Annual Reliability & Power Quality Report

Financial Year Ending June 2007

Published – 30 September 2007

DOCUMENT RELEASE INFORMATION

Document prepared by:

Western Power
ABN 18540492861

363 Wellington Street
Perth WA 6000

Prepared by:	Approved by:
Manager Network Performance Customer Services Division	General Manager Customer Services Division

Table of Contents

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 2007.

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

2 Overview

In 2006/07, customers experienced two Major Event Days (see Section 6 for further detail). Customers in the Dwellingup area experienced long blackouts due to a number of bushfires in February 2007 which burnt down the distribution network supplying them. The most significant incident occurred on the 3 February where the entire town and surrounding environs were without power. Emergency generators were connected the following morning of the incident, which supplied power to the main townsite. However, due to the nature of the network and the extent of the damage, there were a small number of customers in the surrounding areas that remained without power for an extended period. These events are reflected in the percentile charts – Figures 12 and 14 of Section 9.

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 responding to Items 7 and 11, the "isolated system" as defined in Item 1 is the network supplying customers in the town of Bremer Bay and immediate surrounding areas, which was disconnected from the SWIS from March 2004 until April 2007.

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

Source data was collated from measurements conducted in response to power quality complaints. The recordings represent the worst-case situations of predominantly low voltage (LV) and to some degree the medium voltage (MV) distribution network during normal operations and are used to determine the degree of power quality compliance in terms of harmonic voltage distortion, voltage unbalance and voltage variations.

4.2 Harmonics Compliance

Harmonic voltage distortion levels in the distribution network must be contained within the compatibility levels given in Part 2 Section 7 of the Code.

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

Figures 1 and 2 illustrate the THD for 2005/06 and 2006/07 where recordings were taken at 13 sites in 2006/07 and at seven sites in 2005/06. As the amount of data collected for each of the sites can have significant variance, the data is normalised so that each site has equal weighting or influence on the total result.

Figure 1 shows that the THD was 100% compliant with Western Power's Technical Rules requirements and therefore 100% complaint with regulatory requirements for reactive monitoring of the 7 customer sites for 2005/06.

Figure 2 shows that the THD was 99.49% compliant with Western Power's Technical Rules requirements and 99.98% complaint with regulatory requirements for reactive monitoring of the 13 customer sites for 2005/06.

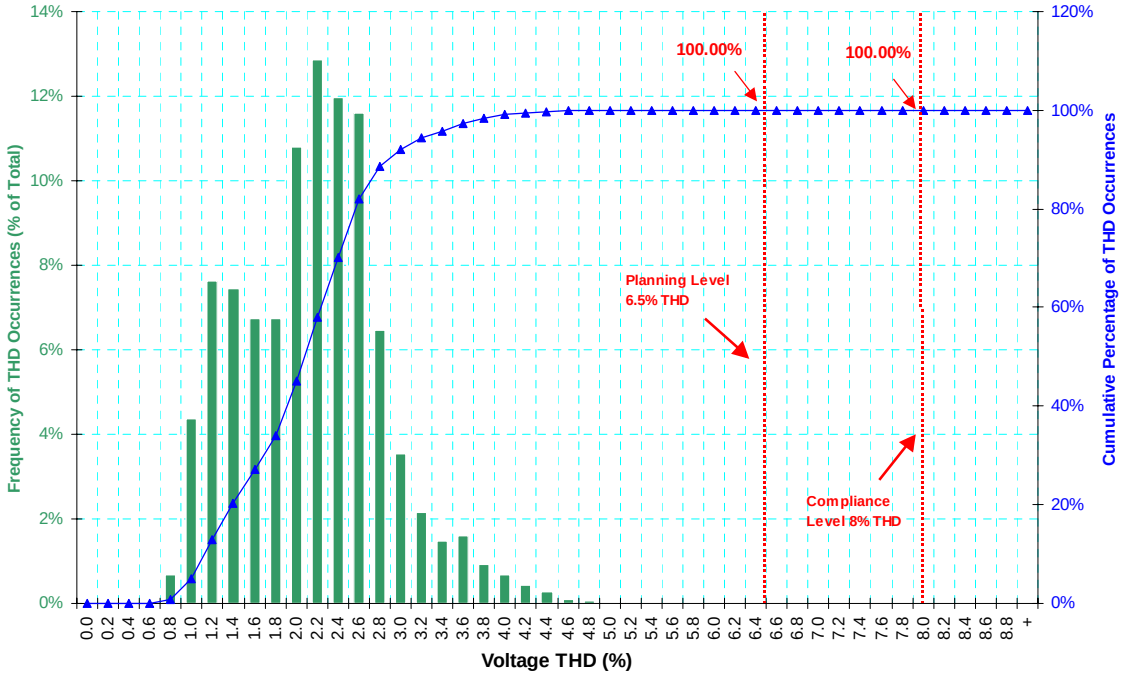

Figure 1 - Percentage of THD across 7 selected sites for 2005/06 financial year

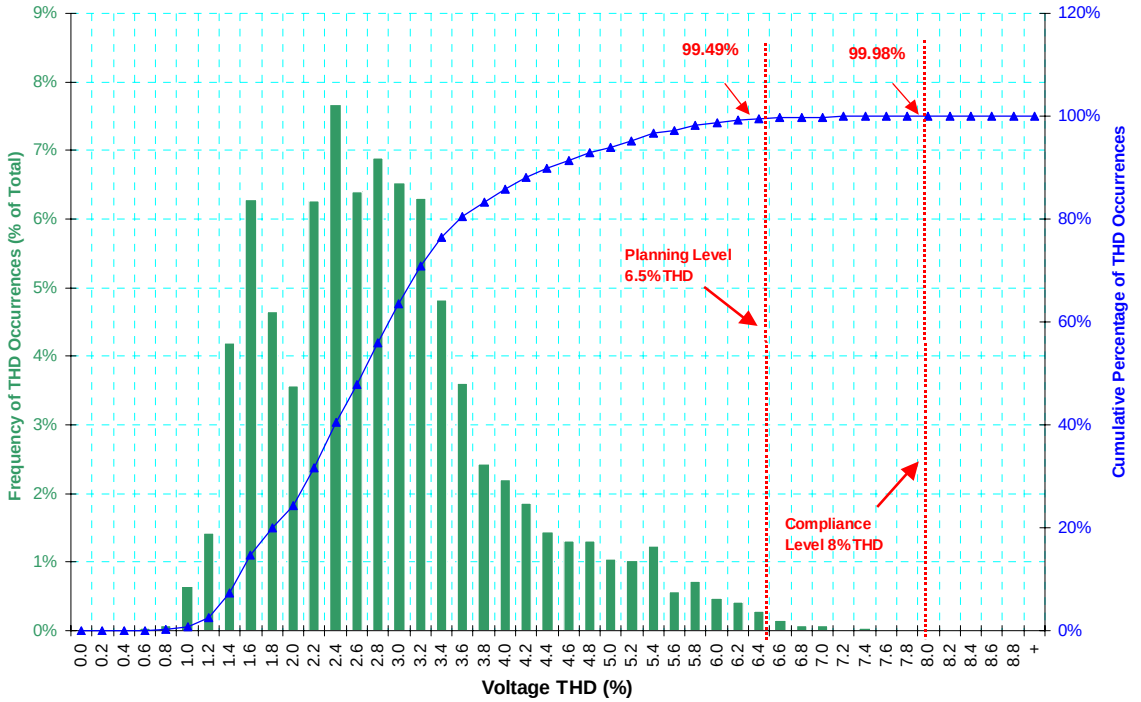

Figure 2 - Percentage of THD across 7 selected sites for 2006/07 Financial Year

4.3 Voltage Variation Compliance

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

- ±6% of the nominal voltage during normal conditions (i.e. greater than 225.6V and less than 254.4 V);
- ±8% of the nominal voltage during maintenance conditions; and
- ±10% of the nominal voltage during emergency conditions.

