

Quality of Service Incentive Scheme – Exceptional Events

Appointed Examiner's Report	
Reporting year	2010/11
DNO	EPN
Cause	Fault in 33kV cable of 132/33kV Grid Transformer
Date of event	07 June 2010

Submitted to:

Ofgem

Submitted by:

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Glossary

AE	Appointed Examiner
BPI	British Power International
CB	Circuit-breaker
CI	Customer Interruptions per 100 connected customers
CML	Customer Minutes Lost per connected customer
DNO	Distribution Network Operator
EHV	Extra High Voltage – all voltages above 20kV up to but excluding 132kV
EPN	Eastern Power Networks
HV	High Voltage – all voltages above 1kV up to and including 20kV
QoS	Quality of Service
UKPN	UK Power Networks
RIGs	Regulatory Instructions & Guidance
SCADA	System Control and Data Acquisition
SLD	Single Line Diagram
SoF	Statement of Facts
ToR	Terms of Reference

Notes:

Within this document:

1. The term “higher voltage” is used to indicate all voltages greater than 1kV.
2. The calculations of CI and CML within this document are adapted from the annual calculations contained in the RIGs to reflect the CI and CML generated by the actual incidents being audited. They are as follows:

CI: the number of interruptions to supply – the number of customers interrupted per 100 connected customers generated by the incidents being audited. It is calculated as:

$$CI = \frac{\text{The sum of the number of customers interrupted for incidents being audited} * 100}{\text{The total number of connected customers}}$$

CML: the duration of interruptions to supply – the number of customers interrupted per connected customer generated by the incidents being audited. It is calculated as:

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

In both the formulae above, the total number of connected customers is as declared as at 30 September during the relevant reporting year. Any claims that occur and are audited prior to 30 September in the reporting year during which they occur will be audited using the total number of customers declared at 30 September in the previous reporting year.

Summary

Ofgem has appointed British Power International Limited (the Appointed Examiner) to audit the submission made by UK Power Networks (UKPN) under the “one-off” exceptional event mechanism that the loss of supply to its Great Yarmouth Grid Substation at 12:04 on Monday, 07 June 2010 adversely affected the reported performance for its Eastern Power Networks plc (herein known as EPN) distribution licensed area for the reporting year 2010/11.

The Appointed Examiner (AE) has visited EPN to audit the claim against part 1 of the “one-off” exceptional event process and finds that it passes the exceptionality threshold in terms of both CI and CML.

The AE concludes that the event falls within the category of an “other event” as defined in paragraph 8.57 of Special Licence Condition CRC 8, including meeting the exceptionality requirements set out in Appendix 3 thereof.

The AE therefore proceeded to part 2 of the “one-off” exceptional event process, assessing EPN’s performance in mitigating the impact of the event upon its customers.

The AE concludes that EPN had no reason to believe that there was any latent defect in the 33kV cables of its n° 1 132/33kV Grid Transformer (GT1) at Great Yarmouth Grid Substation.

The AE also concludes that EPN’s procedures were invoked prior to the outage on the n° 2 132/33kV Grid Transformer (GT2) at its Gorleston Grid Substation.

The AE concludes that EPN restored its customers’ supplies as expeditiously as possible.

The AE concludes that EPN had met the criteria of Appendix 4 to paragraph 8.58 of Special Licence Condition CRC 8 and that therefore the incident is deemed to be eligible for adjustment in the DNO’s reported performance.

