March 2002

# Information and Incentives Project

# Regulatory Instructions and Guidance version 2

# Executive Summary

This document is version 2 of the Regulatory Instructions and Guidance (RIGs). It will take effect from 1 April 2002. In drawing up this version of the RIGs, Ofgem has considered responses to the draft version, which was published in December 2001.

Ofgem has made a number of changes to the RIGs to:

- improve their style and presentation;
- provide further guidance in a number of areas;
- remove inconsistencies; and
- introduce formulae for calculating the number and duration of interruptions to supply per year, the number of re-interruptions and the number of short-interruptions.

Some changes that were proposed in the December draft version have been amended in the light of respondents' comments. This is discussed further in the covering letter to these RIGs.

Copies of this document and the covering letter are available on Ofgem's website (www.ofgem.gov.uk).

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# 1. Introduction

1.1 Version 2 of the revised Regulatory Instructions and Guidance (RIGs) has been produced in accordance with Standard Licence Condition (SLC) 49 of the electricity distribution licence. The purpose of the RIGs is to provide a framework for the collection and provision of accurate and consistent information from the electricity distribution companies. This is important as it reduces the level of regulatory uncertainty that may otherwise exist. The benefits of improvements in the quality of information should be realised by all those with an interest in the regulation of distribution companies, including customers and their representatives, the regulator and the companies themselves.

1.2 The RIGs include definitions and related instructions and guidance for collating "Specified Information" as defined in SLC 49. Where possible Ofgem has specified consistent definitions to apply to all distribution companies. Ofgem is also putting in place an audit framework that will assess whether the information that is collected meets the required levels of accuracy and is consistent with the definitions contained in the RIGs.

1.3 Any changes to the RIGs will comply with the change process set out in paragraphs 9 to 11 of the IIP information licence condition. Ofgem recognises that any significant changes to the scope or form of the information that it requests from the distribution businesses could not only increase the regulatory burden but also the perception of regulatory risk. It is Ofgem's intention to change the scope and form of the information it requests as infrequently as possible, consistent with Ofgem carrying out its duties under the Electricity Act 1989 and the Utilities Act 2000.

1.4 Distribution businesses will be expected to have the necessary measurement systems in place by April 2002 for delivering the required levels of accuracy of reporting.

### *Structure of this document*

1.5 The RIGs covers six main areas:

- definitions, instructions and guidance for collating information on:
  - the number and duration of interruptions to supply and short interruptions to supply – (Section 2);
  - assessing the speed and quality of telephone response – (Section 3); and
  - monitoring medium term performance – (Section 4);
- specification of the required levels of accuracy for reporting – Ofgem has specified minimum levels of accuracy that must be achieved for the reporting of the number and duration of interruptions to supply (Section 5);
- reporting arrangements – an outline of the reporting arrangements for IIP; (Section 6); and
- an outline of the purpose for which Specified Information will be used – Appendix 1;
- formulae for the purposes of reporting – Appendix 2; and
- other formulae – Appendix 3.

# 2. Definitions, instructions and guidance for reporting the number and duration of interruptions to supply

### *Introduction*

2.1 This section sets out definitions and related instructions and guidance for the reporting of:

- the number of interruptions to supply;
- the duration of interruptions to supply;
- short interruptions to supply; and
- the number of re-interruptions to supply.

### *Information sources*

2.2 Most distribution companies use the National Fault and Interruption Reporting Scheme (NaFIRS) which is administered by the Electricity Association (EA) - or an equivalent system - to collect information on the number and duration of interruptions to supply. For the purpose of reporting under the IIP, companies must use the definitions contained in this document.

### *Definitions of output measures*

2.3 Definitions to be applied for reporting on the number and duration of interruptions to supply, the number of short interruptions to supply and the number of re-interruptions to supply are shown below. Further definitions, instructions and guidance are provided in paragraphs 2.4 to 2.66.

- **the number of interruptions to supply per year** – the number of customers interrupted per 100 customers per year, where an interruption of supply to customer(s) lasts for three minutes or longer, excluding re-interruptions to the supply of customers previously interrupted during the same incident (see below for further details). It is calculated as:

$$\frac{\text{The sum of the number of customers interrupted for all incidents} * 100}{\text{The total number of customers}}$$

- **the duration of interruptions to supply per year** - average customer minutes lost per customer per year, where an interruption of supply to customer(s) lasts for three minutes or longer, calculated as:

$$\frac{\text{The sum of the customer minutes lost for all restoration stages for all incidents}}{\text{The total number of customers}}$$

- **the number of short interruptions to supply per year** – the number of customers interrupted by a short interruption per 100 customers per year, where the initial interruption to supply is restored in less than three minutes , calculated as:

$$\frac{\text{The sum of the number of customers interrupted by short interruptions} * 100}{\text{The total number of customers}}$$

- **the number of re-interruptions to supply per year** – the number of customers re-interrupted per 100 customers per year, calculated as:

$$\frac{\text{The sum of the number of customers re - interrupted} * 100}{\text{The total number of customers}}$$

### *Further definitions, instructions and guidance*

**Customer**

2.4 Any energised or de-energised entry or exit point to the distribution system, where metering equipment is used for the purpose of calculating charges for electricity consumption. Customers should be identified from Metering Point Administration Numbers (MPANs), such that individual customers are identified at each connection point.

2.5 Only one (individual) customer should be identified at each connection point. This means that multiple (or secondary) MPANs which arise due to the type of

"tariff" (or equivalent) and/or metering arrangements, but are associated with a single connection point, should not be counted.

2.6 In some cases (e.g. flats), the connection point may be from the distribution system to wiring owned by a landlord or a facilities manager. In such cases, individual customers supplied by such wiring are classed as customers of the distribution system where they are identifiable from MPANs.

2.7 The method adopted by companies to identify customers from MPANs shall be agreed in advance with Ofgem. Ofgem will want to ensure that, as far as possible, distribution companies use a consistent method for identifying customers.

**Total number of customers**

2.8 The total number of customers is defined as the total number of customers connected to the company's distribution network as at 30 September in the relevant reporting year.

**Incident**

2.9 Any occurrence on the distribution system or other connected electricity supply system, which involves a physical break in the circuit upstream of the customers interrupted (or circuit affected), for three minutes or longer, due to automatic or manual operation of switchgear or fusegear, or due to any other open circuit condition, which:

- results in an interruption of supply to customer(s) for three minutes or longer; or
- prevents a circuit or item of equipment from carrying normal load current or being able to withstand "through fault current" for three minutes or longer.

2.10 In addition to failures of power equipment, other occurrences classed as an incident include:

- the unprogrammed isolation of any circuit or item of equipment, energised at power system voltage, which has not been classified as a pre-arranged incident;

- failures of non-system equipment (e.g. pilot cables, oil and gas alarms, voltage control equipment etc) which result in the disconnection of equipment energised at power system voltage;

- incorrect operations of protection equipment which result in the disconnection of a circuit energised at power system voltage;

- failures of protection equipment to operate. This includes incidents where the main protection fails to operate and a fault clearance is initiated by back-up protection or protection at another point on the network;

- the loss of infeed from other connected systems, including those owned by the National Grid Company/Transmission Companies (in Scotland), other distribution companies and distributed generators, that cause a loss of supply to customers for 3 minutes or longer; and

- the pre-arranged isolation of any circuit or item of equipment energised at power system voltage that results in loss of supply.