Figures 3 to 6 represent the frequency of voltage occurrences for customer and transformer sites surveyed in 2005/06 and 2006/07.

Typically, this was recorded over a 1 - 4 day period (on some occasions up to 8 days) from July 2005 to June 2007 from sites within the SWIS using high accuracy power quality (PQ) measuring instruments and shows the number of customer and distribution transformer sites recorded for 2005/06 and 2006/07.

Table 1 - Percentage of Customer and Distribution Transformer Sites recorded over the past two financial years

		2005/06	2006/07
Customers	Recorded	649	539
	Actual	837,601	862,558
	Percentage	0.077%	0.062%
Transformers	Recorded	688	592
	Actual	57,297	59,530
	Percentage	1.201%	0.994%

The voltage measurements are based on the average of the root mean squared voltage (V_{rms}) values over a sample period of 5-minutes. In a minority of cases, involving some of the older PQ instruments, sample intervals of 1 or 6 minutes were used. Overall, this has not had any noticeable impact on the final results.

At present Western Power is not using the standard (AS60038) because the LV voltage levels are legislated in the *Electricity Act 1945* ("the Act"). Neither the Act nor the Code specifies a recommended sample interval.

A recommended sample interval (V_{rms} over a 5 minute period at the consumer's terminal) had previously been stated in both the superseded voltage standard, AS 2926-1987 - Appendix A, and the previous Electricity Regulations. Current international standards recommend a 10 minute sample interval, which is less onerous than the 5 minute sample interval used by Western Power.

In 2005/06, the percentage of voltage distribution at customer sites that occurred below 225.6V and above 254.4V was 0.74% and 8.38% of the time respectively. The percentage of voltage distribution at transformer sites that occurred below 225.6V and above 254.4V was 0.10% and 8.01% of the time respectively.

In 2006/07, the percentage of voltage distribution at customer sites that occurred below 225.6V and above 254.4V was 0.96% and 4.78% of the time respectively. The percentage of voltage distribution at transformer sites that occurred below 225.6V and above 254.4V was 0.15% and 8.51% of the time respectively.

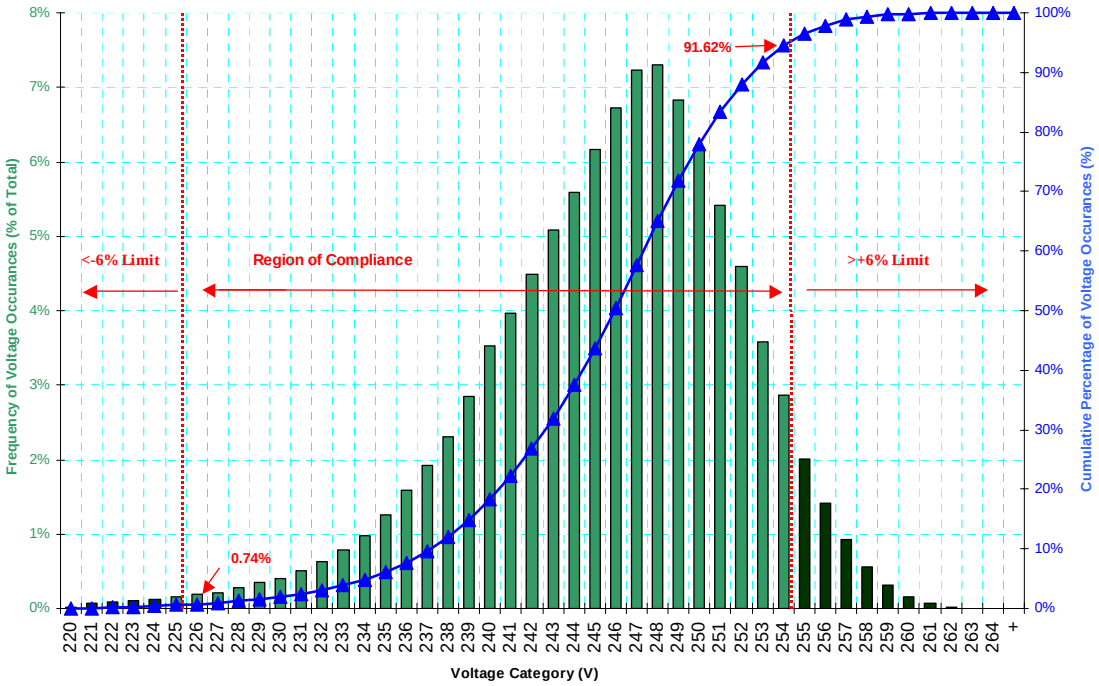

Figure 3 – Accumulated voltage distribution for recorded customer sites in the 2005/06 financial year

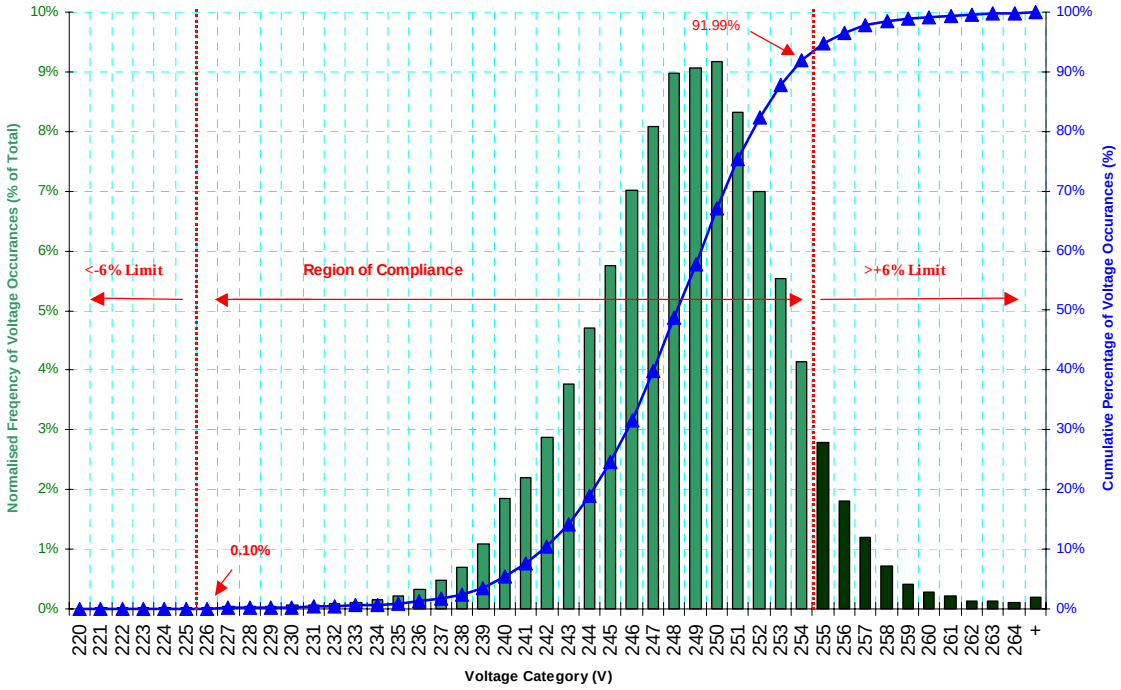

Figure 4 - Accumulated voltage distribution for recorded distribution transformer sites for the 2005/06 financial year