The AE therefore recommends that an adjustment to EPN 2010/11 reported distribution system performance is made, in line with the part 1 audited CI figures as shown in the following table:

	Audited number	Number above the threshold	Recommended adjustment
CI	1.41	0.71	0.71
CML	1.00	0.4	0.4

1. Audit part 1

Summary of main facts

- 1.1 The AE's headline information log for this event is set out in Table A-1 at Appendix A. In addition, the following paragraphs summarise the main facts of the event.
- 1.2 EPN's Great Yarmouth and Gorleston Grid Substations each have one 132/33kV Grid Transformer (GT1 and GT2 respectively) and run with 33kV interconnection.
- 1.3 At the time of the incident, GT2 at Gorleston Grid was out of service for a routine maintenance outage and all local 33kV supplies were being fed from GT1 at Great Yarmouth Grid Substation.
- 1.4 EPN has furnished evidence to support its claim that a fault in the 33kV cable 'tail' of GT1 at Great Yarmouth Grid Substation resulted in the loss of supplies to six of its Primary Substations.
- 1.5 EPN's protection operated to clear the incident from its distribution network.
- 1.6 As a result of the incident, 49,475 of EPN's customers suffered a supply interruption.
- 1.7 Supplies were initially restored via switching on EPN's 33kV and 11kV networks.
- 1.8 Due to loading restrictions, the maintenance outage on GT2 was terminated and it was returned to service before all supplies could be restored.
- 1.9 A simplified view of the section of EPN's 132/33kV network affected by this event is shown in Figure 1.

Diagram Redacted

Figure 1 – Simplified Network Diagram of EPN's 132/33kV distribution network affected by the incident

Notes:

1. GT2 at Gorleston Grid was out of service for a maintenance outage at the time of the incident.
2. Initial supplies were restored by EPN's control engineer using tele-controlled switching.
3. Final restoration was after the maintenance on GT2 was halted and it was returned to service.

Exceptionality requirements

Does the event qualify for exclusion?

- 1.10 The AE considers that the event falls within the category of an "other event" as defined in paragraph 8.57 of Special Licence Condition CRC 8, and meets the exceptionality requirements set out in Appendix 3 thereof.
- 1.11 The AE therefore considers that, subject to satisfying the requirements of Appendix 4 to CRC 8, the event qualifies for possible exclusion under the "one-off" exceptional events process.

Exceptionality test results

1.12 The number of incidents attributed to the event is shown in Table 1-1.

Table 1-1: Number of incidents attributed to the event

Number of incidents attributed to the event	Claimed number	Audited number
132kV	0	0
EHV	1	1
HV	0	0
LV	0	0
Total	1	1

1.13 The results calculated by the AE to test this claim against Ofgem's exceptionality criteria are shown in Appendix A. A summary of the results is shown in Table 1-2.

Table 1-2: Summary of exceptionality test results

Test	Threshold	Claimed number	Audited number	Pass / Fail	Amount above threshold
CI exceptionality	0.7	1.41	1.41	Pass	0.71
CML exceptionality	0.6	1.00	1.00	Pass	0.4

Notes:

1. Ofgem's CI and CML exceptionality criteria are set out in the AE's ToR¹.
2. The audited CI and CML used in the exceptionality test have been determined from the number of incidents attributed to the event.
3. Where the event passes either or both the exceptionality thresholds, the amount(s) above threshold is/are carried forward into the Audit part 2 assessment of DNO performance.
4. In accordance with guidance from Ofgem, the AE's calculations use the threshold values contained in the current Distribution Price Control and the number of customers connected to the DNO's network relevant to the date on which the incident occurred.

¹ Audits of Electricity Distribution Network Operators' One-off Exceptional Events Claims for 2010/11