2.11 A further incident must be reported if another incident occurs which affects part of the network and/or customers already affected by an incident. Two or more incidents may then be active concurrently and the number and duration of interruptions and the number of re-interruptions should be calculated accordingly.

2.12 Occurrences that would not lead to an incident are as follows:

- maintenance outages and malfunctions of non-system equipment (e.g. pilot cables, etc) which do not result in the disconnection of equipment energised at power system voltage;

- failures and overloads on customers' equipment or another authorised electricity operator's system, which are cleared by the correct operation

of the distribution company's protection and which does not interrupt the supply to other customer(s) of the distribution company; and

- pre-arranged works affecting single customers for the purposes of meter changes, voltage standardisation, and work on service cables and distributors' fuses.

**Unplanned incident on the distribution system**

2.13 Any incident arising on the licensee's distribution system, where statutory notification has not been given to all customers affected at least 48 hours before the commencement of the earliest interruption (or such notice period of less than 48 hours where this has been agreed with the customer(s) involved).

**Pre-arranged incident**

2.14 Any incident arising from the pre-arranged isolation of any circuit or item of equipment energised at power system voltage that results in loss of supply and where statutory notification has been given to all customers affected at least 48 hours before the commencement of the earliest interruption (or such notice period of less than 48 hours where this has been agreed with the customer(s) involved).

2.15 A pre-arranged incident which requires a number of switching operations involving an interruption to supply to customers should be treated as a single incident provided that the outage times are within the period stated on the notification provided to the customer(s).

**Incident on other systems**

2.16 Any incident arising on other connected electricity supply systems which leads to the interruption of supply to the customers of the licensee, including:

- National Grid Company or Transmission Companies (in Scotland);
- distributed generators; and
- any other connected systems – which should be identified.

**Non-damage incident**

2.17 A non-damage incident is defined as any unplanned incident where supply can be restored from the same source without the need for the repair of equipment or other intervention.

**Incident start**

2.18 The incident start time is the earlier of the date and time at which:

- the first report is received of a loss of supply or other abnormality which prevents a circuit or other item of equipment from carrying normal load current or being able to withstand "through fault current" for three minutes or longer; or
- the relevant circuit is automatically, deliberately or otherwise disconnected.

**Report Received Time**

2.19 The report received time is the earliest time that a distribution company became aware of a loss of supply, an abnormality or a suspected abnormality. It shall be the earlier of the date and time at which:

- a customer (or other person) first contacted the distribution company to advise of no-supply, an abnormality or suspected abnormality;
- an alarm was received by the distribution company indicating a loss of supply, abnormality or suspected abnormality; or
- a distribution company employee or agent identified the existence of a loss of supply, abnormality or suspected abnormality.

2.20 For reports that are associated with a loss of supply or other abnormality, which prevents a circuit or other item of equipment from carrying normal load current or being able to withstand "through fault current" for three minutes or longer, the report received time will coincide with the incident start time. For other reports the report received time may precede the incident start time, for example:

- when deliberate disconnection is undertaken some time after the report is received; or
- when some faults are held by arc suppression.

2.21 In respect of loss of supply, some companies wait for a second report before initiating action. However, for the purposes of reporting under the IIP the incident start time must be based on the time of the first report received. The date and time of an incident is the time at which the company first becomes aware of the incident by any means.

**Incident completion**

2.22 An incident is considered complete when supplies have been restored from the network to all customers involved in the incident for a period of at least 3 hours. This does not require the restoration of the normal network configuration and open points.

2.23 If there is a further loss of supply to some or all of the same customers within 3 hours of the initial supply restoration, this should be counted as a re-interruption. Equally, if there is a further loss of supply to some or all of these customers 3 hours or more after the initial supply restoration then this should be treated as a new incident.

2.24 There is a special case where some form of temporary supply arrangement[1] has been used to restore supplies. In this case, if there is a loss of supply to some or all of the same customers within 18 hours of the initial supply restoration in order to connect or disconnect the temporary supply arrangements, then this further loss of supply should be treated as a re-interruption.

2.25 In cases where there is a loss of supply to some or all of the same customers within 18 hours of the initial supply restoration because of a failure of the temporary supply arrangement itself, then this should be treated as a re-interruption.

[1] Defined in paragraph 2.36

2.26 If, for any reason, supplies to some or all of the same customers are subsequently lost after an 18-hour period of supply restoration via a temporary arrangement, then this further loss of supply should be treated as a new incident.

2.27 Where an incident start and completion time/date spans two reporting years, it should be allocated to the year in which the incident started.

**Interruption**

2.28 An interruption is defined as the loss of supply of electricity to one or more customers due to an incident (defined above) but excluding voltage quality abnormalities, such as dips, spikes or harmonics.

**Short interruption**

2.29 Short interruptions are defined as the loss of supply of electricity to one or more customers due to automatic, manual or remote control operation of switchgear or fusegear on the distribution system or other systems, upstream of the customers interrupted, where supply is restored within three minutes.

2.30 For the purpose of reporting under the IIP, companies are required to report the total number of short interruptions, and disaggregated number of short interruptions by the following four causes:

- due to the automatic operation of distribution network switchgear where some or all the customers involved are successfully restored by automatic switching within three minutes of the first interruption;
- due to the automatic operation of distribution network switchgear where some or all the customers involved are successfully restored by manual or remote control switching within three minutes of the first interruption. This definition includes only the initial restoration. Further short interruptions during subsequent stages of fault sectionalising are not included;
- due to the manual or remote operation of distribution network switchgear for reasons such as deliberate disconnection for operational or emergency reasons; and

- due to the operation of switchgear on the networks of NGC/Transmission Companies (in Scotland) or other connected systems and distributed generators.

2.31 Short interruptions do not need to be disaggregated by voltage or by HV circuit. Where companies make significant use of automatic reclosing devices and automatic switching at the LV level, the number of short interruptions at this voltage level should be included in the appropriate short interruption categories identified above.

2.32 In the case of multi-shot reclosing schemes, only one short interruption is to be counted where the successful restoration is achieved by a sequence of multiple operations within a period of three minutes, where these are identifiable. Where the sequence of operations is not identifiable, then a simple count of all operations of automatic reclosing device(s) could be used, excluding those operations recorded elsewhere, e.g. those associated with other incidents or routine switching.

2.33 The number of customers interrupted should be identified in the same way as for incidents (i.e. those situations where customers are off supply for three minutes or longer). If a company uses periodic counts of recloser operations to calculate the number of short interruptions then the number of customers interrupted will be based on an estimate of those customers who would have been interrupted, assuming the circuit affected was configured normally, i.e there were no abnormal feeding arrangements.

2.34 The dates and times of short interruptions are not required. Where short interruptions are identified from a periodic count of circuit breaker operations the counters should be read annually between 1 January and 31 March to ensure a reasonable approximation to a 12-month total.

