
Annual Reliability & Power Quality Report

Financial Year Ending June 2008



Published – 30 September 2008

DOCUMENT RELEASE INFORMATION

Document prepared by:

Western Power
ABN 18540492861

363 Wellington Street
Perth WA 6000

Prepared by:



Manager Network Performance

Customer Services Division

Approved by:



General Manager

Customer Services Division

© Copyright of Western Power

Any use of this material except in accordance with a written agreement with Western Power is prohibited.

Table of Contents

1	INTRODUCTION	4
2	OVERVIEW	4
3	DEFINITIONS	4
4	RESPONSE TO ITEM 4 OF SCHEDULE 1	5
	4.1 Overview	5
	4.2 Harmonics Compliance	5
	4.3 Voltage Variation Compliance	7
	4.4 Voltage Unbalance Compliance	10
5	RESPONSE TO ITEM 5 OF SCHEDULE 1	13
	5.1 Terminology applicable to this Section	13
	5.2 Response	13
6	RESPONSE TO ITEMS 11, 12 AND 13 OF SCHEDULE 1	14
	6.1 Terminology applicable to these Sections	14
	6.2 Response - Perth CBD	14
	6.3 Response - urban areas other than Perth CBD	15
	6.4 Response – isolated networks	15
	6.5 Response – rural areas	16
7	RESPONSE TO ITEMS 6, 7 AND 8 OF SCHEDULE 1	17
	7.1 Terminology applicable in this Section	17
	7.2 Response	17
8	RESPONSE TO ITEM 9 OF SCHEDULE 1	17
9	RESPONSE TO ITEMS 14 AND 15 OF SCHEDULE 1	18
	9.1 Terminology applicable to these Sections	18
	9.2 Average length of interruption	18
	9.3 Number of interruptions	19
	9.4 Total length of all interruptions	20

1 Introduction

This report presents information required as part of Schedule 1 of the *Electricity Industry (Network Quality and Reliability of Supply) Code 2005* (“the Code”) – for the financial year ending 30 June 2008.

Western Power’s commitment is to work with the Office of Energy and the Economic Regulation Authority to ensure that the data presented in the Annual Reliability and Power Quality Report is clear and understandable and interprets the code requirements correctly.

2 Overview

Outages due to storms and bushfires are typically outside the control of an energy utility and there were a number of such events that occurred during this reporting period that had a negative impact on reliability.

In 2007/08, customers experienced two Major Event Days (see Section 6 for further detail). In addition, there was unseasonal storm activity affecting customers in the Metropolitan areas and Southern Coastal region for extended periods. There was significant bushfire that spread through the Southern Cross/Goldfields region (including the Boorabin National Park) in late December, with some premises in Southern Cross without power for up to 6 days. These events are included in the percentile charts – Figures 12 and 14 of Section 9.

There were a number of activities during the year that were focused on improving reliability to customers:

- Continuation of the program to install automated switchgear and significant as network reconfigurations primarily due to the commissioning of four new zone substations. This work has reduced the number of customers affected per interruption;
- Reinforcing the first few kilometres of powerlines from substations in targeted areas; and
- Directing maintenance work to the poorest performing feeders in the network.

3 Definitions

All terminology used in this report is in accordance with definitions presented in Item 1 to Item 3 of Schedule 1 of the Code.

For the purposes of this report, “all other areas of the State” as defined in Items 2 and 3 of Schedule 1 are referred to as “Rural” areas of the South West Interconnected System (SWIS) and will be referred to as such in Sections 6, 7 and 9 of the Report.

4 Response to Item 4 of Schedule 1

4.1 Overview

As part of Western Power's obligation to observe standards stipulated in the Electricity Industry Code 2005 and source information to improve power quality (PQ), permanent power quality meters have been deployed in different parts of the low voltage (LV) distribution network to sample monitor the quality of customers' supply.

As the permanent PQ meters (known as Electronic Design and Manufacturing International or "EDMI" meters) are still in the pilot stage, only 28 of the devices have been deployed in the 2007/08 financial year. A further 30 devices are expected to be deployed during the 2008/09 financial year, with plans to increase this number in subsequent years. As a result of the small sample size of the deployment of PQ meters, data from PQ measurements in response to customer complaints was used in conjunction with EDMI measurements in responding to Item 4.

4.2 Harmonics Compliance

Harmonic voltage distortion levels in the distribution network are to be contained within the compatibility levels given in Part 2 Section 7 of the Code, within reasonable endeavours.

Guidelines have been defined to prevent high levels of voltage disturbances from entering the system. Residential customers are not the main contributors to harmonic voltage distortion, so harmonic limits are generally negotiated with commercial and industrial customers. Rigorous procedures are in place for the management of contracted harmonic limits for customers with potential distorting power loads.

Harmonic limits are assigned in accordance with Western Power's Technical Rules for distribution planning. The total harmonic voltage distortion (THD) limit is 6.5% for each customer, to help ensure that the compatibility level of 8% THD specified in the Code is not exceeded.

Based on Figures 1 and 2 which illustrate THD representation of the EDMI meter sites, Western Power is achieving 100% compliance with the technical rules and regulatory requirements based on the Electricity Industry Code 2005. The median THD is ~2.5% at the customer sites and ~ 2.0% at the transformer sites.

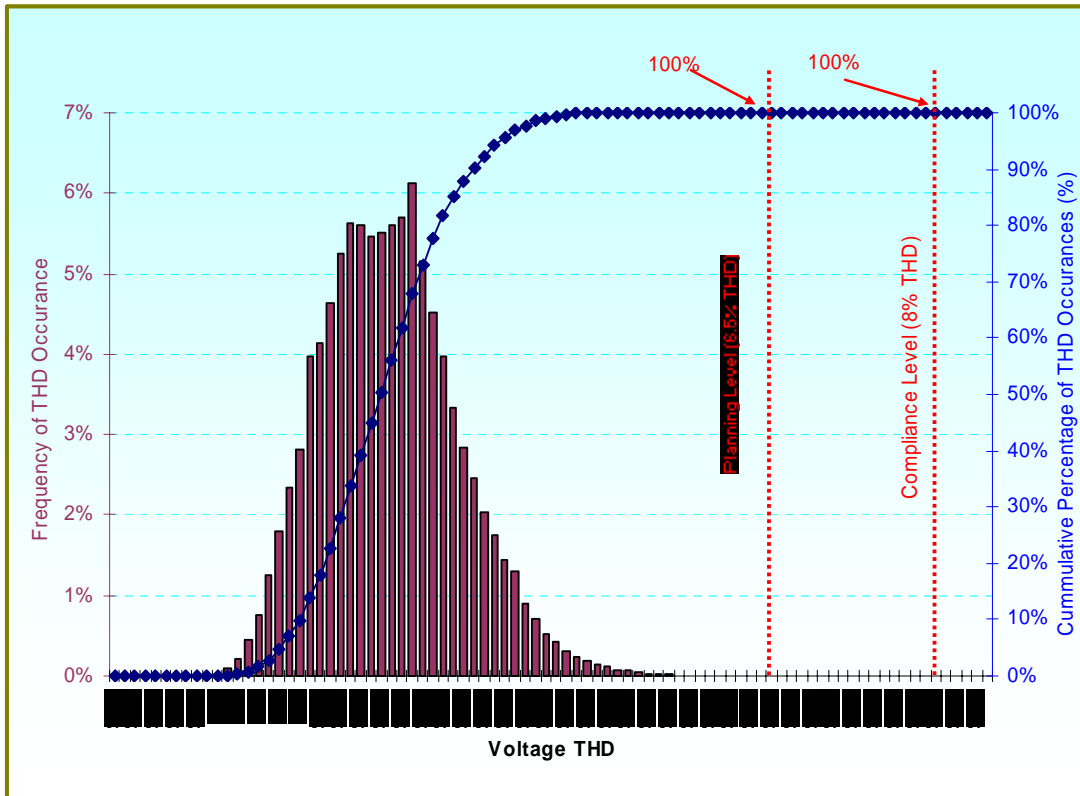


Figure 1 – THD % for EDM customer sites in the 2007/08 financial year (sample size = 13)