EPN's views of its performance

- 1.14 Both Great Yarmouth and Gorleston Grid Substations have one 132/33kV Grid Transformer each. There is 33kV interconnection between the 33kV busbars at the two Grid Substations. This arrangement, which is P2/6 compliant, has operated satisfactorily for many years.
- 1.15 EPN has comprehensive procedures concerning outage planning and pre-outage checks that must be invoked during the process of requesting and carrying-out an outage at or above Extra High Voltage (EHV).
- 1.16 Prior to the outage of GT2 at Gorleston Grid Substation, EPN is satisfied that its outage procedures were fully applied and that its personnel had no reason to suspect the reliability of GT1 at Great Yarmouth Grid Substation.
- 1.17 At the time of the incident, the GT2 at Gorleston Grid Substation was out of service for routine maintenance, the 33kV system being fed via GT1 at Great Yarmouth Grid Substation.
- 1.18 At 12:04 on Monday, 07 June 2010, supplies were lost when the circuit-breakers controlling GT1 at Great Yarmouth Grid Substation tripped.
- 1.19 EPN's control engineer used tele-controlled switching to restore initial supplies via 33kV interconnection to Lowestoft Grid.
- 1.20 Other supplies were restored via EPN's 11kV network.
- 1.21 GT2 at Gorleston Grid Substation was returned to service in order to restore all supplies.
- 1.22 EPN considers that its duty control engineer reacted well in assessing the alarms generated by the event, trying back the faulted circuit and beginning to restore supplies via tele-controlled switching in four minutes.
- 1.23 EPN also considers that its maintenance personnel reacted well, returning to service GT2 at Gorleston Grid Substation.

EPN's answers to questions on its performance

- 1.24 Within the last three years, the AE has reviewed EPN's design standards, construction methods and maintenance procedures during previous visits to audit exceptional event claims and found them fit for purpose.
- 1.25 The AE confirms that EPN's emergency procedures provide for the type of event being examined here.
- 1.26 To aid understanding of the background to EPN's SoF, the AE prepared a list of initial questions regarding this incident. These questions were used as the basis for the examination of EPN's claim.

- 1.27 The initial questions were discussed during the AE's visits to UKPN's Bury St Edmunds offices on 30 June and 12 July 2011, when the records of EPN's SCADA system, the incident report and other information were made available.
- 1.28 EPN has provided answers to the AE's initial list of questions. For ease of reference, the AE's questions are printed in bold font with EPN's answers being printed in normal font.
- Q1. What changes, if any, has UK Power Networks made to its emergency plans and procedures since BPI last visited the erstwhile EdF Energy to audit the exceptional event claim concerning the incident that occurred at Dartford Creek on 20 July 2009?**
- A1. UKPN has reviewed the learning points from the above event with regard to its company-wide policies and procedures. Actions taken include the following:
- Changes have been made to the regime for the inspection of UKPN's various network components;
- UKPN's procedure for outages at EHV and above has been updated; and
- UKPN's procedures for pre- and post- outage checks for Grid and Primary Substations have been updated.
- Q2. What is EPN's policy for assessing the risk associated with a 132 kV outage? How widespread have these been promulgated throughout EPN?**
- A2. UKPN has comprehensive, company-wide, procedures that will be made available to the visiting auditor:
- COP 01 – 005 *System outage planning (EHV and above)*; and
- NOP 50 – 001 *Pre- and post- outage checks at EHV and above*.
- Q3. What explanatory evidence can EPN provide to demonstrate that sufficient pre-event mitigation and preventative actions were taken prior to this incident occurring?**
- A3. The procedures outlined at A2 above were followed as confirmed in the associated switching log.
- Q4. How does EPN's policy incorporate the requirements of Appendix 4 to paragraph 8.58 of its Special Licence Condition CRC8; in particular, the requirements on EPN to take 'all appropriate steps within its power ... to limit the number of Customers interrupted by the event...and restore customers' supplies quickly and efficiently'?**
- A4. The procedures outlined in A2 above demonstrate that UKPN takes appropriate steps both pre- and post- outage to ensure that an outage has limited impact on its customers.
- Q5. What evidence can EPN provide to demonstrate that its policy was applied to the outage of GT2 at Gorleston Grid?**
- A5. The procedures outlined at A2 above were followed as confirmed in the associated switching log.
- Q6. When did the outage begin on GT2 at Gorleston Grid?**
- A6. The outage on GT2 commenced on 07 June 2011, the day of this incident.

Q7. What was the duration of the planned outage of GT2 at Gorleston Grid?

A7. The outage began on 07 June 2010 and GT2 was due back in service on 15 June 2010 (9 days).

Q8. When was the faulted 33 kV Grid Transformer tail at Great Yarmouth Grid installed?