**Re-interruption**

2.35 A re-interruption is defined as the loss of supply of electricity to one or more customers for a period of 3 minutes or longer, where those same customers have experienced an interruption during previous restoration stages of the same incident.

**Temporary Supply Arrangement**

2.36 A temporary supply arrangement is the use of temporary connections, temporary disconnections or mobile generation in order to provide temporary restoration of supplies during an incident.

**Temporary connection**

2.37 A temporary connection is a connection (made without using normal switching devices) which is not to become a permanent feature of the distribution system, but which is used solely to provide a temporary restoration of supplies during an incident.

**Temporary disconnection**

2.38 A temporary disconnection is a deliberate break in the continuity of a circuit, which is not to become a permanent feature of the distribution system, but is used solely to facilitate the temporary restoration of supplies during an incident.

**Restoration stage**

2.39 A restoration stage is defined as a stage of an incident, at the end of which supply to some or all customer(s) is restored and/or a circuit or part of a circuit is re-energised, excluding any restoration/re-energisation which is immediately followed by a circuit trip.

2.40 Where a customer(s) is temporarily restored for a period of less than three minutes, then calculation of the duration of interruptions to supply should ignore the time for which customers were restored.

2.41 There should be no limit to the number of restoration stages for an incident.

**Start of a restoration stage**

2.42 The start of a restoration stage is the date and time at which supply to customer(s) is interrupted and/or a circuit or part of a circuit is de-energised.

**End of a restoration stage**

2.43 The end of a restoration stage is the date and time at which customer(s) have their supply restored and/or a circuit or part of a circuit is re-energised.

**Customers involved in a restoration stage**

2.44 The customers involved in a restoration stage are defined as the customers connected to that part of the distribution network restored in the restoration stage, including restorations from mobile generators and temporary connections.

2.45 The number of customers interrupted for single phase and two phase LV faults may be calculated on a pro-rata basis, i.e. 1/3 or 2/3 of the total number of customers connected to the LV circuit, or part of circuit, affected. Customers with a three phase LV supply (where these can be identified) are considered to be interrupted when supply is interrupted to one or more of the three phases. Individual customer phase connections do not need to be identified for the purpose of reporting under the IIP. It may be helpful, in terms of the audit process, if companies recorded the number and phases of fuses that have operated in the event of an incident on the LV system.

2.46 For HV faults, in the interest of simplicity and consistent reporting, if one phase of a three-phase circuit is disconnected it should be considered that two-thirds of customers connected downstream of the point of disconnection had their supplies interrupted.

2.47 Where a connectivity model is in place it should be used consistently to derive the number of customers interrupted on a particular element of the network modelled. Where the section of network involved is a subset of a modelled network element, then the number of customers interrupted may be derived from records or from information available on site.

2.48 Customers involved for HV, EHV and 132 kV should take account of the real time changes to 132 kV/EHV/HV network configuration during restoration, which may be identified from a connectivity model.

2.49 Customers involved in each restoration stage may be identified from a connectivity model in which customer information is individually linked with the appropriate section of network to which they are connected.

2.50 The date and time of interruption and the date and time of restoration must be recorded for each restoration stage. The numbers of customers involved and the elapsed time in each restoration stage will be used to calculate the number and duration of interruptions to supply.

**Distribution system**

2.51 The distribution system is defined as in the standard distribution licence. Transmission activities in Scotland encompass 132 kV electrical line and plant. References to reporting on 132 kV in the RIGs are not applicable to the two Scottish ex-PES distribution companies.

**Interruption sequences**

2.52 An incident may include both a loss of supply of less than 3 minutes duration and a loss of supply of 3 minutes or longer. Under such circumstances, where the loss of supply of less than 3 minutes duration occurs first, it should be reported as a short interruption. Further losses of supply of less than 3 minutes duration during the course of the same incident do not need to be reported.

**Updating the connectivity model**

2.53 It is important that the connectivity model is kept up to date. The accuracy with which the number and duration of interruptions to supply are reported is, in part, determined by the frequency with which the connectivity model is updated. A reasonable timeframe for updating the connectivity model is likely to be within 14 days of the distribution company being formally notified of any permanent changes to the network or customer connections. (For example, a change expected to be in place for at least 28 consecutive days may be regarded as a permanent change). In addition, the numbers of customers in the model could be reconciled with the total number of connected customers on a monthly basis.

### *Disaggregation of incidents*

2.54 It is necessary to collect information on the number and duration of interruptions to supply at a disaggregated level. This will help in comparing performance across distribution companies and could be used for making adjustments within the incentive scheme. There are three types of mutually exclusive disaggregation required. These are :

- by source;
- by voltage level; and
- by HV circuit.

**Disaggregation by "source"**

2.55 In addition to reporting on the effect on customers of all incidents arising on the distribution system, the number and duration of interruptions to supply arising from the following 5 categories should be separately identified:

- unplanned incidents on the distribution system, i.e. all incidents *excluding* pre-arranged incidents;
- pre–arranged incidents on the distribution system;
- incidents on the systems of the National Grid Company or Transmission Companies (in Scotland);
- incidents on the systems of distributed generators; and
- incidents on any other connected systems – which should be identified.

**Disaggregation by voltage levels**

2.56 All incidents arising on the distribution system should be disaggregated in the following classifications, which are defined in more detail below:

- 132 kV;
- Extra High Voltage (EHV) excluding voltages up to and including 22 kV;

- High Voltage (HV) and voltages up to 22 kV;
- Low Voltage (LV); and
- LV Services.

2.57 For the purpose of reporting under the IIP voltage/system boundaries are defined as follows:

*132 kV systems*

2.58 The "lower boundary" of the 132 kV system should be taken as the supply terminals of the distribution company's customers supplied at 132 kV or the load side terminals of switchgear controlling the secondary (lower voltage) side of 132 kV transformers. If no switchgear exists between the secondary side of the 132 kV transformer and the primary side of an EHV or HV system transformer then the "lower boundary" should be taken as the secondary side terminals of the 132 kV transformer. The lower voltage busbars and their protection equipment at 132 kV//lower voltage substations are NOT included.

2.59 The "upper boundary" of the 132 kV system should be taken as the point at which ownership of the 132 kV circuit or plant becomes the responsibility of the distribution company.

*EHV systems*

2.60 For the purposes of reporting under the IIP, Extra High Voltage (EHV) includes all voltage levels above 22kV up to but excluding 132kV[2]. The "lower boundary" of EHV systems should be taken as the supply terminals of customers supplied at EHV, and in other situations as the load side terminals of protection equipment connected to the secondary side (lower voltage) of distribution transformers. The "upper boundary" should in general be taken as the busbar side of lower voltage switchgear of transformers whose primary voltage is 132kV or above and whose secondary voltage is EHV. If no secondary switchgear exists, the "upper boundary" should be taken as the secondary side terminals of the transformer. Faults on the system connected to the secondary voltage

[2] See paragraph 2.51 in relation to the reporting of incidents in Scotland

terminals of the transformer should be reported as EHV faults and not as 132kV faults.