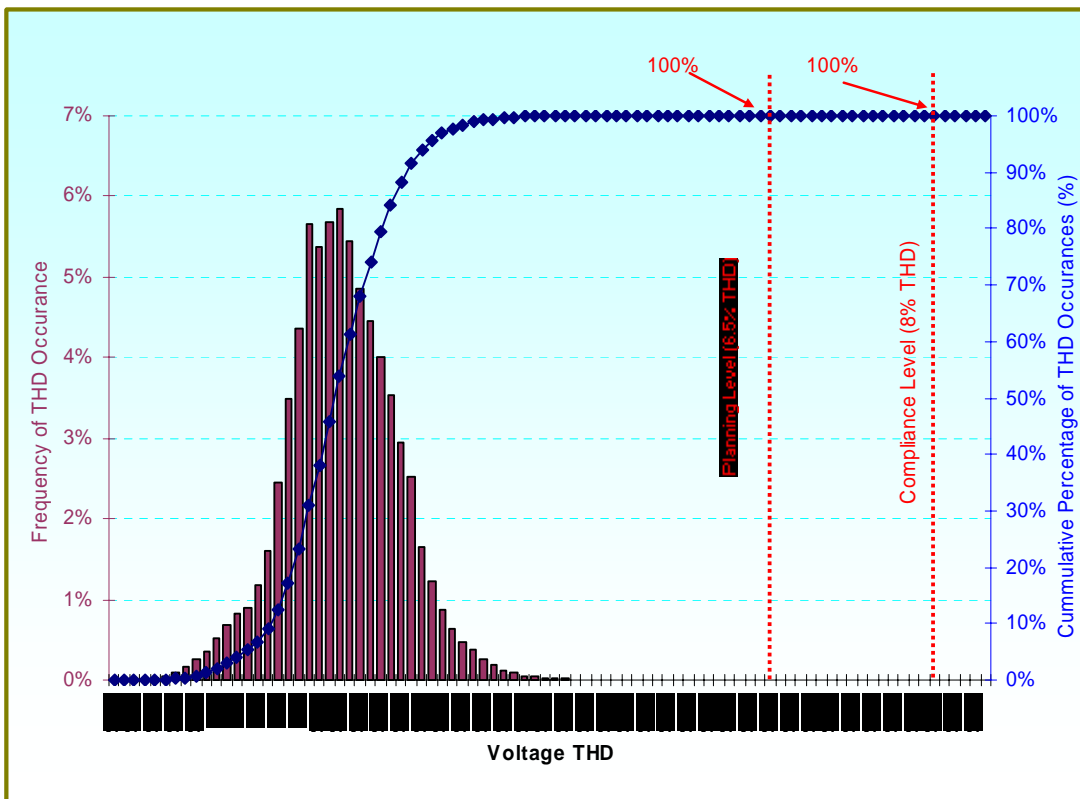


Figure 2 - THD % for EDM transformer sites in the 2007/08 financial year (sample size = 15)

4.3 Voltage Variation Compliance

Voltages must be maintained within $\pm 6\%$ of the supply voltage according to the Electricity Act 1945 Section 25(1)(d). According to the Technical Rules, the steady state voltage must be within the following limits:

- $\pm 6\%$ of the nominal voltage during normal conditions;
- $\pm 8\%$ of the nominal voltage during maintenance conditions; and
- $\pm 10\%$ of the nominal voltage during emergency conditions.

Figures 3 and 4 represent the frequency of variations in voltage levels for customer and transformer sites surveyed for the purposes of reactively investigating PQ complaints.

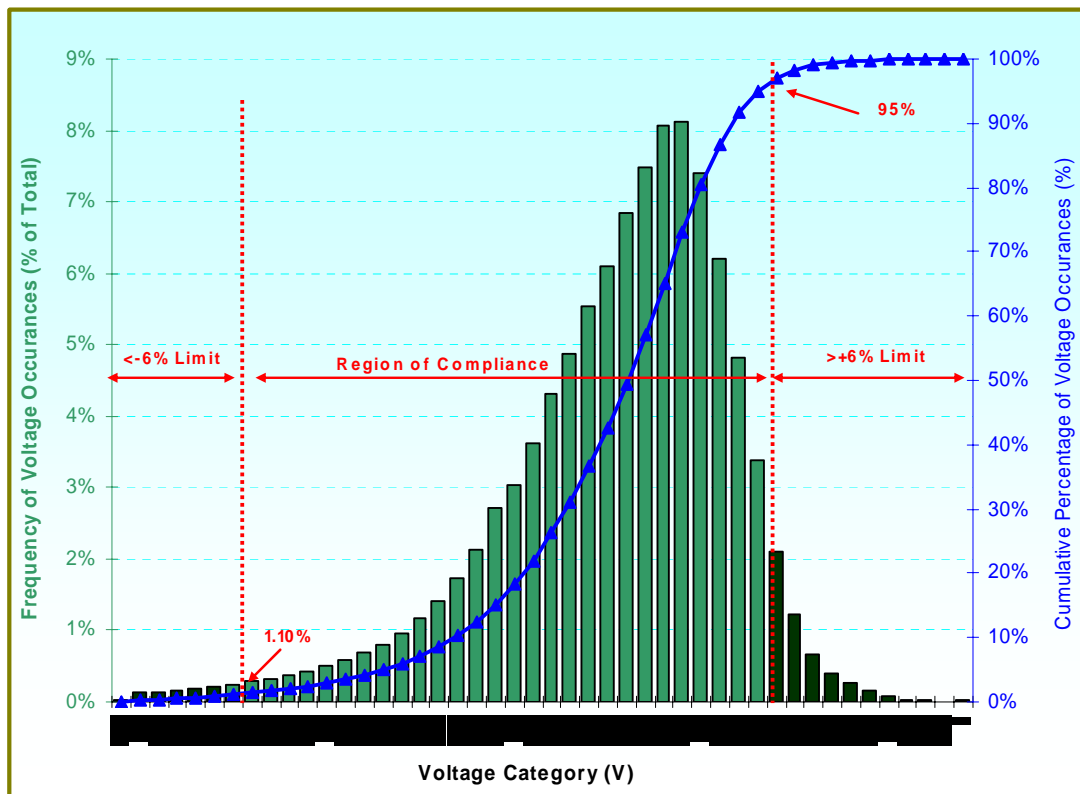


Figure 3 – Voltage distribution for recorded customer sites in the 2007/08 financial year

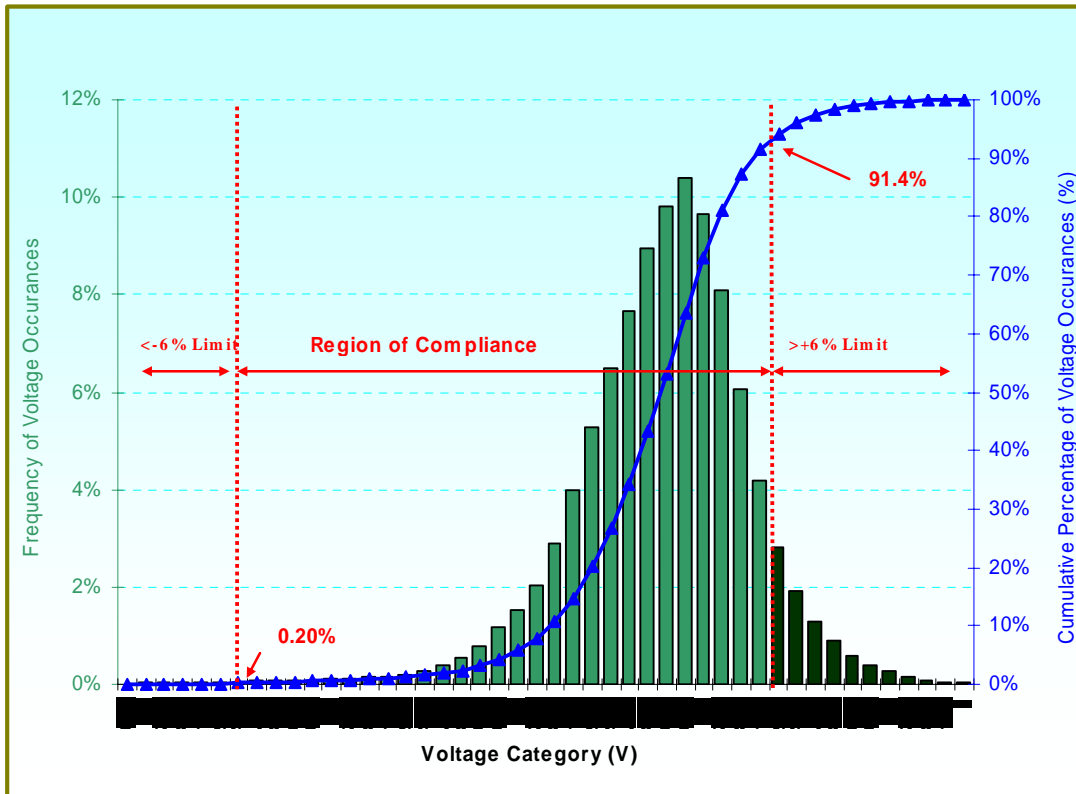


Figure 4 - Voltage distribution for recorded transformer sites for the 2007/08 financial year

Figure 3 shows the percentage of voltage level variations for customer sites that occur below 225.6V and above 254.4V is 1.1% and 5.0% of the time respectively. In addition, Figure 4 shows the proportion of voltage level variations for transformer sites that occur below 225.6V and above 254.4V is 0.2% and 8.6% of the time respectively. Figures 3 and 4 further show that the frequency voltage levels exceeding the “+10% of the emergency limits” outlined in the Technical Rules is negligible.