A8. EPN's records show that the 33kV single-core transformer tails were commissioned on 25 January 1989, the date on which GT2 was put into service. On 12 November 2003 a new 33kV switchboard was commissioned at Great Yarmouth Grid, which required alterations to part of the original cabling.

Q9. EPN's SoF makes reference to the faulted cable being 'just outside a transition straight joint on the transformer tails within the substation compound' - when was this joint installed and for what purpose?

A9. The transition joint was installed at the time the alterations were made in relation to the new switchboard as mentioned in A8 above.

Q10. What is EPN's policy for inspecting the condition of 33 kV Grid Transformer 'tails'?

A10. UKPN has a company-wide procedure for the visual inspection of all above-ground equipment, including transformer tails. A minor inspection is carried out every 3 months and a major inspection is carried out annually.

Q11. When were the 33 kV Grid Transformer tails last inspected at Great Yarmouth Grid?

A11. EPN's records show the following:

29 January 2010 - major inspection, including heat-seeking, diagnostic tests; and
30 April 2010 – minor inspection.

Q12. What was the content of the above report?

A12. EPN's records show that no defects were identified. A copy of EPN's inspection database will be made available during the audit visit.

Q13. What learning points have EPN incorporated into its procedures as a result of this incident?

A13. EPN's post incident investigation has identified the need to minimise the use of joints on Grid and Primary Transformer tails.

EPN considers that the need to carry out routine maintenance is an essential function of maintaining the reliability of its distribution system. This is why there is 'redundancy' built into the system as typified by the network at Great Yarmouth Grid.

However, during maintenance outages, this does lead to the network being at an increased risk and customers losing supply if an incident occurs on the alternative feeder, as recognised in UKPN's procedures as outlined in A2 above.

An immediate learning point from this incident is the procedure that EPN has since instigated whereby a feeder is off-loaded but left energised for one day before it is de-energised for a planned outage. *[AE's note: For 'business as usual' outages where feeders providing the alternative supplies have shown no sign of trouble, it is normal practice for a DNO to switch out a feeder and to begin work on it that day. In applying the above learning point, EPN is allowing time for any latent and unknown*

problem with the alternative supply arrangements to manifest itself whilst the off-loaded, but still energised, feeder is available for immediate restoration].

Q14. What further learning points should be considered as a result of the application of the revised Exceptional Event Claims process?

A14. EPN considers that the existing process continues to work well, where Ofgem engages an experienced AE to examine an EE claim for a 'one-off' event.

1.29 EPN also provided further information both during and subsequent to the audit visits. This includes:

- a discussion regarding the running arrangements of the 132kV and 33kV networks;
- a copy of the relevant 33kV SLD;
- a discussion on how the customers' supplies were restored;
- sight of the latest version of UKPN's procedure for system outage planning at EHV and above;
- sight of UKPN's latest version of its procedure for pre- and post-fault checks for outages at EHV and above;
- sight of EPN's database showing that no defects had been identified during site inspections;
- a copy of the report of EPN's post-incident investigation;
- a copy of EPN's incident report from which it calculated the CI and CML attributed to the event;
- a representation of the incident on EPN's SCADA system;
- a copy of EPN's SCADA alarms received during this incident; and
- sight of the switching log from EPN's SCADA system showing the confirmation that the pre-outage procedures had been completed.

2. Audit part 2

EPN's performance in preventing the event

- 2.1 In viewing EPN's performance in preventing this event, the AE has considered what more EPN could have reasonably done to ensure that GT1 at Great Yarmouth Grid Substation and associated cables were free from any defect prior to the outage on GT2 at Gorleston Grid Substation.
- 2.2 The AE has discussed the fault history of GT1 and is satisfied that EPN's database shows no previous incidents of this kind.
- 2.3 EPN's measurement systems clearly show the tripping of circuit-breakers controlling GT1 at Great Yarmouth Grid Substation at 12:04 on 07 June 2010.
- 2.4 EPN's measurement systems confirm the initial restoration of supplies at 12:08 and subsequent restoration stages, the final one of which was at 14:34; all as reported in EPN's SoF.
- 2.5 An examination of EPN's documentation shows that its outage planning / risk assessment policy is comprehensive and that it was rigorously applied during the planning of the outage of GT1 at Gorleston Grid Substation.
- 2.6 The AE therefore concludes that EPN had done all it could reasonably have been expected to do in considering that GT1 at Great Yarmouth Grid Substation could not be relied upon during the necessary outage of GT2 at Gorleston Grid Substation.