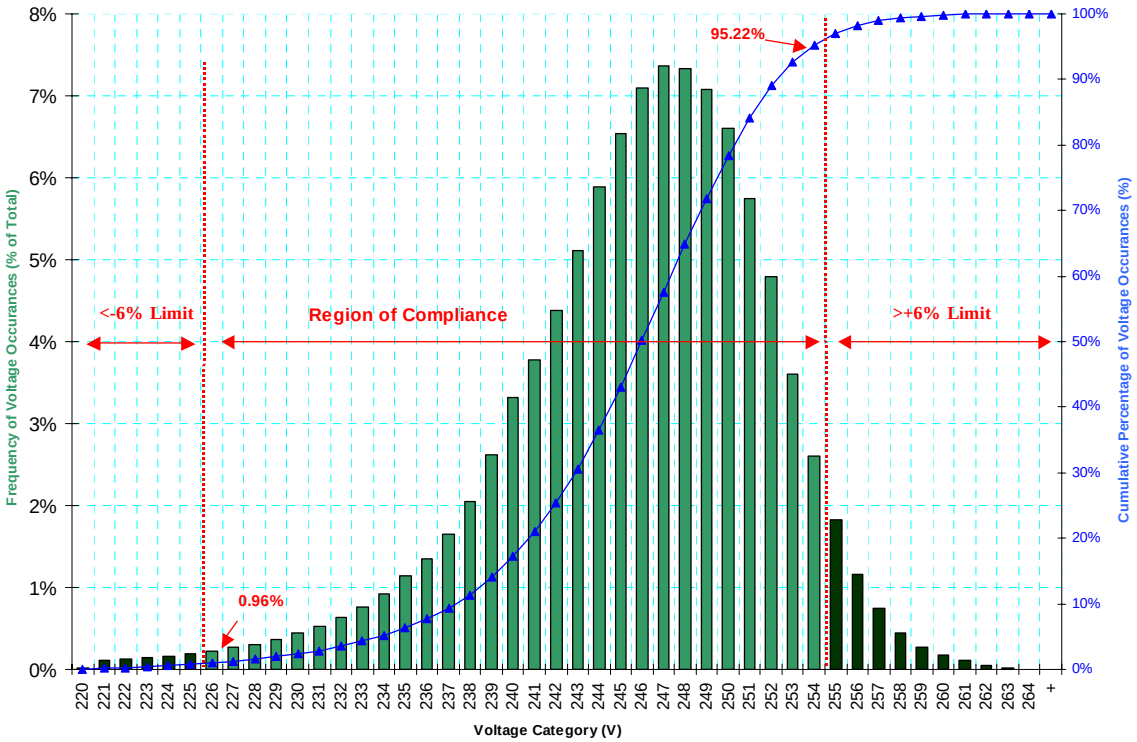

Figure 5 - Accumulated voltage distribution for recorded customer sites for the 2006/07 financial year

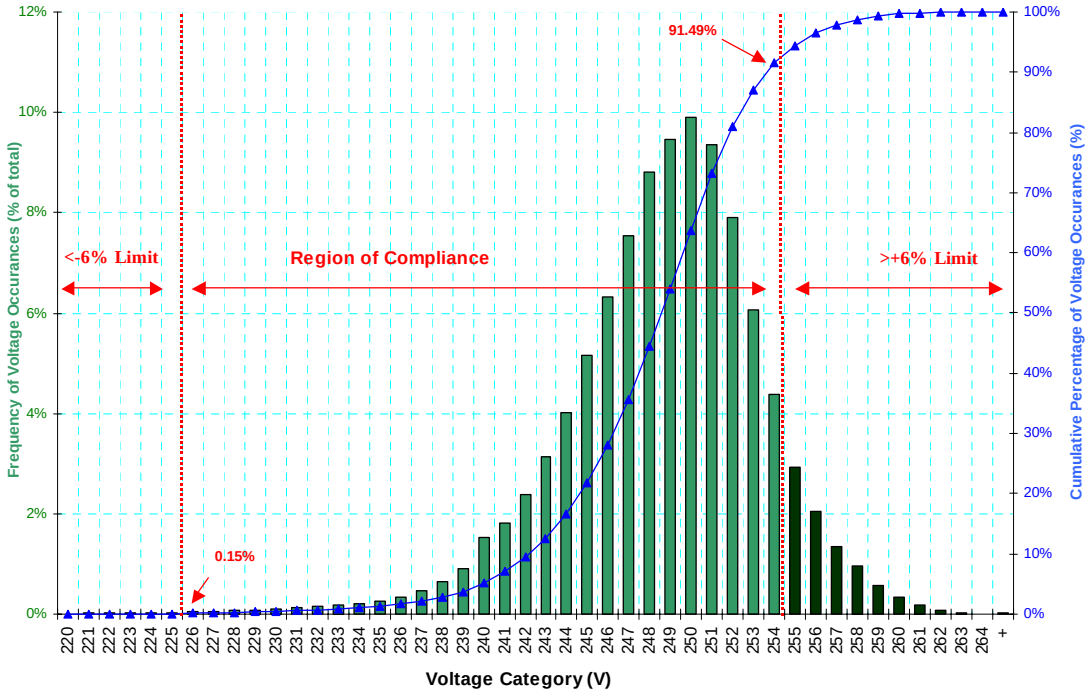

Figure 6 - Accumulated voltage distribution for recorded distribution transformer sites for the 2006/07 financial year

Voltage Unbalance Compliance

Figures 7 to 10 represent the aggregate of LV voltage unbalance at the distribution transformer and customer sites, and illustrate the level of compliance for Voltage Unbalance for 2005/06 and 2006/07.

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%.

Calculations were performed in accordance to the International Standard IEC 61000-4-30.

The results given in Figures 7 to 10 for voltage unbalance are based on an approximation method of comparing the voltage differences on each phase. This is because measuring instruments capable of measuring sequence components are not readily available. The approximation method requires voltage measurements to be phase to phase but in the process of addressing PQ complaints, only phase to neutral measurements were taken and therefore these values were used in the calculations. Nevertheless, as the phase angle displacement between all phases is typically 120°, the approximation method, using phase to neutral voltages still provides reasonable accuracy for voltage unbalance values.

Figures 7 to 10 depict the occurrences of voltage unbalance between 0 and 4 % 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 at below 2%.

In 2005/06 compliance with this requirement was achieved 96.28% of the time at customer sites and 99.48% at transformer sites. For 2006/07, compliance was achieved 96.93% of the time at customer sites and 99.18% at transformer sites The European Standard EN50160 requires that this be achieved 95% of the time or better.