Deviations exceeding the voltage limits are likely to be higher from the data results in Figures 3 and 4 in comparison to the whole SWIS as these measurements were conducted in response to customer complaints. Any non-compliances in voltage levels identified by these measurements were subsequently rectified.

Figure 5 and 6 show the results of measurements undertaken on the distribution network (by way of EDM meters) on a sample basis, for both customer and transformer sites. In comparison to sites recorded as a result of customer complaints, the voltage regulation from these sites recorded by EDM meters is more compliant with the statutory limits. Table 1 provides a summary of the findings from Figures 3 to 6.

Table 1- Non compliance summary of voltage level measurements over the 2007/08 financial year

Data Source		Sample Size	<-6% Non-Compliance	>+6% Non-compliance
Measurements arising from PQ complaints	Customer sites	399	1.10%	5.00%
	Transformer sites	537	0.20%	8.60%
Measurements arising from EDM meters	Customer sites	13	0.67%	0.35%
	Transformer sites	15	0.00%	0.84%

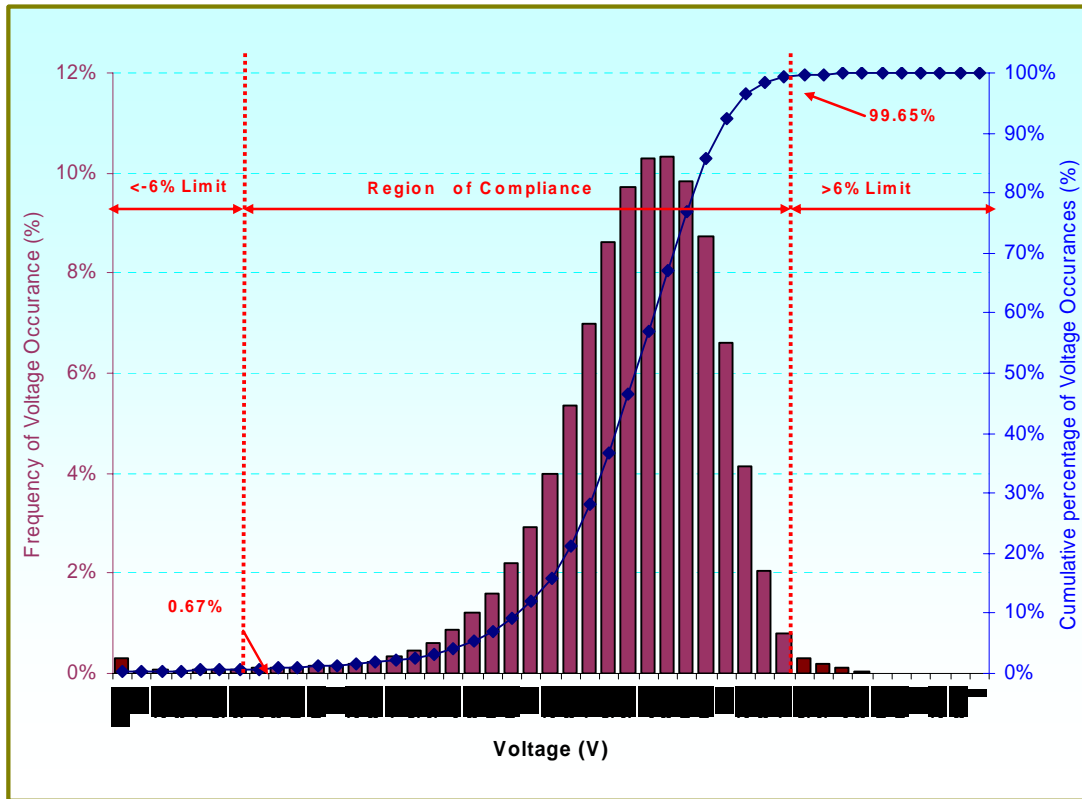


Figure 5- Voltage distribution for EDM I customer sites in the 2007/08 financial year

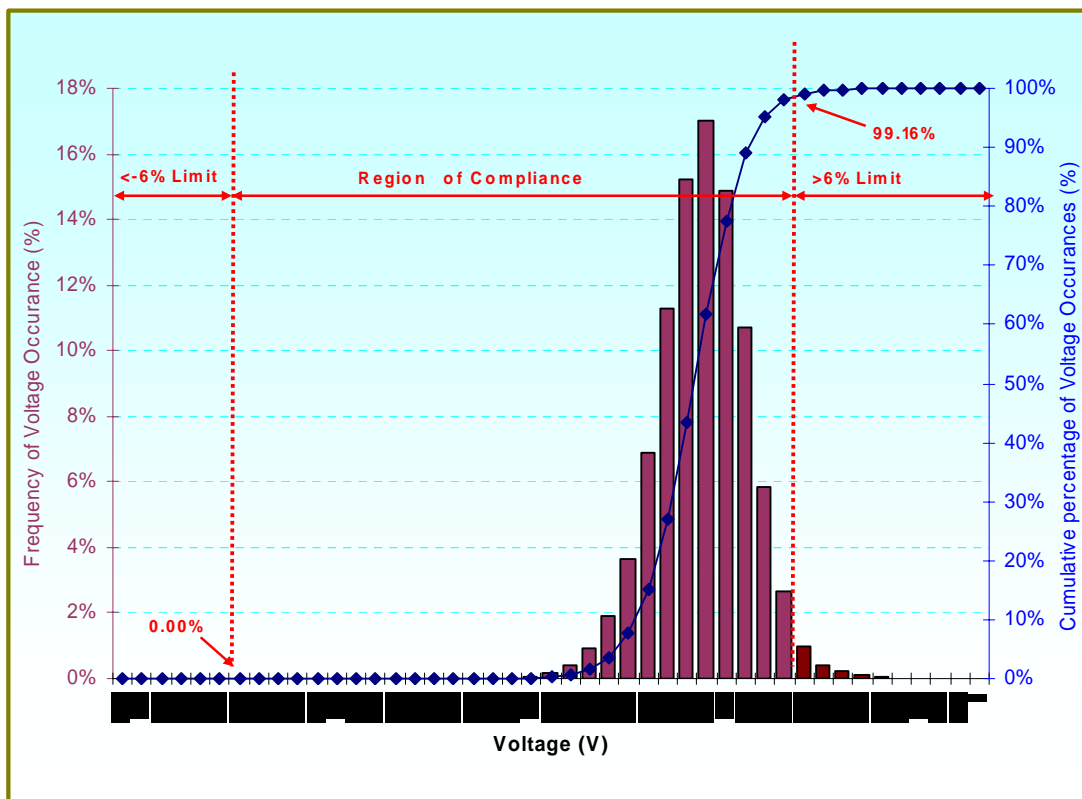


Figure 6- Voltage distribution for EDM I transformer sites in the 2007/08 financial year

4.4 Voltage Unbalance Compliance

According to the Western Power Technical Rules, the voltage unbalance on the distribution system (<10kV) for the ratio of negative and positive phase sequence components must be less than 2%.

Instrumentation for measuring sequence components is not readily available. The measurements for voltage unbalance are based on an approximation method that compares the voltage differences between each phase. The approximation method requires voltage measurements to be either:

- Phase to phase; or
- If phase to neutral measurements are taken, then phase displacement angles also need to be considered.

As all measurements for investigating customer complaints were taken as phase to neutral, a phase angle displacement of 120° between phases was assumed.

Figures 7 to 10 depict the occurrences of voltage unbalance between 0 and 4.0 % for customer and transformer sites respectively. Although reporting voltage unbalance is not a requirement by the Code, Western Power endeavours to maintain the network voltage unbalance below 2%.

Based on PQ customer complaints, Figures 7 and 8 show that voltage unbalance is maintained at 96.3% of the time for customer sites and 99.1% for transformer sites respectively.

Based on recordings from the permanent EDMI sites, Figures 9 and 10 show that voltage unbalance is maintained at 93.9% of the time for customer sites and 96.4% for transformer sites.