*HV systems*

2.61 For the purposes of reporting under the IIP, High Voltage (HV) includes all voltage levels above 1,000 volts up to and including 22kV. The "lower boundary" of HV systems should be taken as the supply terminals of customers supplied at HV, and in other situations as the load side terminals of the protection equipment connected to the secondary side (lower voltage) of distribution transformers respectively. The "upper boundary" should in general be taken as the busbar side of lower voltage switchgear of transformers whose primary voltage is 132 kV or above and whose secondary voltage is HV. If no secondary switchgear exists, the "upper boundary" should be taken as the secondary side terminals of the transformer; faults on the system connected to the secondary voltage terminals of the transformer should be reported as HV faults and not as 132 kV faults.

2.62 In practice companies will normally report and disaggregate by each discrete voltage level in order to report to the above classifications.

*LV systems*

2.63 For the purposes of reporting under the IIP, a Low Voltage (LV) system is one that operates at a nominal voltage of 1000 V or less.

2.64 The upper boundary should be taken as the load side terminals of the protection equipment connected to the secondary side (low voltage) of distribution transformers. The lower boundary should be taken as the points of connection associated with LV services.

*LV Services*

2.65 For the purpose of IIP reporting LV Services are defined as the service line from the LV distributing main to the distribution company's protection device situated upon the customer's premises including the joint and associated components connecting the service line to the distributing main. It should be noted that incidents on meters and time-switches and cutouts, including cut out fuse

operations are excluded from reporting under the IIP (even where this results in the operation of a fuse at the distribution company's substation) and the definition of LV Services therefore excludes this equipment.

**Disaggregation by HV circuit**

2.66 The number and duration of interruptions to supply arising on HV systems need to be reported by HV circuit.

# 3. Definitions, instructions and guidance for reporting on speed and quality of telephone response

### *Introduction*

3.1 This section sets out definitions and related instructions and guidance to be used for the reporting on:

- the speed of telephone response and other related information; and
- the information which Ofgem, and its appointed agents, require for undertaking a survey of customers' views of the response that they receive when they contact the distribution company by telephone.

### *Speed of telephone response*

#### Definition of the specified contact lines

3.2 It is necessary to specify which telephone calls are relevant for measuring the speed of telephone response. All telephone calls received to the following lines should be included:

- to the "freephone power outage telephone number" (and its equivalents) operated by the distribution company or by its appointed agents (or contractors);
- to the security and safety enquiry service telephone number (if different from the above) operated by the distribution company or by its appointed agents (or contractors); and
- to contractors and/or agents of the distribution company who act as an overflow or crisis management facility during peak periods.

3.3 To the extent that companies provide a different emergency telephone number as required by the Electricity Supply Regulation (ESRs), this is not included in the definition of specified contact lines.

**Definitions of required information**

3.4 Companies are asked to provide the following information.

*Average speed of response*

3.5 Average speed of response can be measured by:

- **direct measurement -** companies using direct measurement to calculate the average response time should use the formula below for calculating the average speed of response, i.e. the summation of wait times for all calls divided by the total number of calls answered:

$$\frac{\text{Total response times for all relevant telephone calls each year}}{\text{Total number of telephone calls answered each year}},$$

where relevant phone calls are defined as calls answered on the specified contact lines.

In addition companies are required to provide an analysis of the average speed of response on a calendar month basis, where each element (total wait times and total number of calls answered) are identified separately. Companies should submit the monthly figures at the end of the reporting year with other IIP information.

3.6 Where direct measurement is not possible, the average speed of response can be measured by sampling or interpolation. While companies are allowed to use sampling and interpolation, the approach must be agreed in advance with Ofgem. It is also expected that companies will move towards using direct measurement as soon as practicable to ensure that there is greater consistency in measurement. In the accompanying narrative companies are required to outline their plans and timetable for introducing direct measurement.

3.7 Companies also need to measure and provide the following information:

- **total calls on the specified contact lines** - this is defined as the total number of incoming telephone calls to the lines specified above, including, where appropriate, calls which receive an engaged tone;

- **total calls received -** this is defined as the total number of calls which enter the company's telephony system on the specified contact lines and receive a ringing tone. Calls that receive an engaged tone are not to be counted as calls received. These calls will be accounted for within the "all lines busy" indicator which is defined below;

- **total calls answered –** this is defined as the total number of calls received on the specified contact lines that are answered by either an automated messaging system or a telephone operator;

- **response times –** this is defined as the amount of time that a customer has to wait before receiving a response once their call has entered the company's telephony system. The distribution company's telephony system includes systems operated by a service provider on behalf of the company. For example, an automatic messaging system on a BT platform. The response times should be calculated for each relevant telephone call according to the guidance provided below; and

- **total response times** – this is defined as the sum of all response times for each relevant telephone call in the reporting year.

**Other required information**

*All lines busy*

3.8 The "all lines busy" indicator measures the degree of difficulty customers experience in getting through to the customer contact number/enquiry service. Companies are required to report the number of calls to the distribution company on the specified contact lines, which receive a busy tone (or equivalent). Ofgem will multiply this number by 2 seconds in order to estimate the total time that customers experience busy lines. Where companies are unable to provide this information they should report the total time the customer contact number/enquiry service is physically unable to take additional calls.

*Calls abandoned*

3.9 Companies using recorded messages, or answering machines, or facilities for touch-tone telephones should take particular care when reporting against this

indicator. All calls abandoned, including those abandoned within ten seconds (which should be separately identified if applicable), are to be reported. Calls should be reported as "calls abandoned" whenever the following circumstances apply:

- **group announcements –** where callers hang up during the group announcement; or
- **recorded messages (queuing) -** where callers hang up during or after hearing the recorded message advising them that they are in a queue, and before the company answers the call; or
- **touch-tone telephone facilities -** where callers hang up during or after hearing the message explaining the touch-tone telephone facilities, but before pressing the appropriate buttons.

### *Instructions and guidance*

3.10 In collating the required information the following guidance should be applied.

**Recorded messages**

- **queuing (or equivalent) -** some distribution companies employ recorded messages in their telephony systems advising customers that they are in a queue and that there are no operators available to answer their calls. Some recorded messages trip-in within a few seconds of the ringing tone being heard by the customer while others are activated later. Under such situations the response time should be measured as the time that the customer first hears the ringing tone to the time that the company agent answers the call or that an automated fault message (or equivalent) is provided, **not** from or to the time that the customer hears the recorded queuing message informing them that they are in a queue. If customers hang up during or after hearing the recorded message advising them that they are in a queue, but before the company agent answers the call, then such calls are to be reported as abandoned;
- **"group announcements" (or equivalent) –** some companies also operate a recorded message informing customers of the purpose of the telephone

number that they have rung and to provide a Data Protection Notice. This is used to filter out calls that have been made to the company by mistake and to inform customers that they may be asked to take part in a customer survey. The response time should be taken from the time that the customer first hears the ringing tone to the time that the company agent answers the call or that an automated fault message (or equivalent) is provided, excluding the length of time that the group announcement lasts. In the accompanying narrative companies should provide details on:

- the length of the group announcement message (including the length of the Data Protection Notice); and
- its content (including the content of the Data Protection Notice).