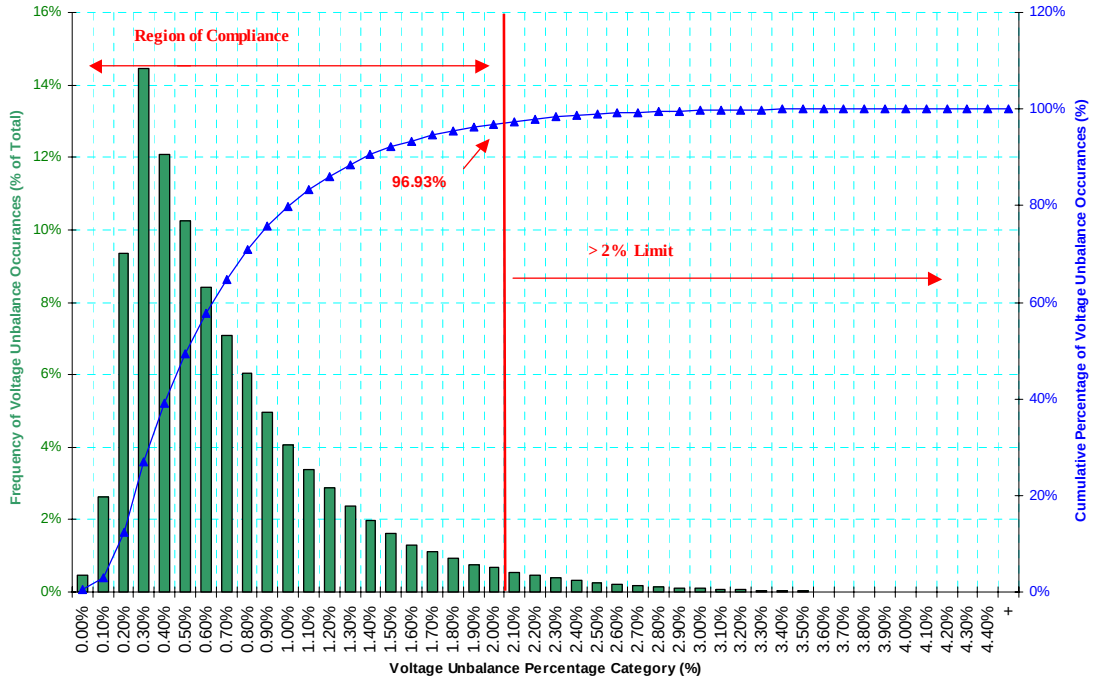

Figure 7 - Accumulated voltage unbalance for recorded customer sites for the 2005/06 Financial Year

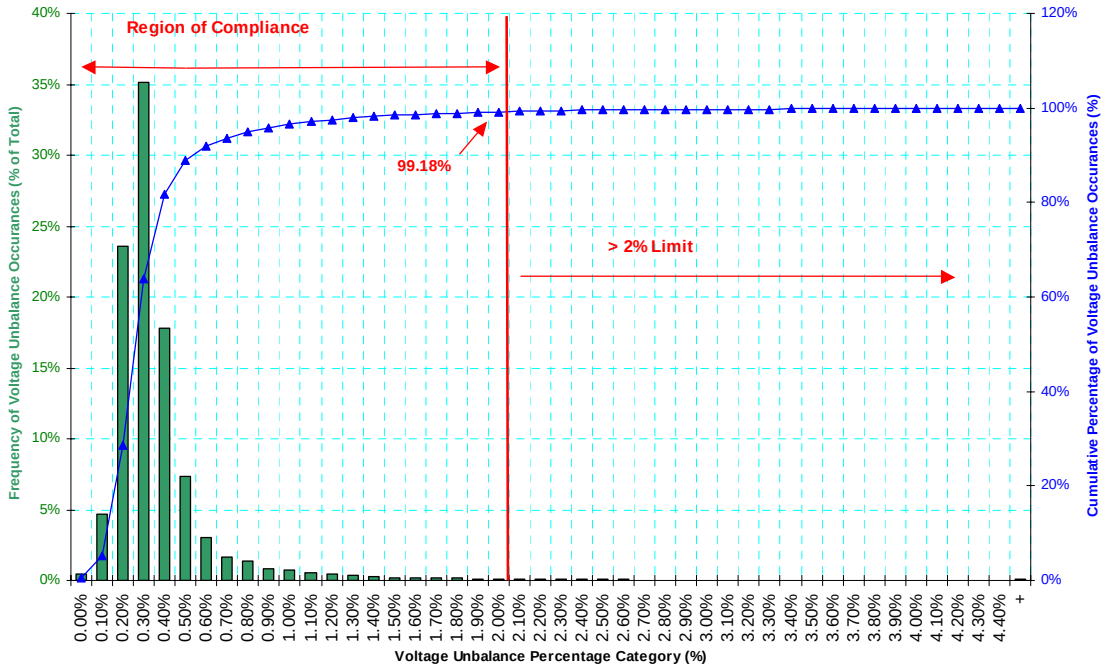

Figure 8 - Accumulated voltage unbalance for recorded distribution transformer sites for the 2005/06 financial year

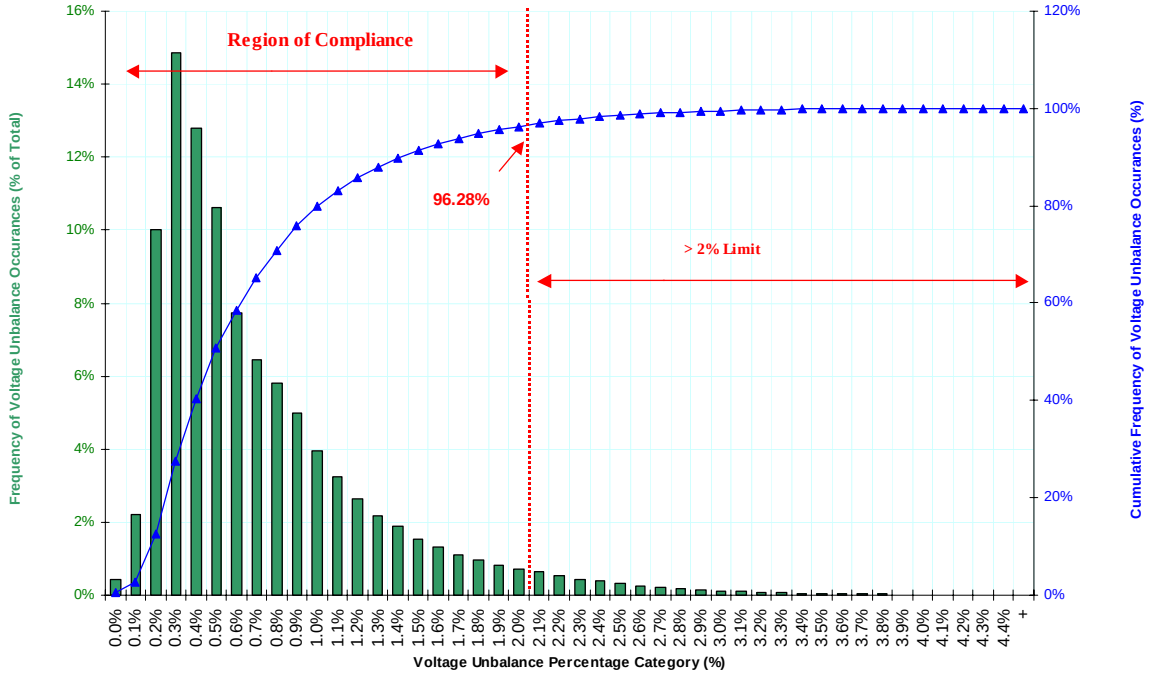

Figure 9 - Accumulated voltage unbalance for recorded customer sites for the 2006/07 financial year