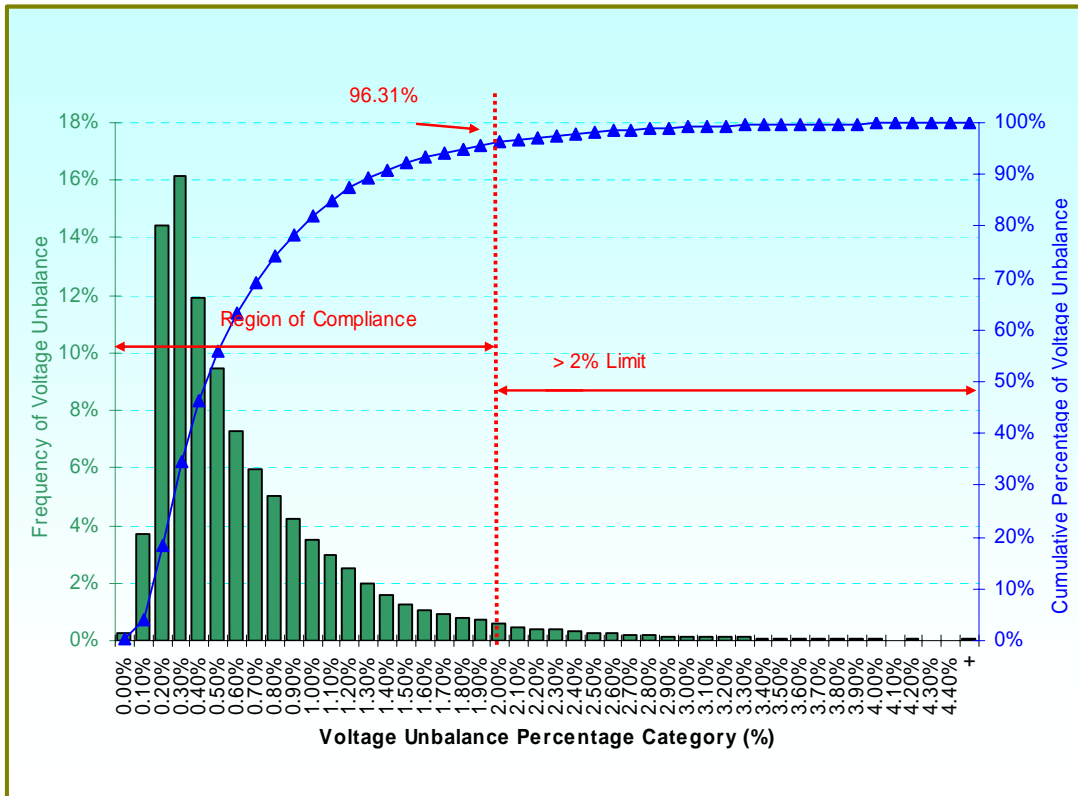


Figure 7 - Voltage unbalance for recorded customer sites for the 2007/08 Financial Year

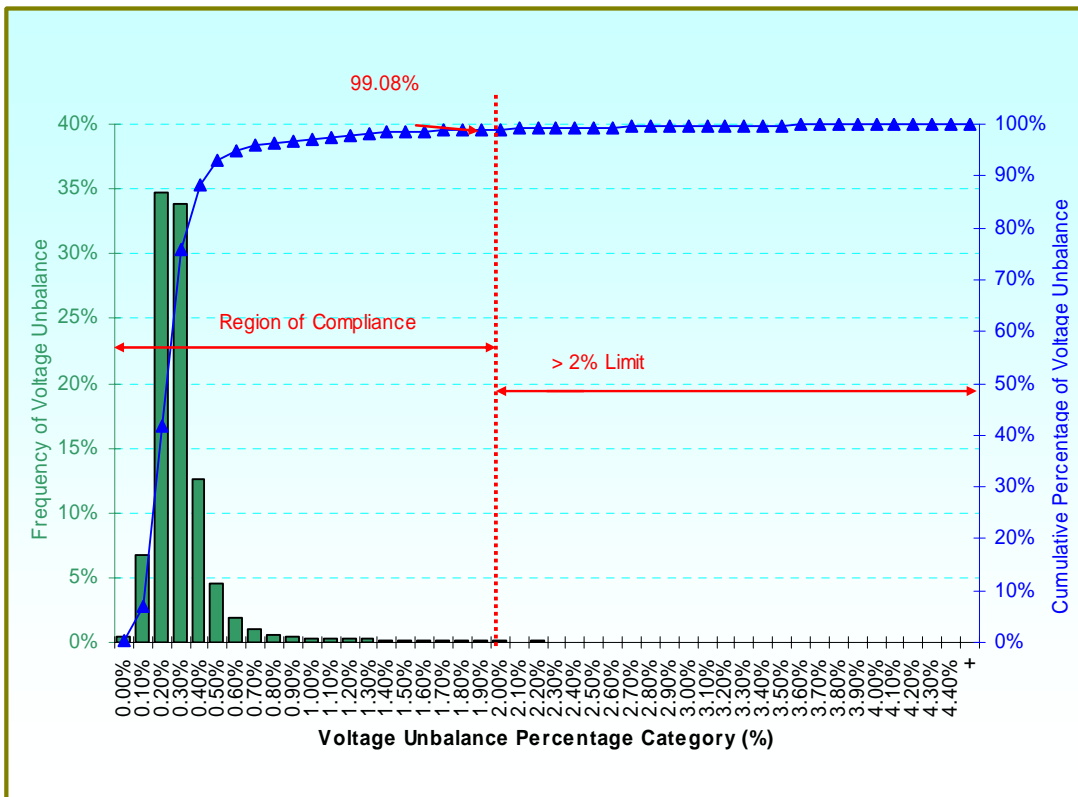


Figure 8 - Voltage unbalance for recorded distribution transformer sites for the 2007/08 financial year

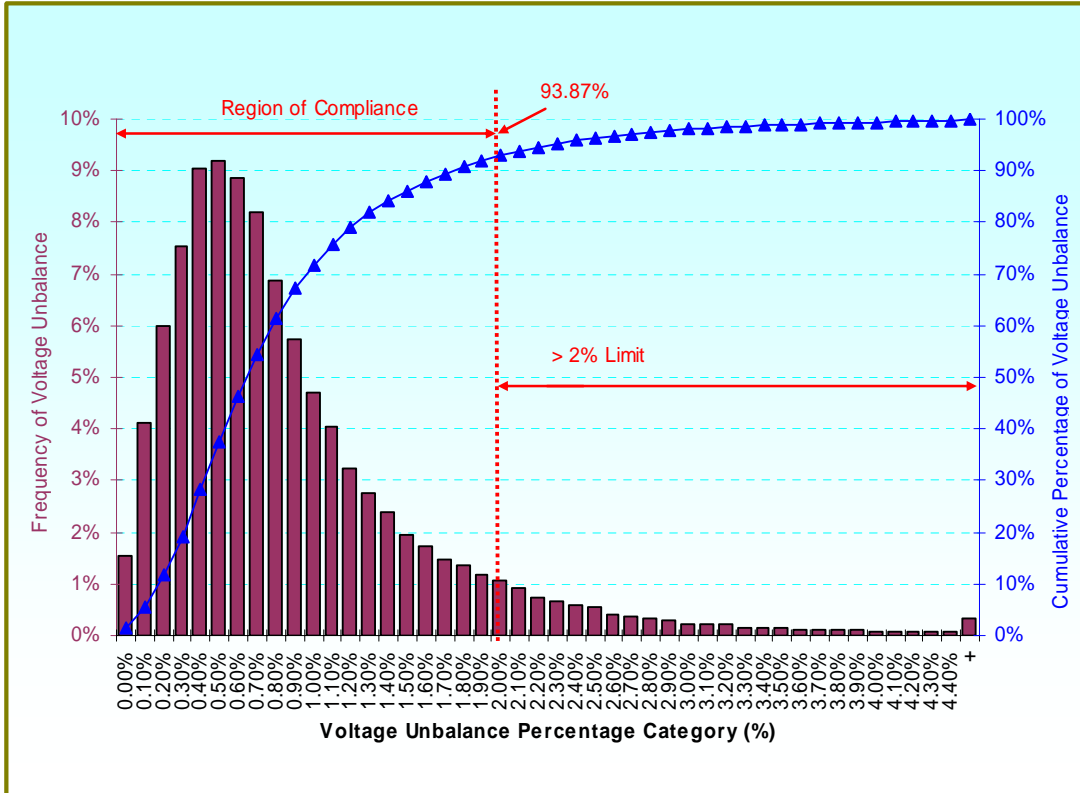


Figure 9 - Voltage unbalance for EDM I customer sites for the 2007/08 financial year