EPN's performance in mitigating the effects of the event

- 2.7 EPN's incident report shows the cause of the incident to be a fault on the 33kV cables of GT1 at Great Yarmouth Grid Substation "due to ageing or wear".
- 2.8 The AE has discussed the running arrangements and protection schemes associated with the affected section of EPN's 132kV and 33kV distribution networks with EPN's engineering personnel.
- 2.9 The examination of the protection arrangements applied to the Great Yarmouth and Gorleston 132kV and 33kV networks shows that EPN's protection schemes operated correctly to clear the fault from its network.
- 2.10 The AE concludes that EPN did all it could to restore supplies as expeditiously as possible, thereby minimising the duration of the interruption.
- 2.11 The AE is pleased to note that EPN has reviewed this incident and concluded that its procedures were properly applied for a routine maintenance outage, the likes of which are 'business as usual' for all UK DNOs.
- 2.12 The AE is also pleased to note that EPN's post-incident review resulted in:
 - the other buried sections of the Grid Transformer tails at Great Yarmouth grid Substation being inspected with no suspect problems being found;
 - modifications to EPN's design standards regarding minimising joints in Grid and Primary Transformer tails; and
 - the process of off-loading a feeder but not de-energising it for a day to allow for any unknown problem with the alternative source to occur.

Recommended performance adjustment(s)

2.13 The AE's recommendations to Ofgem are shown in Table 2-1.

Table 2-1: Audit part 2 recommended adjustment(s)

	Amount above threshold	Audit part 2 recommendation
CI	0.71	0.71
CML	0.4	0.4

Detailed justification

- 2.14 In reaching a judgement on a recommendation, the AE has firstly considered whether or not EPN could have reasonably taken any different course of action that would have prevented the incident on GT1 at its Great Yarmouth Grid Substation.
- 2.15 In viewing EPN's performance in preventing this event, the AE has taken into account the lack of any previous incidents on the affected feeder and the rigorous application of EPN's comprehensive procedures for outage planning and pre-outage checks associated with the work on GT2 at Gorleston Grid Substation.
- 2.16 The AE has also discussed this incident with his colleagues who have considerable operational experience of incidents with many differing causes; they agree with the visiting auditor's conclusions and recommendations.
- 2.17 In considering EPN's restoration strategy, the AE is conscious that EPN's duty control engineer acted with commendable skill and speed in analysing the SCADA alarms and indications for this incident, trying the faulted feeder back, beginning to restore supplies in four minutes and calling upon and directing field personnel to assist in the restorations completed at 11kV.
- 2.18 Similarly, EPN's maintenance personnel are to be commended for returning GT2 to service as speedily as they did.
- 2.19 The AE is satisfied that the affected sections of EPN's distribution network comply with the requirements of Security of Supply Standard P2/6.
- 2.20 The AE has discussed EPN's review of this incident and accepts that, with a P2/6 compliant network, where a DNO has no reason to suspect the reliability of its normal running arrangements, outages for 'business as usual' maintenance work would proceed without network reconfiguration.
- 2.21 The AE is satisfied that EPN has met the criteria for preventative and mitigating actions set out in Appendix 4 to paragraph 8.58 of Special Licence Condition CRC 8.
- 2.22 The AE therefore concludes that EPN's claim is justified and recommends to Ofgem that the amount of CI above the threshold value should be excluded from its performance for regulatory reporting year 2010/11.