Some companies provide the Data Protection Notice only to those customers who are queuing for an operator. In such cases, the length of the Data Protection Notice should still be subtracted from the response time for the relevant calls.

- **automated fault messages –** some distribution companies use a recorded message (e.g. via a 'message manager' or equivalent system) to relay information to customers on incidents, (i.e. automated fault messaging). In such circumstances each call to the automated recorded message is to be counted as a "call answered" once the automatic message trips in. The response time is defined as the period of time from the first ringing tone to the start of the fault message. If customers hang up during the recorded message then such calls do not need to be reported as abandoned;

- **calls disconnected** – companies should report the number of calls that are disconnected where either:

(a) the customer chooses to hold for an agent following an automated fault message but is disconnected before the agent answers the call; and

(b) the customer is not provided with an opportunity to continue the call following an automated fault message.

- **answering machines –** where companies use answering machines they should use the accompanying narrative to provide details on:
  - the number of days during the reporting year where answering machines were in operation;
  - their function and the company's policy for responding to customer messages; and
  - the total number of calls received that were handled by an answering machine.
- **touch-tone telephone facilities -** some companies employ a system that asks customers with touch-tone telephones to press specified buttons to access specific company information. It is recognised that customers will need to listen to the message before they can respond but it is important that messages are clear and concise. The response time is taken from the time that the customer **either** hears the first ringing tone, **or** (where there is no ringing tone) from the commencement of the interactive voice response message to the time that the company agent answers the call or an automated fault message trips in. In measuring this period of time a company is allowed a 15-second grace period.

**Additional narrative**

3.11 In addition to the information specified above for inclusion in the accompanying narrative companies are also required to identify, on an annual basis:

- the number of temporary customer telephone contact points that are put in place and the reason for their introduction;
- the length of time each of the contact points was in place; and
- the number of calls received to each contact point.

3.12 In addition companies should also report on the configuration of their telephony systems. Companies are asked to describe the number and configuration of incoming lines linked to lines identified under the categories outlined above - a schematic diagram should be included to explain how the telephony system is set up.

3.13 Where companies are unable to provide information on the indicators for all lines busy, calls disconnected and calls abandoned, they should use the accompanying narrative to explain why this is the case and when they will be able to provide the relevant information.

### *Quality of telephone response*

3.14 Ofgem intends to undertake a survey of the views of customers of the telephone response that they receive when they contact the distribution company. To undertake this survey, Ofgem (and/or its appointed agents) will require information on the customers that have contacted the distribution companies by telephone.

3.15 In order for Ofgem to undertake the survey, distribution companies are required to provide the following information:

- the telephone number of each person (or customer contact) telephoning either of the following enquiry services/contact lines whose call is answered by a telephone operator (i.e. excluding automated responses):
  - to the freephone power outage telephone number (and its equivalents) operated by the distribution company or by its appointed agents (or contractors);
  - to the security and safety enquiry service telephone number (if different from the above) operated by the distribution company or by its appointed agents (or contractors);
- together with, if known, the name of that person, whether that person is a domestic or non-domestic customer and when they telephoned the distribution company.

**Customer contact**

3.16 In some instances customer information may not be available to the distribution company, including where:

- customers choose to withhold their telephone number, either verbally or by using a call line identification blocking service (i.e. by pressing 141 before contacting the distribution company);
- customers refuse to partake in a survey; and
- where, in consultation with the Data Protection Registrar and distribution companies, Ofgem considers that the provision of information would be a breach of the Data Protection Act.

3.17 In such circumstances the distribution company is not required to submit the customer information outlined above.

# 4. Definitions, instructions and guidance for monitoring medium term performance

### *Introduction*

4.1 This section sets out definitions and related instructions and guidance for the reporting of information that Ofgem requires for monitoring the medium term performance of distribution networks. Ofgem intends to collect information in three main areas, namely:

- an analysis of fault rates and causes on electrical line and plant and equipment;
- a supporting narrative provided by the distribution companies; and
- activity based information on the number of "units" replaced of an asset that has been identified as poorly performing and that is the subject of a replacement programme.

4.2 It is not Ofgem's intention to constrain companies' monitoring and reporting of medium term performance (MTP). The framework for monitoring MTP will develop over time and as such companies could report at a more disaggregated level, and are encouraged to report additional indicators and/or narrative that they consider relevant.

4.3 At future price control reviews Ofgem will want to understand the impact of future expenditure (both capital and operating) on MTP.

4.4 The requirements for reporting on MTP are outlined below. PB Power (Ofgem's technical advisors on the initial phase of the IIP) produced a report on monitoring MTP. This is available on Ofgem's website (www.ofgem.gov.uk). This is for information purposes only and companies are not required to report on the basis of the PB Power document.

### *Definitions*

#### Reliability

4.5 Ofgem intends to monitor the reliability (fault rates) of electrical line and plant and equipment, together with the fault causes. For the purposes of this document reliability is defined as the number of reportable incidents affecting line, plant and equipment expressed as the:

- number of faults per unit length of circuit classification (per 100 km); and
- number of faults per unit of equipment classification (per 1000 units); and
- number of service faults per 1000 customers connected at low voltage.

4.6 For the purposes of medium term reporting, a fault comprises an unplanned incident or a series of related unplanned incidents each resulting from a single direct cause on the same single item of equipment. In other words, a single failure of the system (including any recurrence) is to be included once only and pre-arranged incidents and incidents on other connected systems are to be excluded.

#### Required information

4.7 For the first year of reporting under the IIP (2001/2), distribution companies are required to provide an historical analysis of reliability and fault causes according to the classifications outlined below. This should be provided for the last five years including for the reporting year 2001/02 (i.e. reports should be submitted in 2002). This will ensure that there is a track record of information going forward for assessing reliability. Distribution companies must also explain any changes that have been made to definitions or measurement over this period that have led to a change in the reported figures.

#### 132 kV, 66 kV and 33 kV circuits and equipment

4.8 Fault rates need to be provided according to the following breakdown, i.e. 3 trend lines per voltage level. It should be noted that the total fault rate may exceed the sum of the fault rates for overhead lines and underground cables.

| 132 kV | 66 kV | 33 kV |
|---|---|---|
| Total (all faults) | Total (all faults) | Total (all faults) |
| Overhead lines | Overhead lines | Overhead lines |
| Underground cables | Underground cables | Underground cables |

**High voltage**

*Overhead lines and underground cable*

4.9 All high voltage levels should be aggregated from more than 1 kV up to and including 22 kV, i.e. there should be a single classification for HV. This should be disaggregated by overhead line and underground cable. The fault rates on each should be reported according to the following classification, i.e. 5 trend lines for each.

| Overhead line plus pole mounted/structure mounted fusegear, isolators and switch disconnectors | Underground cable (i.e. power cables) |
|---|---|
| Total (all causes) | Total (all causes) |
| Weather and environment[3] | Weather and environment |
| Company causes and faulty manufactures | Company causes and faulty manufactures |
| Unknown or unclassified causes | Unknown or unclassified causes |
| Third party | Third party |

4.10 Total fault rates (all causes) in the table above include all fault rates attributed to the relevant class of equipment and will be equal to the sum of the fault rates for the disaggregated causes.[4]

*Switchgear and protection systems*

4.11 Distribution companies should include NaFIRS defined (or equivalent) pole-mounted automatic circuit breakers and automatic sectionalisers and all (automatic or non-automatic) ground-mounted switchgear and protection and control equipment classifications. Distribution companies should report all

[3] The classification "Weather and Environment" should include incidents relating to "Birds, Animals and Insects".
[4] If companies provide information at a more disaggregated level it must reconcile with the classifications in the table.

faults for this aggregated category, i.e. 1 trend line. For the purposes of calculating the fault rate for switchgear and protection systems, the number of protection units should be excluded from the denominator.