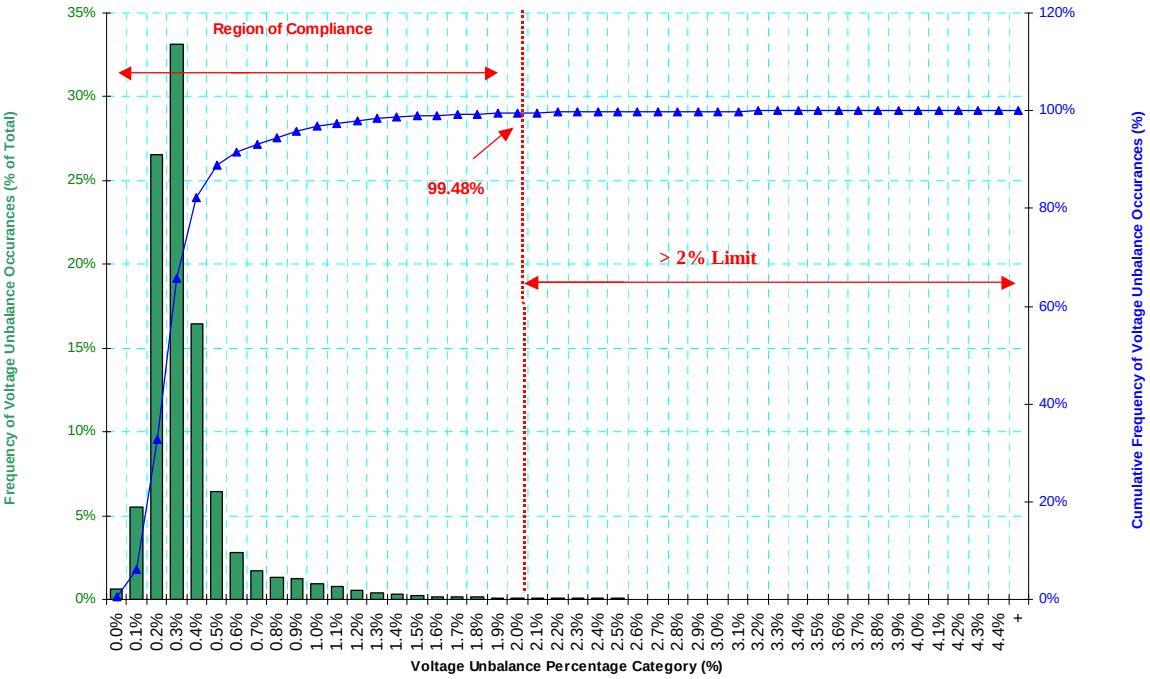

Figure 10 - Accumulated voltage unbalance for recorded distribution transformer sites for the 2006/07 financial year

5 Response to Item 5 of Schedule 1

5.1 Terminology applicable to this Section

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

Distinct outages are separated by 3+ hours.

5.2 Response

Customers that have been interrupted for more than 12 hours (customer premises are only counted once): 14,889.

Total customer interruption count for outages exceeding 12 hours (customers premises are counted each time an outage exceeds 12 hours): 18,228.

There were 335 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.

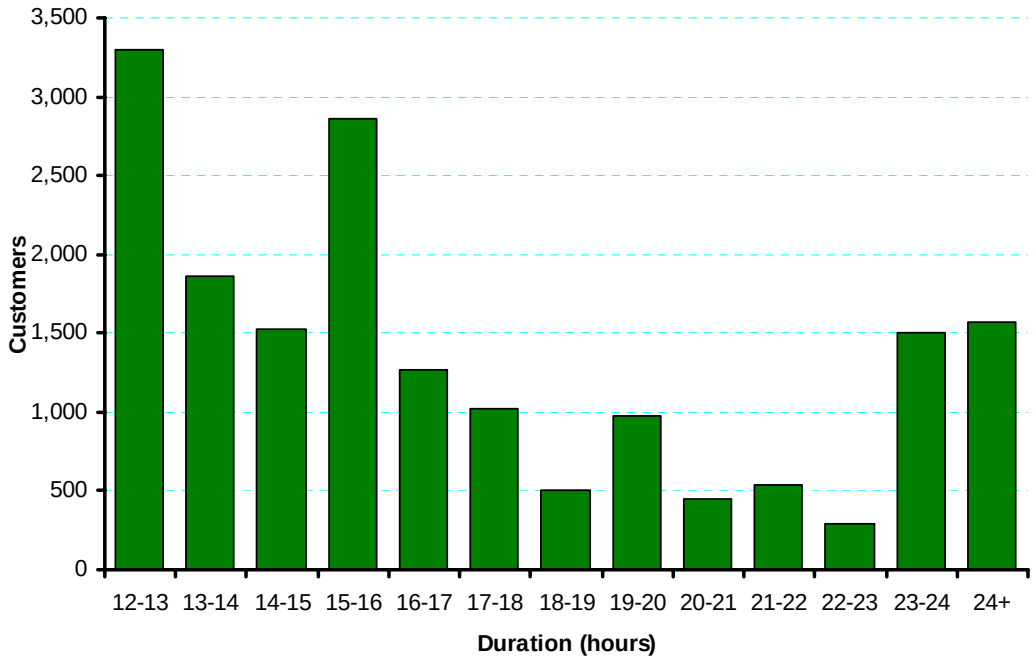

Figure 11 – Distribution of Customers by Outage Duration for the 2006/07 Financial Year

Urban area (including Perth CBD) customers that have been interrupted more than 9 times during the 2006/07 financial year: 25,577.

Rural area customers that have been interrupted more than 16 times during the 2006/07 financial year: 266.

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:

- 4 February 2007 - Bushfires in the Southern Metro/Peel region damaged transmission infrastructure resulting in blackouts of the Mandurah and Meadow Springs substations causing outages to approximately 50,000 customers; and
- 26 March 2007 - Approximately 52,000 customers were without power, predominantly in the Perth metropolitan area, due to pole top fires.

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 2006/07. This is in part due to an increase in planned outages and equipment failure.

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

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	22	10	11	33	19
SAIFI		0.33	0.1	0.05	0.26	0.19
CAIDI	Minutes	67	68	218	128	98
ASAI	%	100.00	100.00	100.00	99.99	100.00

Table 4 – Perth CBD area reliability (major event day inclusion)

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	44	10	11	33	25
SAIFI		0.38	0.14	0.05	0.3	0.21
CAIDI	Minutes	117	68	218	128	119
ASAI	%	99.99	100.00	100.00	99.99	100.00

6.3 Response - urban areas other than Perth CBD

SAIDI, SAIFI and CAIDI increased in urban areas during 2006/07. This is in part due to pole top fires, birds, equipment failure, bushfires and damage to assets from third party machinery. Strong focus on reliability improvement strategies and increased capital and operating expenditure in the urban areas for the forthcoming years are in place to reverse this recent upward trend.

Table 7 – Urban areas other than the Perth CBD reliability (major event day exclusion)

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	260	248	218	242	242
SAIFI		3.6	3.0	2.7	2.9	3.05
CAIDI	Minutes	73	83	81	84	79
ASAI	%	99.95	99.95	99.96	99.95	99.95

Table 8 - Urban areas other than the Perth CBD reliability (major event day inclusion)

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	283	408	218	264	293
SAIFI		3.7	3.5	2.7	3.0	3.23
CAIDI	Minutes	76	117	81	87	91
ASAI	%	99.95	99.92	99.96	99.95	99.94

6.4 Response – isolated networks

There were no outages recorded on the Bremer Bay network during the Major Event Days. There was insufficient data from March 2004 to June 2004 to adequately calculate the KPIs for the 2003/04 financial year. The Bremer Bay network is now connected to the SWIS where it will benefit from the more reliable distribution network supplied from the Albany zone substation.

Table 11 – Isolated Networks

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	N/A	121	232	856	478
SAIFI		N/A	4.0	10	19.4	13.4
CAIDI	Minutes	N/A	30	23	44	36
ASAI	%	N/A	99.98	99.96	99.84	99.91

6.5 Response – rural areas

SAIDI, SAIFI and CAIDI increased for rural areas during 2006/07. This is in part due to lightning, birds, bushfires and vegetation. Strong focus on reliability improvement strategies and increased capital and operating expenditure in the rural areas for the forthcoming years are now in place to reverse this recent upward trend.