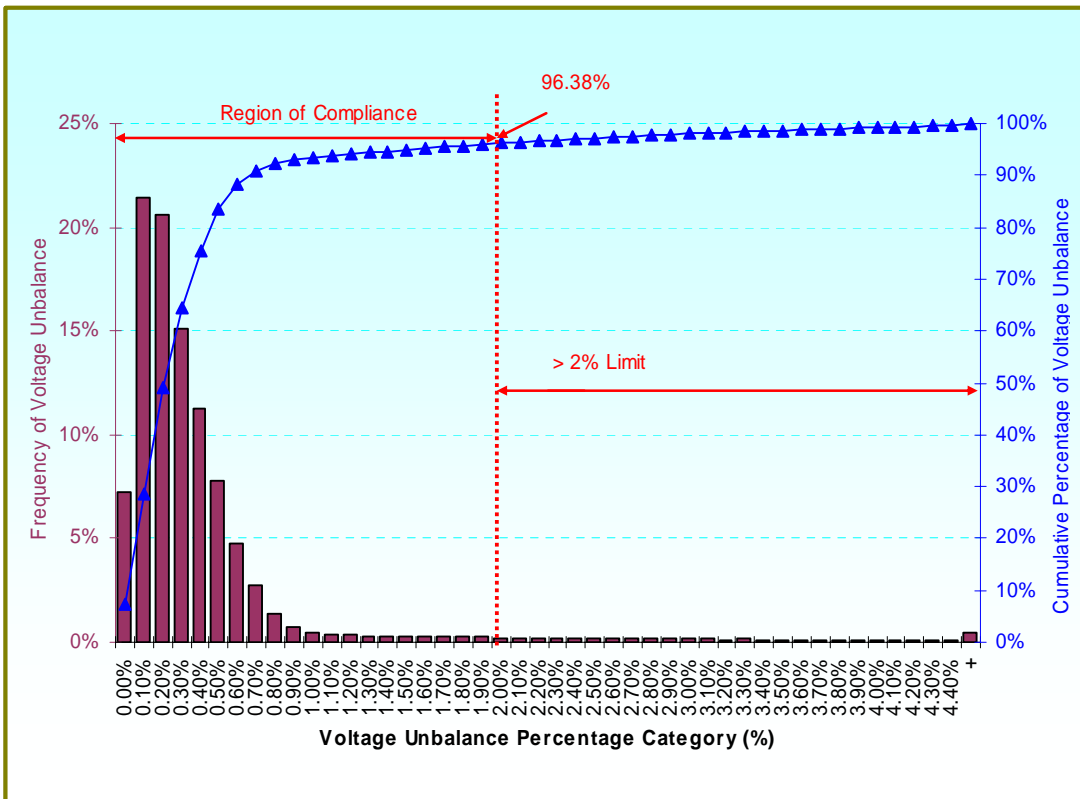


Figure 10 - Voltage unbalance for EDM I transformer sites for the 2007/08 financial year

5 Response to Item 5 of Schedule 1

5.1 Terminology applicable to this Section

Source data is the Trouble Call Management System (TCMS).

Outages separated by 3 or more hours are treated as different outages.

5.2 Response

Out of a customer base of approximately 920,000, customers that have been interrupted for more than 12 hours (customer premises are only counted once): 20,699. These outages were predominantly due to events beyond Western Power's control such as storm activity (wind and lightning), as well as distribution equipment failure.

Total customer interruption count for outages exceeding 12 hours (customers premises are counted each time an outage exceeds 12 hours): 23,135.

There were 393 incidents where customers experienced outages exceeding 12 hours. Refer to Appendix A for a complete list of these outages. Figure 11 shows the distribution of customers by outage duration.

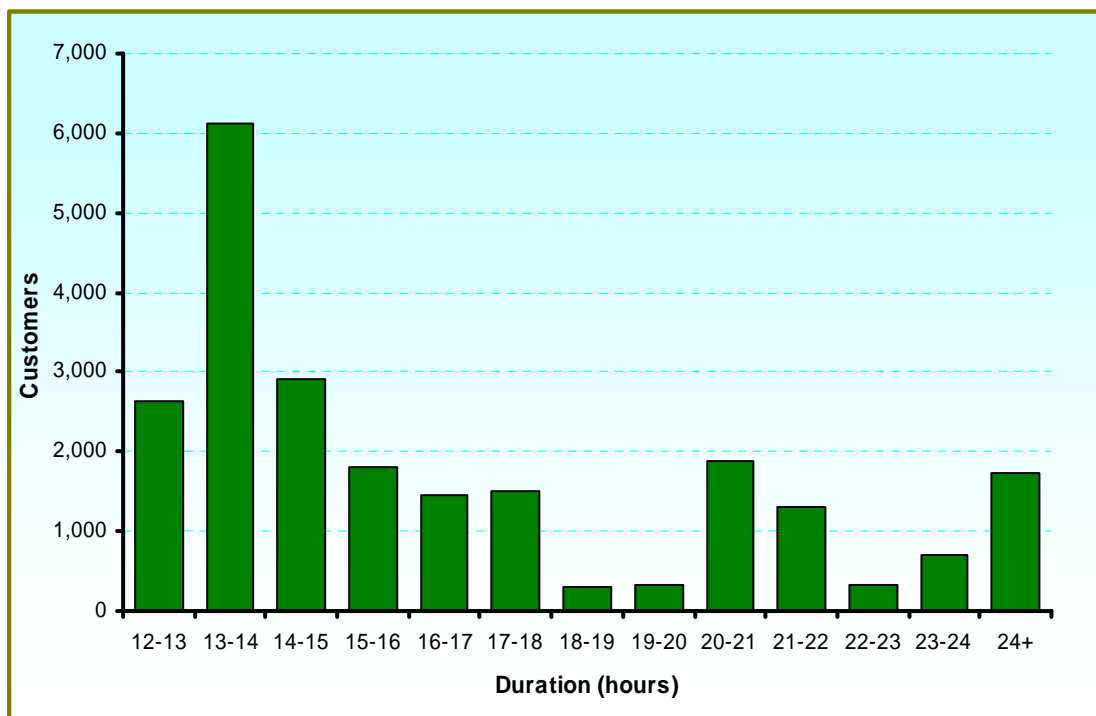


Figure 11 – Distribution of Customers by Outage Duration for the 2007/08 Financial Year

Urban area (including Perth CBD) customers that have been interrupted more than 9 times during the 2007/08 financial year: 27,006. These customers were predominantly within the outer suburbs of the Perth Metropolitan area.

Rural area customers that have been interrupted more than 16 times during the 2007/08 financial year: 1,168. These customers were predominantly within inland South Country areas.

6 Response to Items 11, 12 and 13 of Schedule 1

6.1 Terminology applicable to these Sections

Source data is TCMS.

This data is inclusive of all protection device trips on the network greater than or equal to one minute that resulted in loss of power to customers.

'Major event day exclusion' figures exclude Major Event Days as per IEEE Std 1366 (Guide for Electric Power Distribution Reliability Indices). There were two Major Event Days recorded during 2006/07:

- 1 July 2007 - Major storm with strong winds affecting approximately 52,000 customers, predominantly in the area from Perth to Margaret River; and
- 31 March 2008 - Major storm with lightning, rain and strong winds affecting approximately 68,000 customers, predominantly in the Perth metropolitan area.

In reference to Item 11 of Schedule 1 of the Code:

'SAIDI' (System Average Interruption Duration Index) refers to 11(d);

'SAIFI' (System Average Frequency Interruption Duration Index) refers to 11(b);

'CAIDI' (Customer Average Interruption Duration Index) refers to 11(a);

'ASAI' (Average Service Availability Index) refers to 11(c).

6.2 Response - Perth CBD

SAIDI and SAIFI increased in the Perth CBD during 2007/08. This is in part due to an increase in planned outages, which are conducted to expand and upgrade the network to mitigate unplanned interruptions, as well as equipment failure.

Table 2 – Perth CBD area reliability (major event day exclusion)

KPI	Units	Financial Year Ending 30 June				4 Year Average
		2004/05	2005/06	2006/07	2007/08	
SAIDI	Minutes	10	11	33	57	28
SAIFI		0.14	0.05	0.26	0.25	0.18
CAIDI	Minutes	68	218	128	223	158
ASAI	%	99.998	99.998	99.994	99.989	99.995

Table 3 – Perth CBD area reliability (major event day inclusion)

KPI	Units	Financial Year Ending 30 June				4 Year Average
		2004/05	2005/06	2006/07	2007/08	
SAIDI	Minutes	10	11	33	57	28
SAIFI		0.14	0.05	0.26	0.25	0.18
CAIDI	Minutes	68	218	128	223	158
ASAI	%	99.998	99.998	99.994	99.989	99.995

6.3 Response - urban areas other than Perth CBD

SAIDI, SAIFI and CAIDI increased in urban areas during 2007/08. This is in part due to outages due to: planned interruptions which are conducted to expand and upgrade the network to mitigate unplanned interruptions (accounted for 19 per cent of interruption minutes); factors beyond Western Power's control such as storm damage (7.3 per cent of interruption minutes); birds (3.7 per cent of interruption minutes); and equipment failure of overhead assets (17 per cent of interruption minutes). Western Power's siliconging program contributed to reductions in pole top fires. There were also reductions from outages from car versus pole incidents.

Targeted maintenance work and line reinforcements planned for this and subsequent years will mitigate the frequency of unplanned interruptions from equipment failure. Automated switchgear will reduce the customer impact of all unplanned interruptions such as storms and other environmental events.

Table 4 – Urban areas other than the Perth CBD reliability (major event day exclusion)

KPI	Units	Financial Year Ending 30 June				4 Year Average
		2004/05	2005/06	2006/07	2007/08	
SAIDI	Minutes	248	218	242	257	243
SAIFI		3.0	2.7	2.9	2.8	2.87
CAIDI	Minutes	83	81	84	92	85
ASAI	%	99.95	99.96	99.95	99.95	99.95

Table 5 - Urban areas other than the Perth CBD reliability (major event day inclusion)

KPI	Units	Financial Year Ending 30 June				4 Year Average
		2004/05	2005/06	2006/07	2007/08	
SAIDI	Minutes	408	218	264	269	292
SAIFI		3.5	2.7	3.0	2.9	3.05
CAIDI	Minutes	117	81	87	92	96
ASAI	%	99.92	99.96	99.95	99.95	99.94

6.4 Response – isolated networks

The Bremer Bay network was now connected to the SWIS during the 2006/07 financial year where it will benefit from the more reliable distribution network supplied from the Albany zone substation.

