

NSW Electricity Information Paper No 3

Reliability and quality of supply of electricity to customers in NSW

For the period 1 July 2002 to 30 June 2005

A series of information papers on the performance of NSW electricity businesses

Introduction

The licensing regime under which NSW electricity distributors operate was extended considerably on 28 July 2005 when the Minister approved additional conditions addressing network design, reliability and performance.

Prior to the changed licence conditions, the licensing regime required the then four NSW electricity distributors to *publish information* on reliability and quality of the supply of electricity to NSW customers.¹ This Information Paper summarises this information as reported by the distributors. The distributors are known as DNSPs or Distribution Network Service Providers in the *National Electricity Rules*.

The Information Paper is one of a series of papers published by the Independent Pricing and Regulatory Tribunal of NSW (the Tribunal), which aim to ensure that all stakeholders in the distribution and retailing of electricity in NSW have ready access to some pertinent information about the DNSPs and electricity retailers.²

¹ The four distributors were Australian Inland, Country Energy, EnergyAustralia and Integral Energy. Australian Inland was merged with Country Energy on 1 July 2005. Each distributor's website contains the annual *Electricity Network Performance Reports*.

² Other information papers include #1: Distribution businesses' performance against customer service indicators and #2: Retailers' performance against customer service indicators.

Defining and measuring reliability of electricity supply

Most people and businesses which purchase electricity are interested to know how reliable the supply of it is likely to be. Customers usually like to know, at the very least, how many unexpected interruptions to supply might they face in a year, and for how long in each case.

The DNSPs maintain records on planned and unplanned interruptions, both their number and length. The terminology employed to define interruptions sounds complex, but it reflects the diverse range of possibilities for interruption that the distributors and their customers may face.

The following terminology is used to define **outages** and **reliability standards**:

- ▼ **Planned outages:** occur when a DNSP needs to disconnect supply to undertake maintenance or construction work. Under the NSW Guaranteed Customer Service Standards, which came into force on 28 July 2005, DNSPs are required to give customers a minimum of two business days written notice of a planned outage.
- ▼ **Unplanned outages:** occur when equipment failures cause the supply of electricity to be disconnected unexpectedly. The principal causes of unplanned outages are external factors related to such things as lightning strikes, trees (or birds or possums) falling, vehicles crashing and vandalism. Unplanned outages can also be caused by equipment failure, due to overload and general deterioration. The impact of unplanned outages on the reliability of supply is further influenced by weather conditions, the design of the network, maintenance practices and the time taken by a DNSP to restore supply after a power interruption.
- ▼ **Momentary interruptions:** are outages which are reduced to only momentary interruptions due to auto-close devices being installed on the network to restore supply. The alternative to experiencing a momentary interruption would be an extended outage requiring supply to be restored by an operator.

To measure outages and interruptions in a consistent and precise manner, the DNSPs calculate the following indices:

- ▼ **SAIDI:** System Average Interruption Duration Index. This index measures the time customers were without electricity in a given year relative to the total number of customers connected to the network. It is a measure of interruptions (in minutes) per customer. It includes planned and unplanned interruptions, but not momentary interruptions.
- ▼ **SAIFI:** System Average Interruption Frequency Index. This measures the *number of interruptions* customers experienced in a given year relative to the total number of customers on the network. Again, both planned and unplanned interruptions are included, momentary interruptions excluded.
- ▼ **CAIDI:** Customer Average Interruption Duration Index. This index measures the time taken to restore supply relative to the total number of customer interruptions, or duration of interruptions per customer. It is simply measured by dividing SAIDI by SAIFI.
- ▼ **MAIFI:** Momentary Average Interruption Frequency Index. This measures the number of momentary interruptions customers experienced in a year relative to the total number of customers connected to the network, or number per customer.

Measuring the reliability of electricity supply across the state

The System Average Interruption Duration Index (SAIDI) can be calculated in several ways:

- ▼ as a measure of the extent of planned or unplanned interruptions
- ▼ normalised to exclude interruptions caused by events beyond the control of the DNSP
- ▼ as an overall measure of interruption duration.

All four measures are shown in Table 1 for the NSW distributors. Planned and unplanned outages have been defined on the previous page. Normalised interruptions are measured to exclude interruptions caused by events beyond the control of the DNSP. Total interruptions may be higher than the sum of planned and unplanned interruptions because they include outages that were actually caused within the transmission system.

Minutes lost through interruptions have been broadly stable in recent years, especially for the normalized interruptions that are within the control of the DNSPs.

