliance. The adjustment that is made should be carried out in line with the recommendations of engineering technical recommendation ETR130.

*LI firm capacity*

2.31. The calculated firm capacity for use within the derivation of LI ranking and LI risk points. It is the firm capacity calculated as the capacity available under n-1 outage conditions including the contribution from DNO contracted DSR and the contribution of DG to security of supply compliance.

*Season of most onerous demand*

2.32. The “Season of most onerous demand” sets out whether the highest utilisation (as defined by the ratio of demand to firm capacity and not taking into account any DSR or generation contribution) occurs during winter or summer. For example whilst the absolute value of demand may be lower in the summer, the utilisation may be higher as a result of lower equipment ratings – this would lead to the summer being the season of most onerous demand.

*Limiting Factor*

2.33. The “Limiting Factor” refers to the specific restricting factor, of those listed, that determines the substation’s/substation group’s firm capacity:

- (a) Cyclic rating of a transformer
- (b) Rating of the incoming circuit(s)
- (c) Capacity of normally connected secondary interconnection
- (d) Rating of the secondary switchboard
- (e) Rating of any ancillary equipment
- (f) Voltage regulation
- (g) Substation or network configuration
- (h) Rating of the primary switchgear or busbars
- (i) Redundant substation
- (j) Meshed network circuit capacity
- (k) Customer connection agreement.

2.34. There could be more than one restricting factor in place. This column should be used to specify the factor that limits the firm capacity to the lowest value.

*Substation/substation group observed maximum demand*

2.35. The maximum demand (in MVA) which corresponds to the season of most onerous demand for the substation/substation group within the regulatory year corrected only for abnormal running conditions. Correcting for abnormal running conditions relates to removing abnormal demand peaks that may arise, for example,



during fault situations or maintenance outages. These corrections amend measured maximum into observed maximum demand.

*Weather correction adjustment to observed maximum demand*

2.36. The negative or positive adjustment to maximum demand (in MVA) that results from any weather correction, eg using ambient temperature data to rebase maximum demand values to an average cold spell.

*Measurable distributed generation latent demand adjustment to observed maximum demand*

2.37. Measurable DG output that coincides with the observed maximum demand and latent demand which needs to be supplied under n-1 conditions. This specifically applies to DG which does not contribute to firm capacity. The latent demand should be determined with reference to the assessment of latent demand as specified in engineering technical recommendation ETR130. This assessment is only required for highly loaded sites (those that are in load index bandings LI3 – LI5). DNOs can include data for all substations/substation groups where the data is readily available.

*Connected non-firm demand adjustment to observed maximum demand*

2.38. Non-firm demand that can be discounted from maximum demand. For example a DNO may have an agreement with a demand customer that they will be disconnected from the network under fault conditions. This should be entered as a negative value.

*LI maximum demand*

2.39. The calculated maximum demand for use within the derivation of LI ranking and LI risk points. This is calculated as the observed maximum demand adjusted for the weather correction, measurable DG latent demand and non-firm demand.

*LI maximum demand as % of LI firm capacity*

2.40. This calculation shows the LI maximum demand as a percentage of the LI firm capacity.

*Hours at risk*

2.41. This is the amount of time the substation/substation group demand is above 100% of LI firm capacity during the regulatory year.

### LI ranking

2.42. This column calculates the LI ranking as directed by the bandings published in Ofgem’s Strategy Decision for RIIO-ED1 published in March 2013:

| LI ranking | Loading percentage | Duration factor |
|------------|--------------------|-----------------|
| <b>LI1</b> | >=0 and <80        | n/a             |
| <b>LI2</b> | >=80 and <95       | n/a             |
| <b>LI3</b> | >=95 and <99       | n/a             |
| <b>LI4</b> | >=99               | <9 hours        |
| <b>LI5</b> | >=99               | >=9 hours       |

### LI risk points

2.43. This column calculates the LI risk points consistent with the weightings used in the RIIO-ED1 Business Plan Data Templates submitted to Ofgem.

2.44. The calculation is the product of the number of customers on a substation/substation group and the weighting assigned for the LI ranking, as shown in the table below:

| LI ranking | LI risk point weighting |
|------------|-------------------------|
| <b>LI1</b> | 1                       |
| <b>LI2</b> | 1                       |
| <b>LI3</b> | 1                       |
| <b>LI4</b> | 20                      |
| <b>LI5</b> | 100                     |

## P2 Compliance

2.45. This column records details of any P2 derogation associated with the substations/substation groups.

2.46. This column must be completed for all substations/substation groups ranked as LI3, LI4 and LI5. It is recognised that not all these substations/substation groups will require intervention as this depends on DNOs policies and approaches to compliance with P2.

- Where a derogation is in place select “Yes, in place”.
- Where a derogation is anticipated select “Yes, anticipated”. This situation would arise where a substation/substation group is forecast to require intervention, but the planned intervention may be subject to delays and as a consequence the substation/substation group would become non-compliant with P2.
- Where a derogation will be avoided due to interventions taking place select “No, avoided”.