6.5 Response – rural areas

SAIDI and SAIFI increased for rural areas during 2007/08. This is in part due to: factors beyond Western Power's control such as storm damage (22 per cent of interruption minutes); overhead equipment failure (15 per cent of interruption minutes); planned interruptions (10 per cent of interruption minutes), which are conducted to expand and upgrade the network to mitigate unplanned interruptions; and damage from third party machinery (eg Car vs Pole – 3 per cent of interruption minutes). Western Power's silconing program contributed to reductions in pole top fires. There were also reductions in the outages due to underground hardware failure.

Targeted maintenance work and line reinforcements (which in part, is funded by the Rural Power Improvement Program) planned for this and subsequent years will mitigate the frequency of unplanned interruptions from equipment failure. Further installation automated switchgear, as well as upgrading existing switchgear will reduce the customer impact of all unplanned interruptions such as storms and other environmental events.

Table 6 – Rural areas reliability (major event day exclusion)

KPI	Units	Financial Year Ending 30 June				4 Year Average
		2004/05	2005/06	2006/07	2007/08	
SAIDI	Minutes	503	462	552	544	501
SAIFI		3.7	3.9	4.2	4.5	4.02
CAIDI	Minutes	135	119	131	120	125
ASAI	%	99.90	99.91	99.89	99.90	99.90

Table 7 - Rural areas reliability (major event day inclusion)

KPI	Units	Financial Year Ending 30 June				4 Year Average
		2004/05	2005/06	2006/07	2007/08	
SAIDI	Minutes	552	462	563	599	530
SAIFI		4.0	3.9	4.3	4.7	4.15
CAIDI	Minutes	137	119	131	128	128
ASAI	%	99.89	99.91	99.89	99.89	99.90

7 Response to Items 6, 7 and 8 of Schedule 1

7.1 Terminology applicable in this Section

Source data for complaints (Table 8) is based on records from TCMS that have been defined as power quality complaints and that have been subsequently directed for corrective action in the Distribution Quotation Management 2 Operational Data Storage (DQM2ODS) database.

7.2 Response

Table 8 - Complaints received in 2006/07 and 2007/08 - total and by discrete area as per Items 6 and 7 of Schedule 1 of the Code

Discrete Area	# Complaints	
	2006/07	2007/08
Perth CBD	9	12
Urban areas other than the Perth CBD	1,605	1,370
Rural areas	481	492
Isolated systems	0	0
Total	2,095	1,874

The total amount spent during 2007/08 addressing complaints (including materials and labour on the network) was \$9.2 million. This figure included the complaints received in Table 8 as well as complaints received prior to this time period.

8 Response to Item 9 of Schedule 1

Source data for failure to give notice of planned interruption (Table 9) is from the Cusrems and for the supply interruption payments is from the Extended Outage Payment Scheme (EOPS) databases.

Table 9 - Payments in 2006/07 and 2007/08 as per Items 8 of Schedule 1 of the Code

	2006/07		2007/08	
	Number	Value	Number	Value
Payments for failure to give required notice of planned Interruption	81	\$1,620	241	\$4,820
Payments for supply interruptions exceeding 12 Hours	3,709	\$296,720	3,099	\$247,920

9 Response to Items 14 and 15 of Schedule 1

9.1 Terminology applicable to these Sections

Source data is TCMS and is inclusive of all protection device trips on the network greater than or equal to one minute that resulted in loss of power to customers.

Percentiles are selected over the customer premise count for each discrete area. For example, Table 12 and Figure 13 show that in 2007/08, 50 per cent of customers in urban areas had no more than 2 interruptions.

9.2 Average length of interruption

The 100th percentile figure for Rural showing an average interruption length of 3,569 minutes is from customers experiencing an outage due to a bushfire in December 2007 (refer to Section 2 for further detail). The 100th percentile figure for CBD showing an average interruption length of 2,340 minutes is principally due to a cable failure in which restoration time was exacerbated by access and isolation issues in conjunction with trading hours.

Table 10 – Average length of interruption (minutes) percentile figures as per Item 14(a) of Schedule 1 of the Code

	25 th	50 th	75 th	90 th	95 th	98 th	100 th
Perth CBD	0	0	0	43	117	251	2,340
Urban (ex Perth CBD)	24	58	97	165	221	314	1,714
Rural	51	83	145	212	275	395	3,569

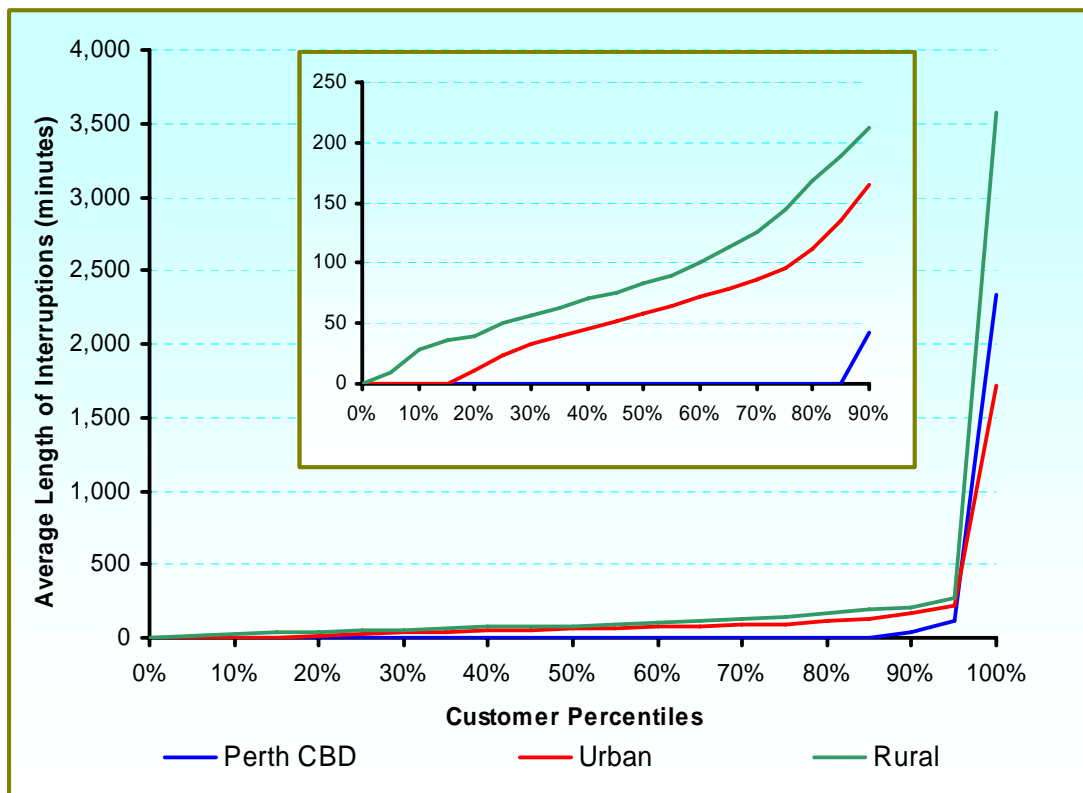


Figure 12 – Average length of interruption percentile distribution as per Item 15 of Schedule 1 of the Code

9.3 Number of interruptions

For 2007/08:

- Approximately 87% of CBD customers experienced no outages;
- Approximately 96% of urban area customers experienced 9 or less outages; and
- Approximately 99% of rural area customers experienced 16 or less outages.

Targeted remedial work for the worst served customers continues to be implemented to mitigate the current interruption frequency.