Table 1 Duration of interruptions (in minutes per annum) per customer (SAIDI)

	2002/03	2003/04	2004/05
EnergyAustralia			
Planned	5	6	6
Unplanned	113	142	143
Normalised	91	107	112
Total	120	148	154
Integral Energy			
Planned	35	30	29
Unplanned	182	396	176
Normalised	120	117	86
Total	219	426	211
Country Energy			
Planned	48	67	52
Unplanned	239	295	296
Normalised	230	248	269
Total	308	371	355
Australian Inland			
Planned	113	158	94
Unplanned	161	277	232
Normalised	157	259	193
Total	336	507	367

Sources for all Tables and Figures: *Electricity Network Performance Reports* published by the DNSPs.

Different customer types had very different interruption experiences, on average. In general, **rural** customers faced much longer (Table 2) and more frequent (Table 3) interruptions than either central business district (CBD) or urban customers. Not surprisingly, the length and number of interruptions is highest for rural customers whose feeder supply lines are long.

The most common number of interruptions has been only one or two in recent years (Table 3) with the most occurring in the rural areas of three of the four DNSPs and up to an average of six interruptions a year for rural – long customers supplied by Energy Australia.

Table 2 Duration of interruptions by customer location (overall SAIDI)

	2002/03	2003/04	2004/05
EnergyAustralia			
CBD	48	106	10
Urban	93	109	123
Rural - short	423	568	507
Rural - long	887	1,450	1,279
Integral Energy			
CBD	na	na	na
Urban	na	241	154
Rural - short	na	871	362
Rural - long	na	174	994
Country Energy			
CBD	na	na	Na
Urban	144	145	139
Rural - short	309	388	370
Rural - long	631	874	820
Australian Inland			
CBD	na	na	na
Urban	255	163	154
Rural - short	155	305	170
Rural - long	366	736	566

na = not applicable or not available.

Table 3 Number of interruptions by customer location (normalised SAIFI)

	2002/03	2003/04	2004/05
EnergyAustralia			
CBD	0.16	0.17	0.10
Urban	0.97	1.09	1.14
Rural - short	3.73	4.06	3.16
Rural - long	5.30	9.18	6.22
Overall	1.18	1.32	1.30
Integral Energy			
CBD	na	na	na
Urban	0.87	1.10	0.83
Rural - short	1.22	2.19	2.13
Rural - long	0.99	0.82	4.34
Overall	1.30	1.43	1.18
Country Energy			
CBD	na	na	na
Urban	1.25	1.58	1.50
Rural - short	2.18	2.47	2.74
Rural - long	3.83	4.27	4.85
Overall	2.16	2.39	2.60
Australian Inland			
CBD	na	na	na
Urban	3.10	2.40	1.04
Rural - short	0.50	1.60	1.25
Rural - long	1.20	3.10	2.24
Overall	1.60	2.64	1.83

Feeder category definitions

CBD	A feeder supplying Sydney CBD as determined from zone substation coverage maps.
Urban	A feeder, which is not a CBD feeder, with load density greater than 0.3MVA/km.
Short Rural	A feeder, which is not a CBD or Urban feeder, with total length less than 200km.
Long Rural	A feeder, which is not a CBD or Urban feeder, with total length greater than 200km.

Note: Short Rural feeders include feeders in urban areas with low load densities.

Measuring the reliability of electricity supply by region

Each DNSP collects reliability data by regions ('supply areas'). These are shown in Table 4.

In general in 2004/05, rural and regional customers on widely-spread networks experience more time lost from interruptions than urban customers. (Sydney North in the EnergyAustralia area is an exception.) About half the areas showed fewer minutes lost in 2004/05 than in 2003/04 and about half showed more minutes lost.

Table 4 Duration of interruptions per customer (normalised SAIDI, minutes pa)

	2002/03	2003/04	2004/05
EnergyAustralia			
Central Coast	238	256	228
Sydney East	27	32	34
Lake Macquarie	74	144	Note1
Lower Hunter/Maitland	196	312	246
Upper Hunter/Muswellbrook	264	418	219
Newcastle	146	111	118
Sydney North	96	107	171
Sydney South	53	62	56
Integral Energy			
Northern	104	105	89
Central	99	117	71
Southern	187	142	107
Country Energy			
Mid North Coast	221	231	245
Far North Coast	208	338	288
Northern	417	339	345
Central Western	202	242	276
North Western	213	317	296
South Eastern	213	190	282
Riverina	181	170	263
South Western	157	107	154
Australian Inland			
Northern	147	274	117
Southern	172	235	319

Source: Electricity Network Performance Report published by the DNSPs.