- Where a derogation is not required due to P2 requirements being met without intervention select “Not required”.
- Where a substation/substation group is LI1 – LI2 select “n/a”.

## **Intervention Details**

### *Intervention action during year*

2.47. This column is used to indicate where some form of intervention action that impacts the substation/substation group, has taken place during the regulatory year. This intervention may relate to a multi-year project which has not yet been commissioned. Where this is the case “in progress” should be selected. Where the intervention has been commissioned leading to an increase in capacity or reduction in demand select “completed”. For multi-year projects, completed should only be selected once the entire project has been completed.

### *DNO reference for intervention (eg project id)*

2.48. This is the unique reference used by the DNO for the intervention project. The same reference may be used on different rows where a project impacts more than one substation (eg where the installation of a new substation off-loads two existing substations).

2.49. In some cases more than one reference may be required where a DNO uses more than one project for an intervention.

### *N-1 or N-2 intervention?*

2.50. This column indicates whether the intervention is to resolve a single circuit outage (select “n-1”) or second circuit outage (select “n-2”) issue. Engineering recommendation P2 specifies when an n-2 assessment is required.

2.51. Leave blank if there is no intervention.

### *Expenditure in-year (£m)*

2.52. This column records the amount of expenditure on the intervention in the regulatory year.

2.53. Where the intervention takes place at a substation, the expenditure should be assigned to the substation where the work takes place. For example, where a new substation is constructed, the expenditure should be entered against the new substation. In this situation it should be made clear which existing substations benefit by including the project reference in the “DNO reference for intervention” column for those substations.

2.54. Where the intervention takes place on a circuit, the expenditure should be assigned to the associated substation or substation group. Where the intervention takes place on a circuit which only supplies one substation, the expenditure should be assigned to the substation in the 'LI – Substations yyyy' worksheets. Where the intervention takes place on a circuit that supplies more than one substation, the expenditure should be recorded against the substation group in the 'LI – Substation Groups yyyy' worksheets.

*Firm capacity change resulting from intervention*

2.55. This column records the change in firm capacity (in MVA) that is delivered by the intervention.

2.56. Any change in firm capacity must only be stated once the intervention is commissioned. For multi-year projects that have staged commissioning, the intervention can only be recognised on commissioning of the entire scheme.

2.57. Conventional interventions tend to lead to discrete step changes in capacity, but since innovative solutions, by their nature, can lead to variable changes in capacity, the approach to specifying the change in capacity is more complex.

2.58. It is also anticipated that innovative solutions will continue to be developed during RIIO-ED1, so it is not possible to pre-define how these should be dealt with.

2.59. To enable DNOs to specify the capacity added for innovative solutions the following guiding principles apply:

- DNOs should determine and define how they calculate additional capacity for each innovative solution
- the methodology should be described in the commentary
- following annual submissions of data, Ofgem may identify whether there is a need for standardisation of the calculation methodology where innovative solutions are being used more widely.

*Demand change resulting from intervention*

2.60. This column records the change in demand (MVA) that arises following the intervention. This may be positive where demand is increased (eg when a new substation is installed and loaded) or negative where demand is off-loaded to another substation.

2.61. For conventional interventions the change in demand should be based upon the new normal running arrangement (eg based upon a new split point on the network).

2.62. Innovative solutions may lead to dynamic operation of the network where the split points change to balance load or reduce losses.

2.63. To enable DNOs to specify the demand change for innovative solutions the following guiding principles apply:

- DNOs should determine and define how they calculate the demand change for each innovative solution
- the methodology should be described in the commentary
- following annual submissions of data, Ofgem may identify whether there is a need for standardisation of the calculation methodology where innovative solutions are being used more widely.

*Type of intervention*

2.64. This column captures whether the intervention is conventional, innovative or a mixed solution.

2.65. Conventional interventions include replacing existing assets (such as transformers, cables and overhead lines) with larger capacity units or installing additional assets to augment the overall capacity. Changes can usually be measured by discrete increments. To align with 'CV1 – Primary Reinforcement' in the Costs and Volumes Reporting Pack conventional reinforcement is subdivided into substation work and circuit work.

2.66. Innovative solutions are new ways of operating and controlling existing assets or using different assets (eg battery storage, dynamic asset ratings) developed through innovation trials (eg funded through the Low Carbon Networks Fund, Network Innovation Allowance or Network Innovation Competition). Changes are generally dynamic responding to conditions observed on the network.

2.67. Where the intervention only includes work at a substation, select "conventional – substation".

2.68. Where the intervention only includes work on circuits, select "conventional – circuit".

2.69. Where the intervention includes work at a substation and on circuits select "conventional – mixed".

2.70. Where the intervention is solely an innovative solution select "innovative".

2.71. Where the intervention is a combination of a conventional solution and innovative solution select "conventional and innovative".