Appendix A Record of Audit part 1

Table A-1: AE's Information Log

“One-Off” Exceptional Event	Reporting Year 2010/11
Licensed Area	EPN
Date of event	07 June 2010
Cause	Fault in 33kV T/F tail resulting in loss of 132kV supplies
Notification to Ofgem	07 June 2010
SoF received	21 April 2011
SoF information	<ul style="list-style-type: none"> • Great Yarmouth and Gorleston Grid each have one Grid T/F (GT1 and GT2 respectively) and run with 33kV interconnection. • GT2 was out of service for routine maintenance (the outage began on the morning of the incident). • at 12:04 on Monday 07 June 2010, GT1 tripped losing all supplies from both Great Yarmouth and Gorleston Grid Substations. • supplies to six Primary Substations were affected. • initial restoration was via the 33kV and 11kV networks. • GT1 was tried back – it tripped. • GT2 was returned to service before all supplies could be restored. • the fault was found to be on a 33kV T/F single-core of GT1.
Additional pre-visit information provided	Based on the SoF the AE drew up a list of initial questions. These were discussed during the audit visit. This initial list of questions, together with EPN's response, is contained in paragraph 1.28 of the report.
Location of audit visits	1 and 2. UKPN's Bury St Edmunds Offices; and 3. UKPN's Ipswich Control Centre
Dates of audit visits	1 and 2. 30 June and 12 July 2011 3. 25 July 2011
Visiting Auditor	Geoff Stott (BPI)
EPN's Representatives	1 and 2. Bill D'Albertanson 3. David Child and Steve Saunders
Information provided during and subsequent to the audit visits	<p>Comprehensive documentation / information including:</p> <ul style="list-style-type: none"> • a discussion of the running arrangements for the Great Yarmouth and Gorleston 132kV and 33kV systems; • a copy of the relevant 33kV SLD; • a discussion of the restoration strategy for the incident; • sight of UKPN's outage planning procedures for the EHV and 132kV voltage levels; • sight of UKPN's procedure for pre- and post- outage checks for the EHV and 132kV voltage levels; • sight of EPN's inspection database – no defects identified; • a copy of EPN's post-incident investigation; • a copy of EPN's SCADA switching log that shows the alarms generated by the event;

	<ul style="list-style-type: none"> • the normal network running arrangements were demonstrated; • a copy of EPN's incident report that shows: <ul style="list-style-type: none"> ○ the number of customers affected by the incident to be 49,475; and ○ the customer minutes lost to be 3,532,580. • the AE confirms that these figures agree with those quoted in EPN's SoF; • using EPNs total connected customers at 30 September 2010 of 3,516,859 the number of customers affected equates to a CI of 1.41 [49475*100/3516859]; and • similarly, the customer minutes lost for this event equate to a CML of 1.00 [3532580/3516859]. <p>No need to visit Great Yarmouth Grid Substation. Confirmed P2/6 compliant (90 MVA firm). The list of initial questions was discussed. EPN provided answers to the initial questions plus additional information both during and subsequent to the audit visits. Ok re compliance with Appendix 4 of Paragraph 8.58 of CRC 8.</p>
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Table A-2: Impact on CI and CML

	CI		CML	
	Claimed	Audited	Claimed	Audited
132kV	0	0	0	0
EHV	1.41	1.41	1.00	1.00
HV	0	0	0	0
LV	0	0	0	0
Total	1.41	1.41	1.00	1.00
EPN Threshold (total)	0.7		0.6	
Part 1 Exceptionality Test	Pass		Pass	
Part 1 Precondition of eligibility (meets App 3 to paragraph 8.57 of CRC 8)	Pass			

EPN's measurement systems are subject to QoS audits for accuracy of reporting and it is not within the AE's ToR to repeat that work as part of the examination of exceptional event claims, although any consequential adjustments to reporting accuracy will be reflected in Ofgem's final adjudication of reported performance for regulatory reporting year 2010/11.