*Transformers and reactors*

4.12 Distribution companies should report all faults for both transformers and reactors, disaggregated by ground- and pole-mounted equipment, i.e. 2 trend lines.

**Low Voltage**

4.13 For LV overhead mains reporting, faults on surface wiring mains and pole-mounted switchgear/fusegear should be included. . For LV underground mains, faults on ground-mounted switchgear/fusegear should also be included. Fault rates should be reported by cause as follows, i.e. 5 trend lines for each. The denominator should exclude the length of service cables.

| LV Overhead line | LV Underground main |
|---|---|
| Total (all causes) | Total (all causes) |
| Weather and environment[5] | Weather and environment |
| Company causes and faulty manufactures | Company causes and faulty manufactures |
| Unknown or unclassified causes | Unknown or unclassified causes |
| Third party | Third party |

4.14 Total fault rates (all causes) in the table above should sum to all fault rates attributed to the relevant class of equipment and will be equal to the sum of the fault rates for the disaggregated causes.

[5] The classification "Weather and Environment" should include incidents relating to "Birds, Animals and Insects"

**Services – overhead and underground**

4.15 All service equipment should be aggregated, and should include:

- overhead service line and equipment;
- surface wiring service;
- underground service cable and equipment; and
- any other service line, cable and equipment (excluding unmetered services).

4.16 Companies are required to report the total number of faults on all service equipment, which does not need to be disaggregated by cause, i.e. there will be 1 trend line for service faults.

***Instructions and guidance***

4.17 In addition the following points need to be considered:

- the fault cause classifications outlined above are those used in NaFIRS. Where distribution companies do not report to NaFIRS, equivalent classifications will need to be agreed with Ofgem;
- no distinction is made between damage and non-damage faults although companies are free to report separately on damage and non-damage faults; and
- volumes of equipment, length of circuits (excluding services) should be based on a count at 30 September in the relevant reporting year.

**Narrative**

4.18 In addition to the reporting of reliability, distribution companies are also required to provide a supporting narrative. Ofgem would like to publish the narrative in some form. This may help spread best practice through the industry. If distribution companies feel that any section of the narrative should remain confidential it should be clearly marked and an explanation provided as to why this is the case. Particular issues that the narrative should cover, include:

- an explanation of the trends observable from the reliability information – to include actions taken to improve reliability or identify and replace/improve deteriorating assets, together with a prediction of future performance; and

- an explanation of any adverse trends in the reliability of sub-asset groups not covered by the RIGs but collected by the distribution company as part of its asset management strategy.

**Activity based information**

4.19 Companies are required to provide some activity based information such as on the number of different assets types replaced, repaired, refurbished or maintained during the year. This should focus on assets which a distribution company has identified as a poorly performing asset type and where it has put in place a replacement or refurbishment programme. The distribution company should provide the number and proportion of the poorly performing asset replaced, repaired, refurbished or maintained each year and how this compares with the envisaged programme. Any differences to the envisaged programme should be explained.

4.20 As explained above, Ofgem will want to understand the impact of future expenditure (both capital and operating) on medium term performance, including on replacement or refurbishment programmes across a range of assets, and not solely those that are poorly performing.

# 5. Required level of accuracy for reporting

### *Introduction*

5.1 Ofgem is concerned that information used to implement the incentive scheme is sufficiently accurate to enable comparisons to be made over time and if appropriate between companies. Ofgem has specified minimum levels of accuracy for the reporting of:

- the number of interruptions to supply – at both the Low Voltage (LV) level and the overall level; and
- the duration of interruptions to supply – at both the Low Voltage (LV) level and the company level.

5.2 In addition distribution companies are also required to estimate the accuracy with which they report short interruptions to supply.

**Required levels of accuracy – number and duration of interruptions to supply**

5.3 The table below specifies the minimum levels of accuracy required for the reporting of the number and duration of interruptions to supply. Distribution companies are required to meet both the overall and the LV minimum levels of accuracy. Meeting one of the required levels of accuracy is not sufficient to satisfy the requirements set out in the IIP licence condition.

| | Minimum overall level of accuracy (%) | Minimum level of accuracy for LV system interruptions(%) |
|---|---|---|
| Number of interruptions to supply | 95 | 90 |
| Duration of interruptions to supply | 95 | 90 |

**Reporting of accuracy levels for short interruptions to supply**

5.4 Distribution companies are required to indicate the estimated accuracy of the reporting of short interruptions to supply. This should include a statement on the method used to measure short interruptions and how the estimated level of

accuracy has been assessed. Ofgem's appointed auditors will provide an assessment on the reasonableness of the estimate and whether in their view it has been achieved.

# 6. Reporting arrangements

### *Introduction*

6.1 It is important that robust arrangements are put in place for the reporting of information required under the IIP. This section sets out the reporting arrangements that Ofgem expects to apply in each reporting year. Different arrangements apply for the provision of customer details for the purpose of Ofgem undertaking a survey of customers' views of the telephone response they receive when they contact the distribution company.

**Ofgem's role in reporting and the requirements on distribution companies**

6.2 The normal reporting year for the provision of information required under the IIP will be from 1 April to 31 March of the relevant year. Ofgem expects to publish the RIGs at least one month in advance of the relevant reporting year, normally in February. At the same time Ofgem will also provide the distribution companies with standard templates that should be used for the reporting of IIP information. Any changes to the RIGs will have been consulted on for a period of time in accordance with the IIP licence condition. Where these changes do not relate to information included in the incentive scheme or the required level of accuracy the consultation period will not be less than 28 days.

6.3 Distribution companies will normally be required to provide the information required under the IIP at the end of the reporting year and by no later than 30 April. This is the earliest that information can be requested for submission. Ofgem could specify a later date if it considers that it is appropriate. Ofgem recognises that companies will be making changes to measurement systems over the course of the reporting year 2001/02 and as such has decided that the information for this reporting year should be submitted by 31 May 2002. Once the distribution companies have submitted the information to Ofgem, it would expect its appointed auditors to undertake an audit of the information over the course of the summer of the relevant year.