Table 13 – Rural areas reliability (major event day exclusion)

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	590	503	462	552	519
SAIFI		4.9	3.7	3.9	4.2	4.10
CAIDI	Minutes	121	135	119	131	127
ASAI	%	99.89	99.90	99.91	99.89	99.90

Table 14 - Rural areas reliability (major event day inclusion)

		Financial Year Ending 30 June				4 Year
KPI	**Units**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**Average**
SAIDI	Minutes	615	552	462	563	548
SAIFI		5	4.04	3.89	4.3	4.29
CAIDI	Minutes	124	137	119	131	128
ASAI	%	99.88	99.89	99.91	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 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 17 - Complaints received in 2005/06 and 2006/07 - total and by discrete area as per Items 6 and 7 of Schedule 1 of the Code

	# Complaints	
Discrete Area	**2005/06**	**2006/07**
Perth CBD	3	9
Urban areas other than the Perth CBD	1,712	1,605
Rural areas	509	481
Isolated systems	7	0
Total	2,231	2,095

The total amount spent during 2006/07 addressing complaints was $10.2 million. This figure included the complaints received in Table 9 as well as complaints received prior to this time period. In comparison, the total amount spent during 2005/06 addressing complaints was $4.1 million.

8 Response to Item 9 of Schedule 1

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

Table 11 – Payments in 2005/06 and 2006/07 as per Items 8 of Schedule 1 of the Code

	2005/06		2006/07	
	Number	**Value**	**Number**	**Value**
Payments for failure to give required notice of planned Interrupton	31	$620	81	$1,620
Payments for supply interruptions exceeing 12 Hours	2,100	$168,000	3,709	$296,720

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 2006/07, 50 per cent of customers in urban areas had no more than 2 interruptions.

9.2 Average length of interruption

For 2006/07, although the majority of Perth CBD customers did not experience any outages (refer to Section 8.3), those that did had an average interruption length of 128 minutes (refer to Section 6.2).

The 100th percentile figure for Rural showing an average interruption length of 11,662 minutes is from a number of customers in the Dwellingup region that experienced successive outages due to bushfires in February 2007 (refer to Section 2 for further detail).

Table 212 – Average length of interruption (minutes) percentile figures as per Item 14(a) of Schedule 1 of the Code

	25th	50th	75th	90th	95th	98th	100th
Perth CBD	0	0	0	23	174	529	551
Urban (ex Perth CBD)	25	55	90	140	186	267	2,023
Rural	45	83	131	218	269	427	11,662

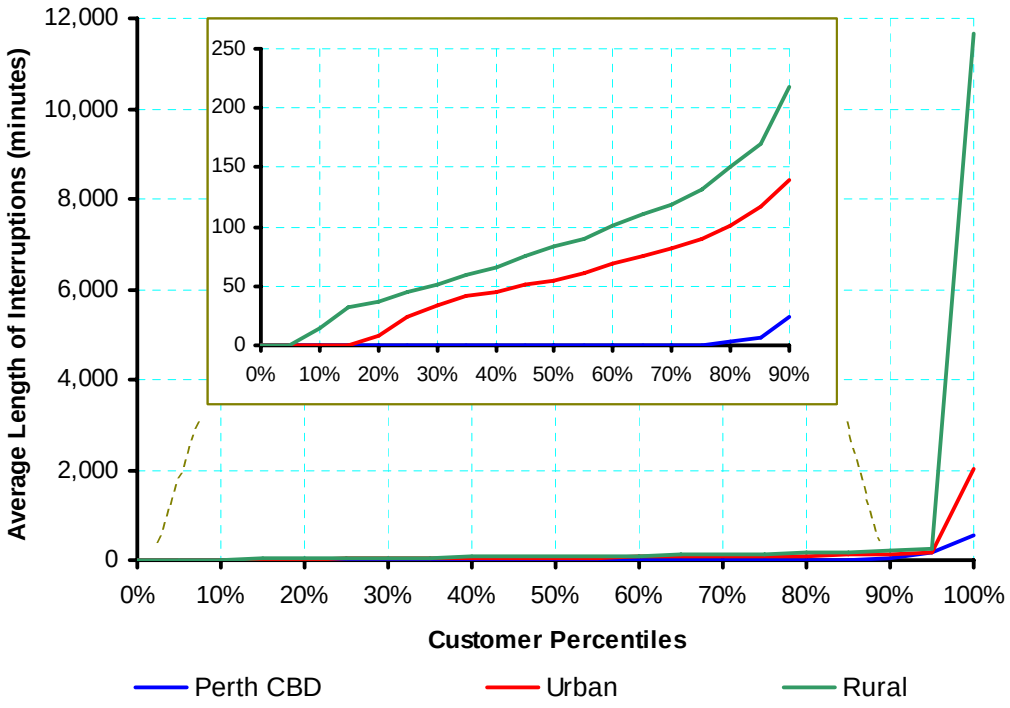

Figure 12 – Average length of interruption percentile distribution as per Item 15 of Schedule 1 of the Code

9.3 Number of interruptions

For 2006/07:

- Approximately 77% of CBD customers experienced no outages;
- Approximately 95% of urban area customers experienced 9 or less outages; and
- Approximately 99% of rural area customers experience 16 or less outages.

Targeted remedial work for the worst served customers is being planned to mitigate the current interruption frequency.

Table 13 – 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	1	2	3
Urban (ex Perth CBD)	1	2	4	6	9	11	25
Rural	2	4	6	8	10	13	28

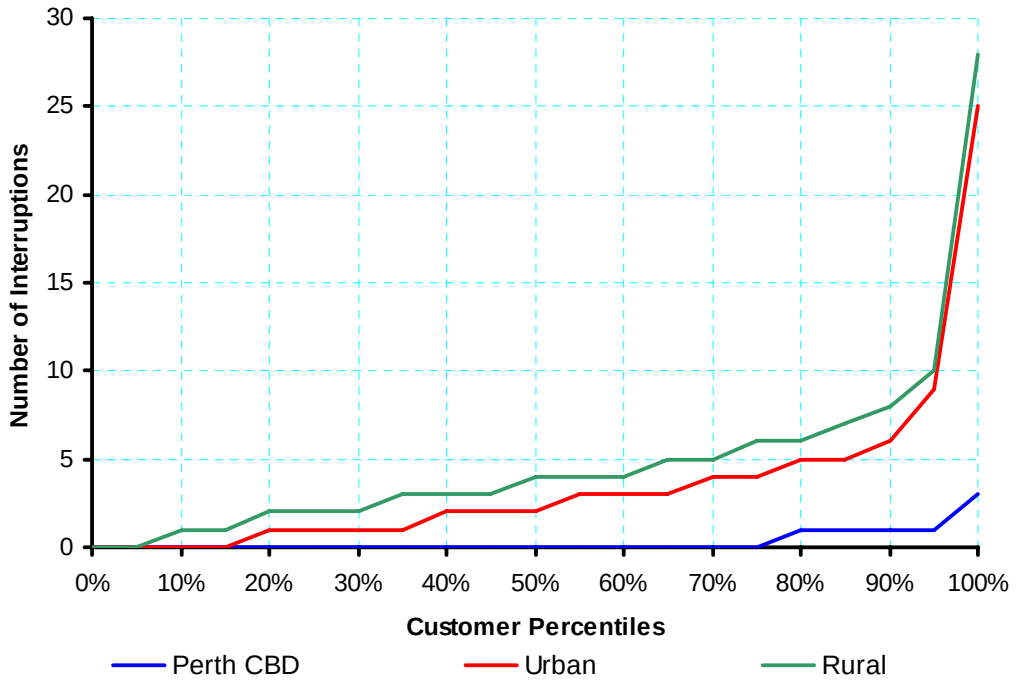

Figure 13 – Number of interruptions percentile distribution as per Item 15 of Schedule 1 of the Code

9.4 Total length of all interruptions

For 2006/07:

- Approximately 92% 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 22,902 minutes and primarily due to successive outages to bushfires in February 2007 (refer to Section 2 for further detail) in the Dwellingup region.