Table 11- Number of interruptions percentile figures as per Item 14(b) of Schedule 1 of the Code

	25th	50th	75th	90th	95th	98th	100th
Perth CBD	0	0	0	1	2	2	5
Urban (ex Perth CBD)	1	2	4	6	7	10	23
Rural	2	4	6	8	10	13	24

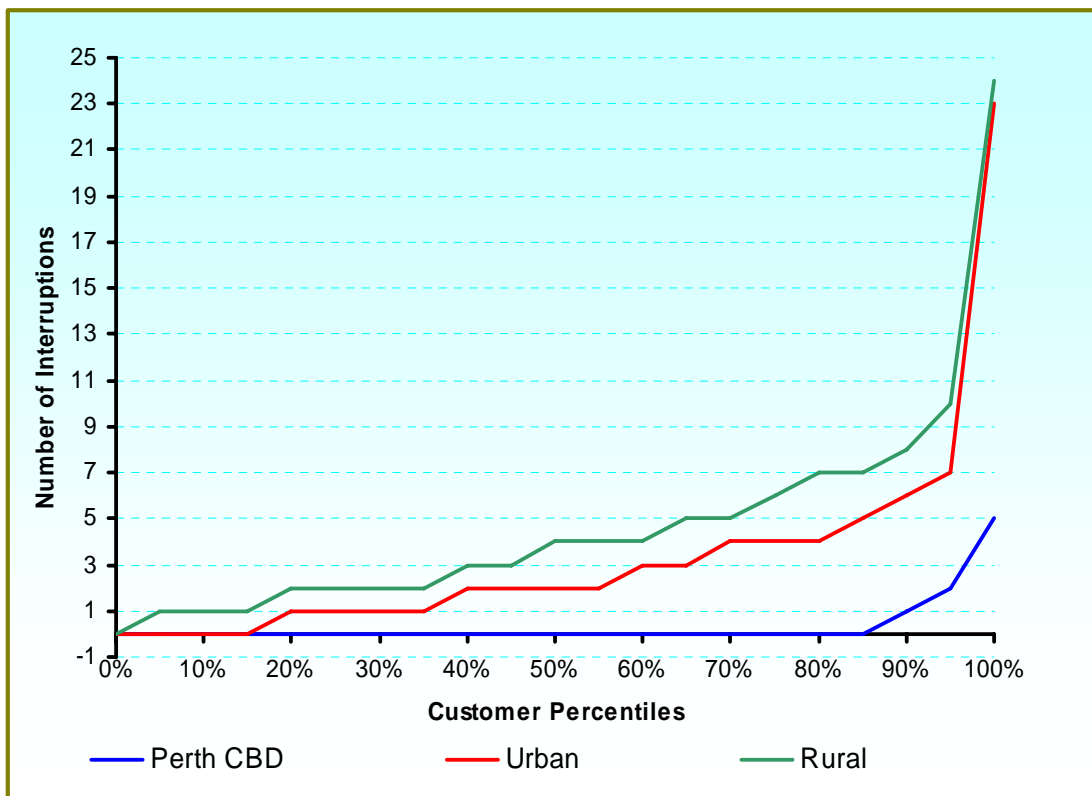


Figure 13 – Number of interruptions percentile distribution as per Item 15 of Schedule 1 of the Code

9.4 Total length of all interruptions

For 2007/08:

- Approximately 87% of Perth CBD customers experienced total outage minutes of less than 30 minutes;
- Approximately 52% of urban area customers experienced total outage minutes of less than 160 minutes;
- Approximately 47% of rural area customers experienced total outage minutes of less than 290 minutes;

The 100th percentile figure for Rural is a total interruption length of 9,899 minutes and is primarily due to a bushfire in December 2007 (refer to Section 2 for further detail). The 100th percentile figure for CBD is primarily due to a cable failure in which restoration time was exacerbated by access and isolation issues in conjunction with trading hours.

Table 12 - Total length of interruptions (minutes) percentile figures as per Item 14(c) of Schedule 1 of the Code

	25th	50th	75th	90th	95th	98th	100th
Perth CBD	0	0	0	86	161	502	2,634
Urban (ex Perth CBD)	34	149	381	659	929	1,276	4,601
Rural	158	315	747	1,486	2,192	2,869	9,899

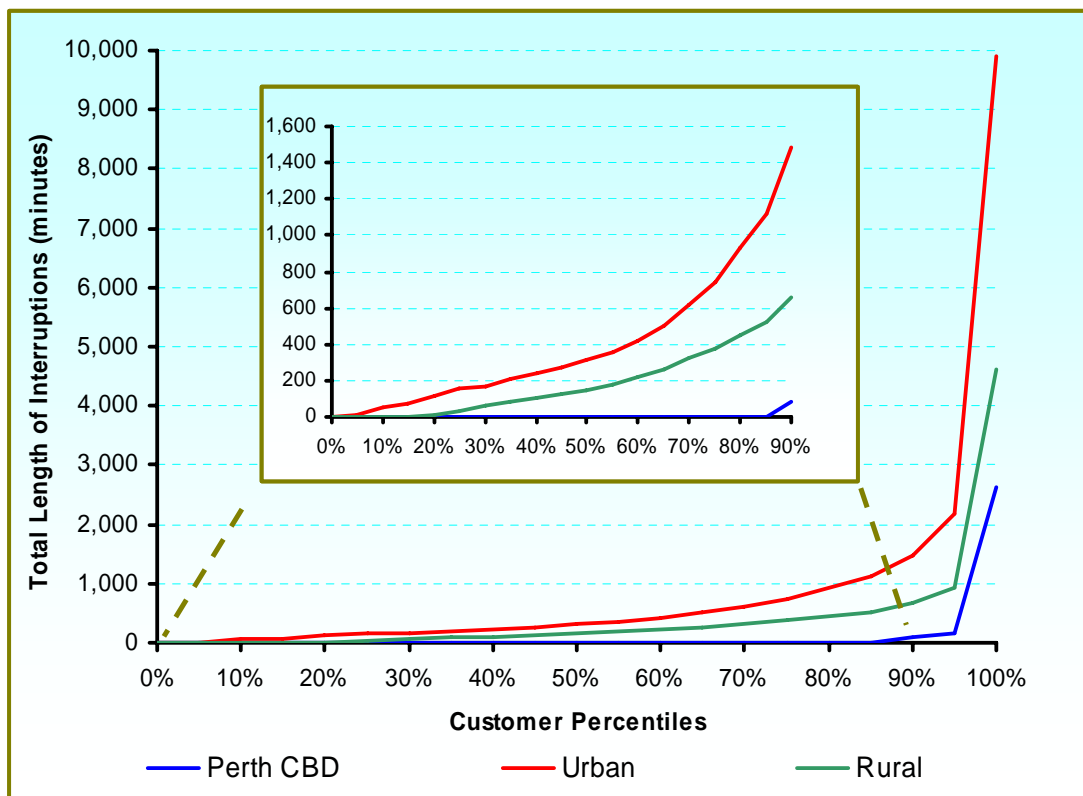


Figure 14 – Total length of interruptions percentile distribution as per Item 15 of Schedule 1 of the Code

Appendix A - List of Customer Outages Greater than 12 Hours

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
1	15.47	15.47	2
2	12.14	12.14	21
3	17.12	17.12	8
4	15.27	15.27	123
5	19.7	19.7	13
6	13.61	13.61	2
7	22.26	25.7	93
8	17.26	18.38	29
9	29.85	29.85	12
10	23.18	23.18	25
11	16.78	16.78	8
12	14.37	14.37	12
13	20.34	20.34	1
14	28.15	28.15	13
15	12.11	12.11	175
16	21.5	21.5	33
17	57.89	57.89	8
18	20.64	20.64	4
19	13.49	13.49	2
20	23.21	23.21	11
21	19.52	19.52	9
22	14.14	14.14	531
23	17.38	17.38	8
24	21.35	23.22	118
25	18.81	18.81	7
26	12.12	13.23	152
27	26.61	26.61	12
28	16.51	16.51	20
29	12.66	12.66	97
30	21.83	44.3	197
31	14.27	14.27	65
32	17.28	20.72	11
33	13.32	13.32	2
34	28.32	28.32	2
35	14.19	14.19	39
36	18.5	18.5	17
37	13.01	13.01	36
38	14.79	14.79	27
39	21.16	21.21	159
40	15.31	15.31	8
41	20.69	20.69	36
42	16.55	16.55	83
43	22.26	22.26	4
44	15.56	15.56	541
45	14.27	14.27	44
46	21.35	21.35	67
47	27.21	27.21	48
48	22.08	22.08	9

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
49	16.96	16.96	96
50	17.58	17.58	21
51	28.33	28.33	2
52	18.08	18.08	25
53	12.42	12.42	6
54	15.66	15.66	65
55	31.78	31.78	6
56	13.94	14.8	70
57	20.65	20.65	3
58	18.56	18.56	8
59	16.35	16.35	12
60	26.99	26.99	7
61	17.7	17.7	7
62	24.91	24.91	2
63	16.77	16.77	61
64	14.09	14.09	9
65	12.94	12.94	7
66	14.01	14.01	46
67	14.7	14.7	90
68	12.24	12.24	89
69	12.34	12.34	82
70	12.1	12.1	2
71	19.46	19.46	13
72	12.35	12.35	8
73	23.97	23.97	3
74	14.63	14.63	1
75	17.54	17.54	2
76	15.53	15.53	16
77	12.47	12.47	9
78	29.8	29.8	2
79	18.58	18.58	16
80	12.78	12.78	27
81	12.11	12.11	64
82	19.92	19.92	15
83	74.28	149.42	5
84	20.55	20.55	29
85	13.21	13.21	59
86	14.82	14.82	33
87	12.3	12.3	16
88	20.98	20.98	836
89	29.23	29.23	10
90	22.22	22.22	100
91	12.38	12.38	36
92	13.9	13.9	513
93	12.31	12.31	6
94	14.07	14.07	156
95	21.47	21.47	24
96	15.72	15.72	77
97	12.68	12.68	17
98	36.27	36.27	51