6.4 The table below sets out the key dates for a normal IIP reporting year.

| Date | Output |
|---|---|
| November | Ofgem publishes draft version of RIGs for consultation. |
| February | Ofgem publishes final version of RIGs and templates to apply for the next reporting year. |
| 1 April | Reporting year begins. |
| 31 March | Reporting year ends. |
| 30 April | Distribution companies submit IIP information to Ofgem. |
| Summer | Ofgem undertakes audit of IIP information. |
| Autumn | Ofgem publishes report on distribution companies' performance |

**Arrangements for the provision of customer information**

6.5 In order for Ofgem's appointed agents to undertake a survey of customers' views on the telephone response that they receive when they contact the distribution company, it is necessary for the companies to provide Ofgem (or its appointed agents) with customer information on a regular basis. The information that must be provided is outlined in Section 3 and should be submitted within 4 normal working days of the end of the week in which the customer contacted either of the specified enquiry services. For these purposes the end of the week is defined as the Friday in the week in which the customer contacted the distribution company and normal working days exclude Saturday and Sunday.

6.6 The most appropriate arrangements for submitting this information needs to be agreed with the distribution companies, although Ofgem's preference is for this to be done in electronic form.

# Appendix 1 Purpose of IIP information

1.1 The table below sets out the purpose for which the specified information in the IIP information licence condition will be used and which is described in detail in this document. It does not specify how this information will be used in the incentive scheme..

| Information | Purpose | |
|---|---|---|
| | Incentive scheme | Other |
| a) Number and duration of interrptions | | |
| Number of interruptions to supply of less than three minutes (short interruptions), included disaggregated by "cause" | | Yes |
| Number of interruptions to supply of more than three minutes | Yes | |
| Duration of interruptions to supply of more than three minutes | Yes | |
| Number and duration of interuptions to supply of more than three minutes disaggregated by: | | |
| ♦ source; | Yes | Yes |
| ♦ voltage level; and | | Yes |
| ♦ HV circuit. | | Yes |
| Aggregate number of re-interruptions to suppy | | Yes |
| b) Speed and quality of telephone response | Yes | |
| Customer information, including the telephone number of the caller; the tine of the call; the name of the caller and whether they are a domestic/non-domestic customer | Yes | |
| c) Medium Term Performance | | |
| Aggregate number and cause of faults on specified classes/types of electrical plant/line | | Yes |
| Statement on the asset management strategy of the licensee | | Yes |
| Statement of the reasons for any increase/decrease in the number of faults | | Yes |

# Appendix 2 Formulae for the purposes of reporting

This annex sets out formulaic expressions for:

- the number of interruptions to supply in the relevant year t (excluding re-interruptions); and
- the duration of interruptions to supply in the relevant year t.

**Definitions**

$CI_t$ = the number of interruptions to supply in the relevant year t, **excluding re-interruptions**

$CML_t$ = the duration of interruptions to supply in the relevant year t, **including re-interruptions**

i = an unplanned incident on the distribution system

j = a pre-arranged incident on the distribution system.

k = an incident on a transmission system such as the systems of the National Grid Company or Transmission Companies in Scotlandin Scotland

l = an incident on an distributed generator's system

m = an incident on any other connected system

r = a restoration stage in any incident i,j,k,l,m

t = relevant year (that financial year for the purposes of which any calculation falls to be made)

$TC_t$ = total connected customers in the relevant year t

$TR_{rit}$ = the restoration time of restoration stage r of an unplanned incident i in the relevant year t.

$TR_{rjt}$ = the restoration time of restoration stage r of a pre-arranged incident j in the relevant year t.

$TR_{rkt}$ = the restoration time of restoration stage r of an incident k on NGC's system or a Transmission Company's system in Scotland in the relevant year t.

$TR_{rlt}$ = the restoration time of restoration stage r of an incident l on a distributed generator's system in the relevant year t.

$TR_{rmt}$ = the restoration time of restoration stage r of an incident m on any other connected system in the relevant year t.

$TI_{rit}$ = the interruption time prior to the restoration time of restoration stage r of an unplanned incident i in the relevant year t .

$TI_{rjt}$ = the interruption time prior to the restoration time of restoration stage r of a pre-arranged incident j in the relevant year t.

$TI_{rkt}$ = the interruption time prior to the restoration time of restoration stage r of an incident k on NGC's system or a Transmission Company's system in Scotland in the relevant year t.

$TI_{rlt}$ = the interruption time prior to the restoration time of restoration stage r of an incident l on a distributed generator's system in the relevant year t.

$TI_{rmt}$ = the interruption time prior to the restoration time of restoration stage r of an incident m on any other connected system in the relevant year t.

and:

$ND_{rit}$ = Number of customers interrupted in restoration stage r of an unplanned incident i in the relevant year t, ***excluding*** re-interruptions to supply

$ND_{rjt}$ = Number of customers interrupted in restoration stage r of a pre-arranged incident j in the relevant year t, ***excluding*** re-interruptions to supply

$ND_{rkt}$ = Number of customers interrupted in restoration stage r of an incident k on NGC's system or a Transmission Company's system in Scotland in the relevant year t, ***excluding*** re-interruptions to supply

$ND_{rlt}$ = Number of customers interrupted in restoration stage r of an incident l in on a distributed generator's system in the relevant year t, ***excluding*** re-interruptions to supply

$ND_{rmt}$ = Number of customers interrupted in restoration stage r of an incident m on any other connected system in the relevant year t, ***excluding*** re-interruptions to supply

$NN_{rit}$ = Number of customers interrupted in each restoration stage r of an unplanned incident i in the relevant year t, ***including*** re-interruptions to supply

$NN_{rjt}$ = Number of customers interrupted in restoration stage r of a pre-arranged incident j in the relevant year t, ***including*** re-interruptions to supply

$NN_{rkt}$ = Number of customers interrupted in restoration stage r of an incident k on NGC's system or a Transmission Company's system in Scotland in the relevant year t, ***including*** re-interruptions to supply

$NN_{rlt}$ = Number of customers interrupted in each restoration stage r of an incident l on a distributed generator's system in the relevant year t, ***including*** re-interruptions to supply

$NN_{rmt}$ = Number of customers interrupted in restoration stage r of an incident m on any other connected system in the relevant year t, ***including*** re-interruptions to supply

**Formulae**

$CI_t$ is the number of interruptions to supply per year in the relevant year t and is derived from the following formula: $CI_t = CIA_t + CIB_t + CIC_t + CID_t + CIE_t$

where

$CIA_t$ is the number of interruptions from unplanned incidents on the distribution system in the relevant year t and is derived from the following formula:

$$CIA_t = \frac{\left(\sum_i \sum_r ND_{rit}\right) * 100}{TC_t}$$

$CIB_t$ is the number of interruptions from pre-arranged incidents on the distribution system in the relevant year t and is derived from the following formula:

$$CIB_t = \frac{\left(\sum_j \sum_r ND_{rjt}\right) * 100}{TC_t}$$

$CIC_t$ is the number of interruptions arising from incidents on the systems of the National Grid Company or Transmission Companies in Scotland in the relevant year t and is derived from the following formula:

$$CIC_t = \frac{\left(\sum_k \sum_r ND_{rkt}\right) * 100}{TC_t}$$

$CID_t$ is the number of interruptions arising from incidents on the systems of distributed generators in the relevant year t and is derived from the following formula:

$$CID_t = \frac{\left(\sum_l \sum_r ND_{rlt}\right) * 100}{TC_t}$$

$CIE_t$ is the number of interruptions arising from incidents on any other connected systems in the relevant year t and is derived from the following formula:

$$CIE_t = \frac{\left(\sum_m \sum_r ND_{rmt}\right) * 100}{TC_t}$$

Each of the terms, $CIA_t$, $CIB_t$, $CIC_t$, $CID_t$ and $CIE_t$ should be separately identified.