Note 1: merged with Newcastle.

Measuring reliability performance against targets

So far in this Information Paper, we have considered actual performance across all DNSPs and across regions. But the DNSPs have performance targets to meet in many areas of their businesses, including reliability. This section, therefore, looks at performance relative to targets set for 2004/05 (where such targets have been set) or the average reliability achieved over the previous five years.

In general, DNSPs have met their targeted or average reliability performance in 2004/05 as measured by normalised time lost and number of interruptions per customer. The exceptions are mostly in the time lost from interruptions in all but two of EnergyAustralia's areas and in the number of interruptions in one of Integral Energy's areas (Table 5).

Table 5 DNSPs' actual performance and targets in 2004/05 (normalised)

	SAIDI Target or Average	SAIDI Actual	% better (+)/worse(-) than Target or Average	SAIFI Target or Average	SAIFI Actual	% better (+)/worse (-) than Target or Average
EnergyAustralia³						
Central Coast	263	228	13%	3	2.7	11%
Maitland/Lower Hunter	240	246	-2%	4	2.7	34%
Muswellbrook/Upper Hunter	242	219	9%	4	2.6	36%
Newcastle	100	118	-18%	2	1.3	37%
Sydney East	29	34	-19%	1	0.4	60%
Sydney North	124	171	-38%	2	1.9	6%
Sydney South	50	56	-12%	1	0.8	24%
Integral Energy						
Northern	115	89	23%	1.2	1.1	6%
Central	99	71	28%	1.0	0.9	17%
Southern	141	107	24%	1.6	1.9	-16%
Country Energy						
	329	269	18%	3.2	2.6	17%
Australian Inland						
Northern	np	117	-	np	1.4	-
Southern	np	319	-	np	2.6	-

Source: Electricity Network Performance Report published by the DNSPs.

np = not provided. Percentage changes have been calculated based on unrounded numbers.

Historical data for normalised interruptions (or "minutes-off-supply" as measured by normalised SAIDI) are shown in Figures 1 to 4. In general, performance is mixed with few discernible trends of improvement or deterioration.

³ The SAIDI and SAIFI figures quoted for Energy Australia are not targets but five year averages and indicate the average reliability that a customer might expect in the specified region (EnergyAustralia, *Electricity Network Operation Standards*, July 2004, p 6).