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
99	17.14	17.14	57
100	15.15	15.15	25
101	15.39	15.39	4
102	16.77	16.77	10
103	15.51	15.51	125
104	15.62	15.62	19
105	17	17	37
106	17.16	17.16	29
107	19.46	19.46	74
108	24.63	24.63	1
109	27.56	27.56	28
110	25.83	25.83	4
111	20.01	20.01	14
112	45.35	45.35	74
113	12.88	12.88	6
114	21.24	21.24	15
115	23.54	25.36	245
116	17.77	17.77	20
117	12.08	13.57	226
118	16.63	16.63	7
119	14.79	14.79	3
120	13.66	13.66	201
121	12.71	12.71	4
122	19.33	19.33	32
123	15.04	15.04	25
124	16.69	16.69	8
125	12.44	12.44	6
126	13.9	13.9	124
127	14.11	14.11	20
128	16.65	16.65	23
129	27.05	27.05	61
130	14.25	14.25	12
131	16.7	16.7	26
132	12.18	12.18	12
133	13.29	13.29	1
134	15.66	15.66	23
135	17.26	17.26	15
136	13.94	13.94	47
137	24.99	24.99	14
138	19.54	19.54	6
139	13.22	13.22	15
140	17.11	17.11	9
141	13.2	39.93	2009
142	12.83	12.83	125
143	23.6	23.6	28
144	13.37	13.37	26
145	20.69	20.69	13
146	13.02	16.02	975
147	29.78	29.78	59
148	17.59	17.59	8

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
149	16.16	16.16	29
150	28.41	28.41	43
151	23.01	23.01	5
152	20.86	20.86	11
153	13.79	13.79	794
154	15.14	15.14	26
155	15.21	15.21	8
156	59.48	59.48	1
157	28.56	28.56	122
158	14.54	14.54	208
159	13.04	14.85	308
160	18	18	47
161	28.66	28.66	37
162	17.84	17.84	17
163	13.73	13.73	64
164	62.52	62.52	22
165	13.31	13.31	30
166	21.24	21.24	6
167	13.22	13.22	115
168	16.09	18.64	50
169	12.68	12.68	76
170	20.7	26.8	129
171	16.67	16.67	13
172	12.18	12.18	1
173	39	39	58
174	16.53	16.53	48
175	13.49	13.49	5
176	15.02	15.02	6
177	16.24	16.24	6
178	24.83	24.83	21
179	23.8	23.8	1
180	15.94	15.94	22
181	26.12	26.12	21
182	25.06	25.06	6
183	17.61	17.61	56
184	15.32	15.32	22
185	26.96	26.96	8
186	14.45	14.45	13
187	14.83	16.93	68
188	19.69	19.69	9
189	12.58	12.58	1
190	13.11	13.11	1
191	17.44	17.44	6
192	20.65	20.65	18
193	24.26	24.26	36
194	12.31	12.31	19
195	17	17	35
196	29.1	29.1	34
197	17.42	17.42	7
198	12.9	12.9	35

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
199	28.56	28.56	25
200	20.48	20.48	23
201	19.38	19.38	8
202	16.7	16.7	4
203	15.91	15.91	8
204	18.77	18.77	9
205	14.8	14.8	840
206	16.43	16.43	10
207	18.25	18.25	4
208	12.75	12.75	2
209	14.8	14.8	32
210	21.77	21.77	4
211	16.52	16.52	84
212	12.34	12.34	40
213	19.76	19.76	15
214	17.48	17.48	10
215	12.09	12.09	340
216	15.59	15.59	15
217	16.3	39.13	17
218	17.65	17.65	188
219	16.67	16.67	3
220	24.58	24.58	5
221	17.38	24.1	204
222	16.83	16.83	36
223	14.88	14.88	74
224	14.21	14.21	26
225	12.26	12.26	118
226	15.88	15.88	36
227	13.56	13.56	15
228	12.72	12.72	160
229	22.92	22.92	37
230	15.89	15.89	25
231	14.88	14.88	5
232	25.97	25.97	2
233	17.04	17.04	8
234	12.13	12.13	64
235	20.17	20.17	67
236	22.95	27.78	64
237	25.85	25.85	1
238	17.11	17.11	5
239	16.78	16.78	21
240	17.16	17.16	5
241	29.29	29.29	22
242	19.28	19.28	2
243	27.67	27.67	84
244	42.59	42.59	35
245	17.72	17.72	7
246	14.93	14.93	5
247	18.41	18.41	2
248	12.23	12.23	54

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
249	15.07	15.07	27
250	16.09	16.09	33
251	15.54	15.54	27
252	19.61	19.61	85
253	26.93	26.93	49
254	16.01	16.01	5
255	21.98	21.98	52
256	16.51	16.51	11
257	21.43	21.43	3
258	21.65	21.65	2
259	27.48	27.48	17
260	21.72	21.72	20
261	25.88	25.88	12
262	20.48	20.48	3
263	15.08	15.08	78
264	25.63	25.63	34
265	17.42	17.42	152
266	15.49	15.49	12
267	14.13	14.13	16
268	23.32	23.32	1
269	21.7	21.7	68
270	16.68	16.68	142
271	12.13	12.13	3
272	16.98	18.52	22
273	15.87	15.87	86
274	14.86	14.86	38
275	30.18	30.18	39
276	15.29	15.29	4
277	19.86	19.86	24
278	18.51	18.51	97
279	18.58	18.58	23
280	26.53	26.53	79
281	25.22	25.22	29
282	21.16	21.16	9
283	20.25	23.27	668
284	30.25	30.25	21
285	17.7	17.7	1
286	14.06	14.06	67
287	12.75	12.75	18
288	33.92	33.92	1
289	15	15	16
290	17.61	17.61	97
291	13	13	15
292	28.63	28.63	3
293	17.72	17.72	9
294	20.54	20.54	6
295	26.23	26.23	53
296	28.33	28.33	14
297	24.71	24.71	52
298	21.11	21.11	16

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
299	12.31	12.31	22
300	44.36	44.36	15
301	17.97	17.97	121
302	12.98	12.98	21
303	14.66	14.66	15
304	15.2	15.2	22
305	14.51	14.51	51
306	12.02	14.05	77
307	18.03	18.03	5
308	14.33	14.33	4
309	13.07	13.07	12
310	25.76	25.76	6
311	17.78	17.78	6
312	16.79	16.79	1
313	28.83	28.83	30
314	17.26	17.26	1
315	13.76	13.76	27
316	15.51	15.51	4
317	15.33	15.78	24
318	21.38	21.38	6
319	19.52	19.52	8
320	21.59	21.59	12
321	51.69	53.18	2
322	20.87	20.87	8
323	26.61	26.61	14
324	17.53	17.91	85
325	21.48	23.8	48
326	16.94	16.94	2
327	12.91	12.91	9
328	12.27	12.27	4
329	26.02	26.02	46
330	20.76	20.76	10
331	20.26	20.26	97
332	15.17	15.17	7
333	14.24	14.24	135
334	14.8	14.8	113
335	17.12	17.12	9
336	28.96	28.96	12
337	16.97	16.97	1
338	16.46	16.46	361
339	23.58	23.58	41
340	13.21	13.21	186
341	14.35	24.36	45
342	12.53	12.53	194
343	13.59	13.59	77
344	17.01	17.01	56
345	14.08	14.08	6
346	17.68	17.68	36
347	12.99	12.99	12
348	12.19	31.57	149

Outage	First Restoration (hours) after 12 hours	Final Restoration (hours)	Customers Affected
349	19.36	19.36	5
350	31.13	31.13	59
351	27.22	27.22	18
352	13.55	13.55	109
353	15.22	15.22	21
354	12.85	12.85	48
355	18.83	18.83	17
356	18.73	18.73	15
357	21.93	21.93	18
358	12.3	12.3	3
359	14.06	14.06	12
360	24.13	24.13	5
361	22.1	22.1	2
362	16.08	16.08	8
363	17.02	17.02	115
364	19.37	19.37	2
365	13.59	13.59	8
366	64.55	64.55	22
367	15.9	15.9	52
368	14.09	14.09	13
369	18.35	18.35	3
370	18.13	23.42	32
371	16	16	195
372	13.09	13.09	9
373	24.42	24.42	5
374	15.6	15.6	2
375	12.47	12.47	89
376	15.2	15.2	5
377	21.11	21.11	1
378	19.33	19.33	7
379	24.66	24.66	4
380	15.33	15.33	10
381	12.55	18.54	164
382	13.19	13.19	126
383	21.91	21.91	27
384	23.74	23.74	101
385	13.62	13.62	3
386	16.1	16.1	12
387	22.92	22.92	7
388	14.32	14.32	10
389	14.02	14.02	24
390	13.36	13.36	84
391	14.74	14.74	1
392	12.45	12.45	4
393	21.26	26.76	696