$CML_t$ is the duration of interruptions to supply in the relevant year t and is derived from the following formula:

$$CML_t = CMLA_t + CMLB_t + CMLC_t + CMLD_t + CMLE_t$$

$CMLA_t$ is the duration of interruptions from unplanned incidents on the distribution system in the relevant year t and is derived from the following formula:

$$CMLA_t = \frac{\sum_i \sum_r \left(NN_{rit} * \left(TR_{rit} - TI_{rit}\right)\right)}{TC_t}$$

$CMLB_t$ is the duration of interruptions from pre-arranged incidents on the distribution system in the relevant year t and is derived from the following formula:

$$CMLB_t = \frac{\sum_j \sum_r \left(NN_{rjt} * \left(TR_{rjt} - TI_{rjt}\right)\right)}{TC_t}$$

$CMLC_t$ is the duration of interruptions arising from incidents on the systems of the National Grid Company or Transmission Companies in Scotland in the relevant year t and is derived from the following formula:

$$CMLC_t = \frac{\sum_k \sum_r \left(NN_{rkt} * \left(TR_{rkt} - TI_{rkt}\right)\right)}{TC_t}$$

$CMLD_t$ is the duration of interruptions arising from incidents on the systems of distributed generators in the relevant year t and is derived from the following formula:

$$CMLD_t = \frac{\sum_l \sum_r \left(NN_{rlt} * \left(TR_{rlt} - TI_{rlt}\right)\right)}{TC_t}$$

$CMLE_t$ is the duration of interruptions arising from incidents on any other connected systems in the relevant year t and is derived from the following formula:

$$CMLE_t = \frac{\sum_m \sum_r \left(NN_{rmt} * \left(TR_{rmt} - TI_{rmt}\right)\right)}{TC_t}$$

Each of the terms, $CMLA_t$, $CMLB_t$, $CMLC_t$, $CMLD_t$ and $CMLE_t$ should be separately identified.

# Appendix 3 Other formulae

This annex sets out formulaic expressions for:

- the number of short interruptions to supply in the relevant year t (excluding re-interruptions); and
- the number of re-interruptions to supply in the relevant year t.

**Definitions**

$RI_t$ = the number of interruptions to supply in the relevant year t, **including re-interruptions**

n = a short interruption due to the automatic operation of distribution network switchgear where some or all of the customer involved are successfully restored by automatic switching within three minutes of the first interruption

o = a short interruption due to the automatic operation of distribution network switchgear where some or all of the customers involved are successfully restored by manual or remote control switching within three minutes of the first interruption

p = a short interruption due to the manual or remote operation of distribution network switchgear for reasons such as deliberate disconnection for operational or emergency reasons

q = a short interruption due to the operation of switchgear on the networks of NGC/Transmission Companies (in Scotland) or other connected systems and distributed generators.

$SI_t$ = the number of short interruptions to supply in the relevant year t.

$NS_{nt}$ = Number of customers interrupted by a short interruption in category n in the relevant year t.

$NS_{ot}$ = Number of customers interrupted by a short interruption in category o in the relevant year t.

$NS_{pt}$ = Number of customers interrupted by a short interruption in category p in the relevant year t.

$NS_{qt}$ = Number of customers interrupted by a short interruption in category q in the relevant year t.

**Formulae**

$SI_t$ is the number of short interruptions to supply per year in the relevant year t and is derived from the following formula:

$$SI_t = SIA_t + SIB_t + SIC_t + SID_t$$

where:

$SIA_t$ is the number of short interruptions in the relevant year t due to the automatic operation of distribution network switchgear where some or all of the customer involved are successfully restored by automatic switching within three minutes of the first interruption and is derived from the following formula:

$$SIA_t = \frac{\left(\sum_n NS_{nt}\right) * 100}{TC_t}$$

$SIB_t$ is the number of short interruptions in the relevant year t due to the automatic operation of distribution network switchgear where some or all of the customers involved are successfully restored by manual or remote control switching within three minutes of the first interruption and is derived from the following formula:

$$SIB_t = \frac{\left(\sum_o NS_{ot}\right) * 100}{TC_t}$$

$SIC_t$ is the number of short interruptions in the relevant year t due to the manual or remote operation of distribution network switchgear for reasons such as deliberate disconnection for operational or emergency reasons and is derived from the following formula:

$$SIC_t = \frac{\left(\sum_p NS_{pt}\right) * 100}{TC_t}$$

$SID_t$ is the number of short interruptions in the relevant year t due to the operation of switchgear on the networks of NGC/Transmission Companies (in Scotland) or other connected systems and distributed generator and is derived from the following formula:

$$SID_t = \frac{\left(\sum_q NS_{qt}\right) * 100}{TC_t}$$

Each of the terms, $SIA_t$, $SIB_t$, $SIC_t$ and $SID_t$ should be separately identified.

$RI_t$ is the number of re-interruptions to supply in the relevant year t and is derived from the following formula:

$$RI_t = RIA_t + RIB_t + RIC_t + RID_t + RIE_t$$

where:

$RIA_t$ is the number of re-interruptions in the relevant year t from unplanned incidents on the distribution system and is derived from the following formula:

$$RIA_t = \frac{\left(\sum_i \sum_r (NN_{rit} - ND_{rit})\right) * 100}{TC_t}$$

$RIB_t$ is the number of re-interruptions in the relevant year t from pre-arranged incidents on the distribution system and is derived from the following formula:

$$RIB_t = \frac{\left(\sum_j \sum_r (NN_{rjt} - ND_{rjt})\right) * 100}{TC_t}$$

$RIC_t$ is the number of re-interruptions in the relevant year t arising from incidents on the systems of the National Grid Company or Transmission Companies in Scotland and is derived from the following formula:

$$RIC_t = \frac{\left(\sum_k \sum_r (NN_{rkt} - ND_{rkt})\right) * 100}{TC_t}$$

$RID_t$ is the number of re-interruptions in the relevant year t arising from incidents on the systems of distributed generators and is derived from the following formula:

$$RID_t = \frac{\left(\sum_l \sum_r (NN_{rlt} - ND_{rlt})\right) * 100}{TC_t}$$

$RIE_t$ is the number of re-interruptions in the relevant year t arising from incidents on any other connected systems and is derived from the following formula:

$$RIE_t = \frac{\left(\sum_m \sum_r (NN_{rmt} - ND_{rmt})\right) * 100}{TC_t}$$