*Intervention description*

2.72. This column allows DNOs to provide a brief narrative description of the intervention. This will be used to group similar activities when comparing costs.

2.73. Typical examples of conventional solutions are:

- Upgrading of transformers
- Installation of additional transformer
- Upgrading upstream circuit
- Upgrading current transformers.

2.74. Typical examples of innovative solutions are:

- Dynamic asset ratings
- Load balancing schemes
- Energy storage.

## **LI Tracker – Substations; LI Tracker – Substation Groups**

2.75. The purpose of these worksheets is to illustrate how the demand and capacity parameters of substations/substation groups vary over time during RIIO-ED1.

2.76. For substations this will be used to demonstrate that DNOs have delivered the overall risk position defined in RIIO-ED1 Business Plan Data Templates submitted to Ofgem.

2.77. For substation groups, it will allow Ofgem to track progress of interventions for those substation groups where specific issues were identified in RIIO-ED1 Business Plan Data Templates. It will also show whether new issues have arisen, where DNOs identify additional substation groups.

2.78. The majority of information is automatically populated from the “LI – Substations yyyy” or “LI – Substation Groups yyyy” worksheets, referred to below as feeder worksheets.

### *Substation/Substation Groups*

2.79. This column should be populated with the same names used in the feeder worksheets. The names should be in the same order as the feeder worksheets so that the tracker data is consistent with the data in the feeder worksheets.

2.80. All substations/substation groups in the feeder worksheets should be included. This applies to substations that are decommissioned during RIIO-ED1 and new substations that are commissioned during RIIO-ED1.

### *Substation/Substation Group Primary voltage*

2.81. This column should be populated with the highest voltage in operation at each substation/substation group.

*Substation/Substation Group Secondary voltage*

2.82. This column should be populated with the lowest voltage in operation at each substation/substation group.

*Season of most onerous demand*

2.83. This data is auto-populated from the feeder worksheets.

2.84. It is used to illustrate whether the season of most onerous demand changes over time. This will help to explain why data for maximum demand and firm capacity has step changes without any intervention.

*LI maximum demand*

2.85. This data is auto-populated from the feeder worksheets.

2.86. It is used to illustrate the change in maximum demand over time.

2.87. It is expected that there will be annual variations due to changes in customer demand. Step changes can result from conventional interventions, innovative interventions or may be observed where the season of most onerous demand changes.

*LI firm capacity*

2.88. This data is auto-populated from the feeder worksheets.

2.89. It is expected that most of these values will remain fixed. Variations may arise where new DSR agreements are put in place or DG that contributes to firm capacity comes on-stream. Step changes will result from conventional interventions, innovative interventions or may be observed where the season of most onerous demand changes.

*LI maximum demand as % of LI firm capacity*

2.90. This data is auto-populated from the feeder worksheets.

2.91. It is expected that these values will vary. Changes will arise in response to changes in demand. Step changes will be observed as a result of interventions.

*LI ranking*

2.92. This data is auto-populated from the feeder worksheets.

2.93. This will be used to identify how the LI ranking changes over time. The main purpose will be to show the LI ranking reduction following an intervention. Note that LI ranking may also reduce where demand falls.

*LI risk points*

2.94. This data is auto-populated from the feeder worksheets.

2.95. This will be used to identify how the LI risk points change over time and how they compare with the target risk points specified in RIIO-ED1 Business Plan Data Templates submitted to Ofgem. Note that small variations in risk points will arise due to changes in customer numbers.

*Target LI risk points*

2.96. This column should be populated with the LI risk points specified in RIIO-ED1 Business Plan Data Templates (as amended (if at all) for volume reductions specified in the slow-track final determinations).

2.97. The target for LI risk points only applies to substations. The target is the total LI risk points across all substations, not the individual risk points for each substation.

2.98. Since substation groups are only populated where there is an identified issue, the total value does not represent the overall network risk. The risk points associated with substations groups are used for tracking of specific issues and interventions. There is no overall network target for substation groups.

*RIIO-ED1 Expenditure*

2.99. This data is auto-populated from the feeder worksheets.

2.100. This will be used to track expenditure and associate it with the changes that result from interventions.

*Changes in firm capacity resulting from intervention*

2.101. This data is auto-populated from the feeder worksheets.

2.102. This will be used to show the firm capacity changes delivered by interventions. It will reveal where multiple interventions occur during RIIO-ED1. This may arise where a smart intervention is used to defer a conventional intervention.

*Changes in maximum demand resulting from intervention*

2.103. This data is auto-populated from the feeder worksheets.



2.104. This will be used to show the maximum demand changes delivered by interventions. It will reveal where demand changes arise as a consequence of multiple interventions during RIIO-ED1 (eg this may arise where demand is off-loaded due to a number of interventions).