	25th	50th	75th	90th	95th	98th	100th
Perth CBD	0	0	0	23	264	529	1,102
Urban (ex Perth CBD)	38	147	351	675	911	1,226	6,068
Rural	104	315	660	1,291	1,946	3,162	22,902

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

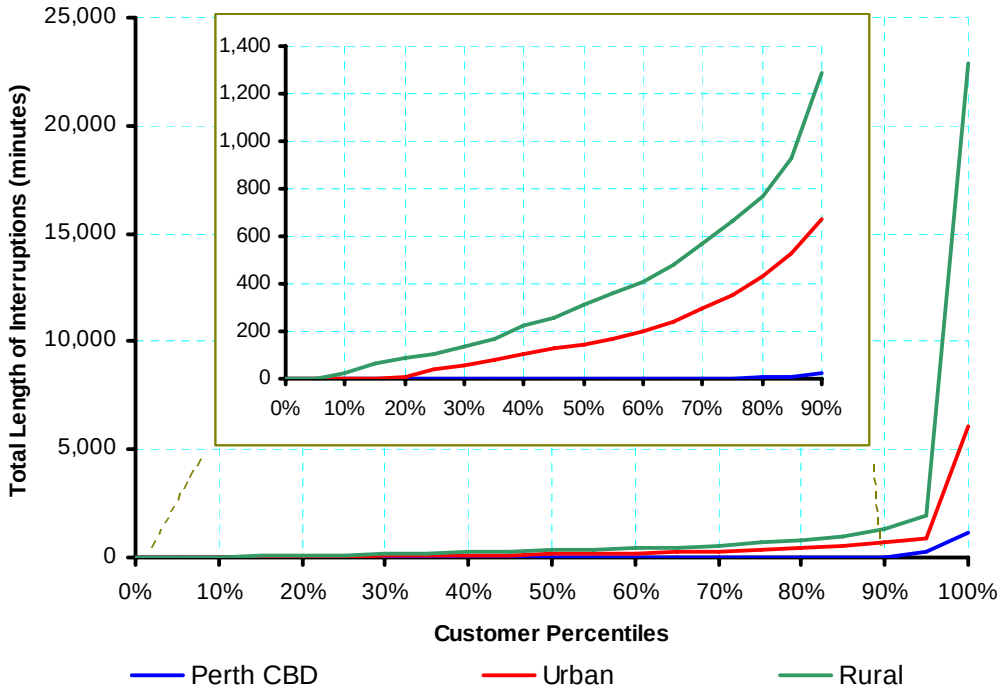

Figure 14 – Total length of interruptions percentile distribution as per Item 15 of Schedule 1 of the Code

Appendix A - List of Customer Outages Greater than 12 Hours

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
201679	13.5	13.5	19
247594	13.52	13.52	12
322654	38.63	38.63	30
325112	110.16	110.16	12
389690	19.69	19.69	39
422342	28.08	28.08	128
500136	25.21	25.22	10
507052	19	19	137
512714	23.19	43.74	5
561451	24.15	24.15	223
562278	14.71	14.71	4
579285	21.14	21.14	4
591630	13.23	13.23	6
648554	12.75	12.75	23
653452	12.83	15.39	769
722938	12.3	12.3	21
732142	51.94	51.94	14
771426	12.31	12.31	15
808055	16.84	16.84	6
904330	12.4	12.4	9
924273	14.65	21.37	27
938472	22.99	22.99	48
983629	21.36	21.36	11
1034763	14.42	14.42	8
1051356	20.87	20.87	37
1058586	18.85	18.85	6
1058725	15.14	15.14	13
1076552	13.09	14.11	197
1145992	25.95	25.95	13
1199906	14.58	14.58	6
1236867	16.13	16.13	45
1260311	15.48	15.48	44
1271935	17.71	17.71	61
1354179	25.83	25.83	15
1410394	25.66	25.66	57
1410519	16.91	16.91	44
1465689	12.78	12.78	176
1465817	19.65	19.65	12
1469935	25.8	25.8	45
1478257	14.26	14.26	41
1497656	24.57	24.57	14
1544860	32.32	32.32	6
1546539	15.83	15.83	10
1557642	13.08	13.08	324
1558987	38.14	38.14	46
1580385	22.75	22.75	38
1595319	15.98	15.98	8
1617799	16.31	16.31	14

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
1626691	16.71	16.71	12
1673109	28.01	28.01	24
1683107	23.06	23.06	15
1688719	15.02	15.02	1
1693143	16.61	16.61	35
1702709	19.42	19.42	2
1759397	16.4	16.4	72
1799534	16.08	16.08	29
1805566	13.44	13.44	31
1933632	21.94	21.94	40
1953084	28.28	28.28	30
1964310	13.94	13.94	12
1967487	21.05	42.17	14
1994084	23.25	23.25	765
2018366	21.05	22.84	5
2045479	22.62	22.62	13
2046614	194.36	194.36	21
2056498	13.51	13.51	13
2067471	15.05	15.05	145
2092032	87.48	87.48	6
2101837	20.4	20.4	11
2268624	17.1	17.1	101
2348035	23.4	23.4	24
2379160	17.4	17.4	2
2381845	19.05	19.05	10
2402700	28.47	28.47	212
2455080	281.75	281.75	2
2459113	15.67	15.67	45
2584874	14.69	14.69	225
2602877	17.99	17.99	17
2637280	12.47	15.42	7
2680574	22.14	22.14	28
2755504	16.63	16.63	6
2801006	20.84	20.84	10
2810637	17.97	17.97	62
2816596	13.08	13.08	119
2876953	17.68	17.68	13
2917096	30.88	30.88	40
2955807	22.71	22.71	16
2981900	74.12	74.28	2
2984823	12.65	12.65	73
2989917	14.5	14.5	8
3047079	15.14	15.14	2
3073736	281.78	281.78	6
3078857	27.08	27.08	17
3082531	13.74	13.74	12
3121590	12	12	24
3123427	12.08	12.08	12
3137160	28.33	28.33	2
3159461	26.8	26.8	6

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
3167974	14.85	14.85	107
3175409	14.04	14.04	1
3180543	14.78	14.78	17
3223817	24.69	29.91	26
3248380	14.9	14.9	37
3250952	13.21	13.21	63
3283590	16.71	16.71	32
3301333	23	24.18	769
3359652	15.71	15.71	102
3449332	18.18	18.18	17
3451059	18.63	18.63	61
3454744	13.33	13.33	120
3497019	20.5	20.5	2
3526969	22.05	22.05	17
3581877	15.52	15.56	712
3584121	34.28	34.28	20
3596180	20.95	20.95	8
3608914	17.91	24.28	62
3632685	16.72	16.72	9
3670362	37.52	37.52	29
3686595	16.41	16.41	140
3690889	14.69	14.69	2
3694667	14.83	14.83	8
3701662	19.81	19.81	5
3787887	12.87	12.87	175
3812665	12.05	12.05	41
3822384	13.32	13.32	103
3906409	31.36	31.36	6
4059389	27.79	27.79	28
4105951	26.22	26.22	12
4143759	17.79	17.79	28
4148442	29.22	29.22	1
4149260	17.93	17.93	185
4201462	17.69	17.69	15
4210493	19.15	19.15	66
4233167	12.44	13.67	162
4282769	15.75	15.75	25
4289340	29.24	29.24	3
4308761	23.21	23.21	7
4340994	13.7	13.7	29
4343291	15.95	17.52	10
4344839	31.76	31.76	9
4363413	12.16	12.16	928
4376339	16.4	16.4	22
4381016	14.79	14.79	18
4397685	13.32	13.32	10
4398435	29.79	29.79	22
4438047	18.39	18.39	23
4458393	28.21	45.19	13
4487703	14.08	14.08	6

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
4496953	20.8	20.8	13
4501532	19.91	19.91	81
4512321	28.57	28.57	12
4517458	13.08	13.08	25
4518139	18.78	18.8	58
4543444	21.26	21.26	161
4568254	23.33	23.33	2
4643190	19.16	19.16	13
4673017	12.21	12.21	17
4682081	21.43	21.43	22
4686212	21.08	21.08	17
4753757	16.12	16.12	9
4755207	21.11	21.11	57
4782229	14.93	14.93	4
4791923	12.64	12.64	23
4841601	281.75	281.75	2
4854785	22.86	22.86	29
4870397	281.76	281.76	3
4972989	19.21	19.21	13
5014023	26.2	26.2	5
5042768	17.72	17.72	15
5042921	12.01	12.01	146
5071127	19.28	19.28	20
5112410	17.53	17.53	10
5138579	21.6	21.6	45
5156278	17.08	17.08	80
5175449	14.05	14.05	9
5319243	29.21	29.21	13
5321285	12.25	12.25	19
5343573	19.19	19.19	40
5447244	12.64	12.64	72
5447844	22.5	22.5	22
5482259	14.06	14.06	19
5493094	13.44	13.44	67
5495808	15.35	15.35	8
5535516	22.44	22.44	22
5549476	23.29	23.29	13
5562572	18.01	18.01	30
5614978	26.93	26.93	3
5636786	12.79	12.79	1
5645797	17.79	17.79	21
5763346	21.07	21.07	16
5791130	16.48	16.48	26
5802991	14.85	14.85	23
5812503	15.13	15.13	1
5822087	16.6	16.6	10
5837515	19.78	19.78	6
5856523	14.23	14.23	8
5900713	49.31	49.31	27
6008308	12.28	12.28	17

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
6054058	21.66	21.66	44
6077437	15.49	15.49	29
6084150	15.78	15.78	12
6133816	15.15	15.15	2
6145667	14.53	14.53	4
6172357	19.63	19.63	9
6225215	12.96	18.69	137
6236354	19.01	19.01	4
6245089	13.02	13.02	133
6296309	16.03	16.03	32
6375307	16.17	16.17	58
6413126	15.28	15.28	5
6440195	19.2	19.2	219
6547632	15.77	15.77	22
6562139	12.9	16.67	50
6588487	17.44	17.44	15
6597110	87.44	87.44	421
6621238	14.56	14.56	18
6671391	22.27	22.8	11
6745436	12.14	23.72	11
6770791	13.12	13.12	29
6897041	14.62	14.62	12
6924922	20.1	20.1	3
6939408	12.97	12.97	7
6949307	12.08	12.08	6
6987285	12.65	12.65	176
7026134	14.34	14.34	50
7046371	20.32	20.32	208
7071295	12.76	13.77	268
7125115	15.95	15.95	58
7127684	20.84	20.84	44
7136793	19.71	19.71	90
7161752	100.88	100.88	13
7173302	13.31	13.31	23
7192745	19.52	19.52	33
7195886	21.78	21.78	23
7243671	12.95	12.95	152
7275481	15.44	15.44	46
7278148	15.73	15.73	2
7284948	15.27	15.27	23
7297083	13.18	13.18	21
7319365	17.01	17.01	17
7376399	13.79	13.79	21
7449007	14.47	17.19	540
7482495	23.55	23.55	17
7501996	16.85	16.85	408
7521305	14.22	14.22	9
7531593	15.63	15.63	100
7549781	17.84	17.84	38
7571825	22.73	22.73	19

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
7585828	19.43	19.43	84
7598814	15.5	15.5	18
7601672	15.54	15.54	12
7639647	49.1	49.1	14
7656228	18.84	18.84	6
7662585	14.93	14.93	227
7703536	15.31	15.31	6
7738063	14.92	14.92	86
7749789	23.88	23.88	26
7752336	12.2	12.2	20
7758346	19.1	19.1	19
7763565	16.49	16.49	91
7803890	14.59	14.59	137
7841133	14.13	14.13	87
7927391	18.52	18.52	5
7954025	21.15	21.15	2
7984158	18.33	18.33	2
7991941	28.31	28.31	4
7997875	25.79	25.79	6
8110706	24.2	24.2	18
8124164	47.24	47.24	12
8139576	17.07	17.07	5
8160261	145.03	145.03	2
8175430	18.88	18.88	14
8197114	14.03	14.03	96
8262362	14.78	14.78	35
8281498	12.75	12.75	31
8391834	16.57	16.57	69
8423399	46.62	46.62	5
8423736	15.53	15.53	29
8519081	15.39	15.39	26
8524308	15.02	15.02	302
8560315	13.19	13.19	7
8561249	24.45	24.45	10
8638697	27.77	27.77	13
8676432	18.5	18.5	22
8685486	16.22	16.22	13
8693089	12.05	12.09	100
8724055	64.95	64.95	4
8728723	38.53	38.53	10
8753542	20.45	20.45	8
8783851	15.12	15.12	60
8804251	25.38	25.38	6
8826813	29.04	29.04	29
8883997	18.7	18.7	8
8890379	14.7	14.7	3
8905709	19.67	19.67	156
8925165	22.16	22.16	8
8931455	20.94	20.94	38
8960193	15.32	15.32	3

Fault Job Number	Restoration Time (hours)		Customers Affected
	First Restoration after 12 hours	Final Restoration	
9010410	15.94	15.94	165
9032997	22.7	22.7	15
9062781	12.29	13.21	63
9081779	14.39	15.02	152
9184843	24.97	24.97	19
9211961	21.07	21.07	13
9228039	24.59	24.59	6
9231503	16.12	16.12	30
9246631	17.13	17.13	26
9268721	44.04	44.04	6
9269101	18.15	18.15	58
9271822	24.02	24.02	6
9324066	18.52	18.52	17
9360356	16.85	16.85	12
9397007	13.73	13.73	1
9429408	12.45	12.45	10
9445019	24.67	24.67	17
9487549	70.6	70.6	62
9503126	15.82	15.82	11
9515280	19.25	19.25	48
9557573	12.15	12.15	51
9578441	12.34	12.34	3
9615823	16.44	16.44	40
9619999	20.33	20.33	37
9679589	24.05	24.05	23
9709236	23.57	23.57	6
9709941	12.31	12.31	201
9735022	21.29	21.29	29
9825071	21.11	21.11	27
9891593	17.6	17.6	16
9910284	14.24	14.24	35
9964474	20.39	20.39	31
9975061	14.71	14.71	29
9987573	12.9	12.9	11
9990873	17.87	17.87	265
9993361	15.87	15.87	60
9993407	19.69	19.69	2