Figure 1 Australian Inland – minutes-off-supply

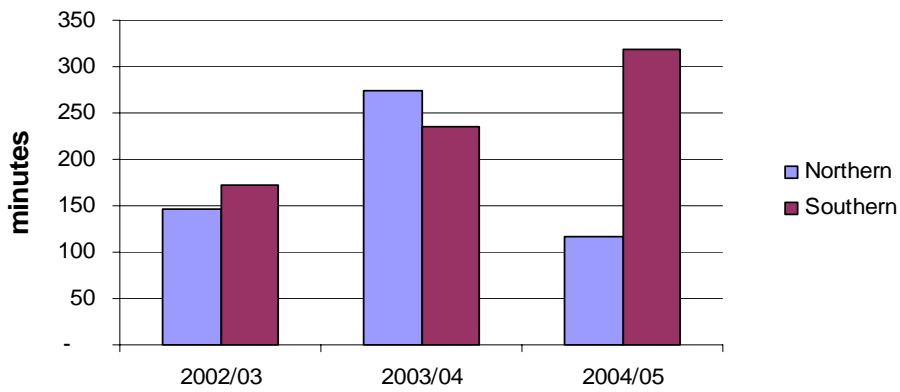


Figure 2 Country Energy – minutes-off-supply

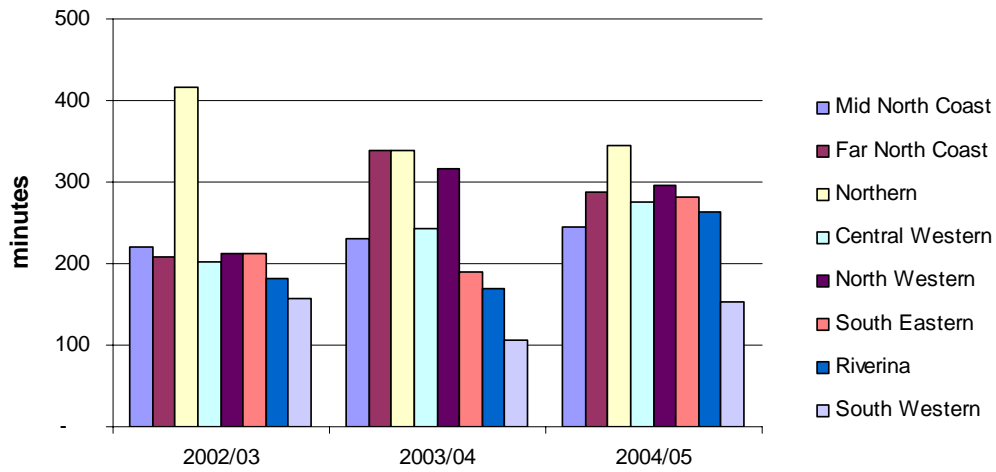


Figure 3 EnergyAustralia – minutes-off-supply

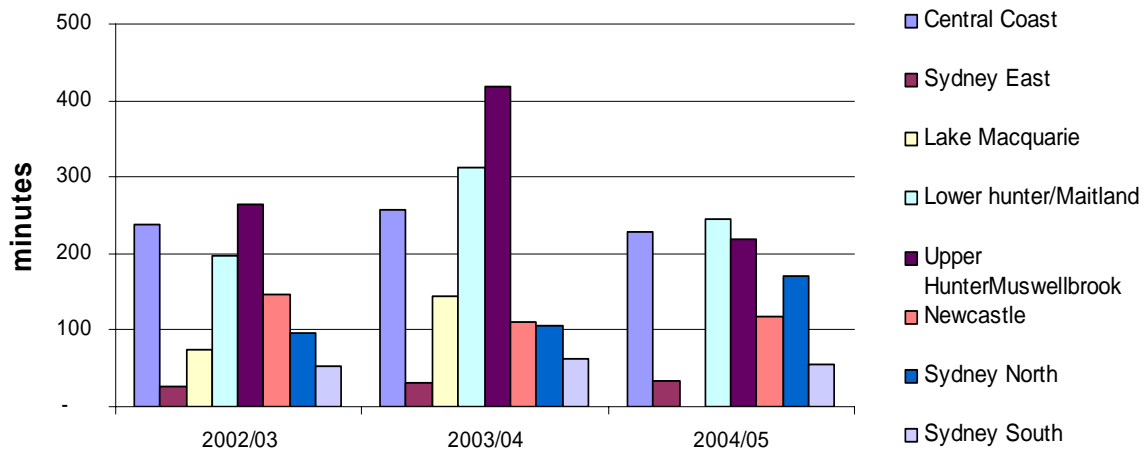
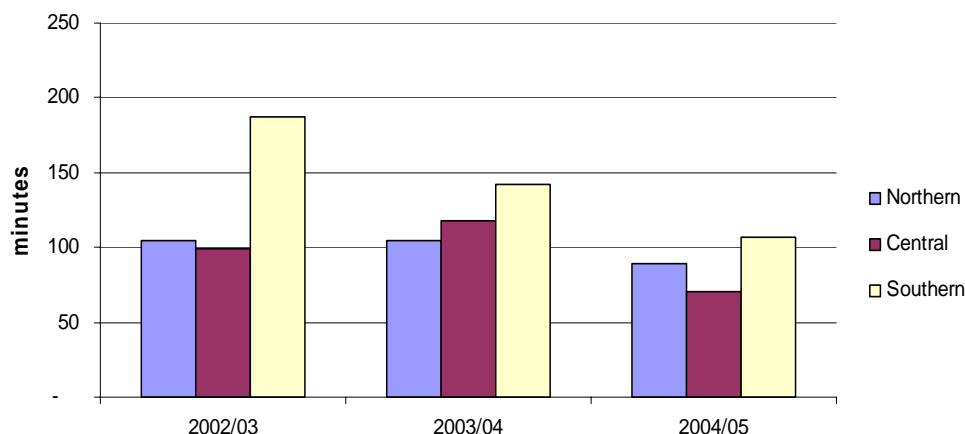


Figure 4 Integral Energy – minutes-off-supply



Defining and measuring the quality of supply

Customer complaints are investigated by DNSPs and valid ones⁴ are categorised into: 'quality of supply', 'reliability of supply' and 'network safety'.

The 'quality of supply' of electricity is measured by its 'voltage', its 'current' and 'other quality' measures:

- ▼ 'voltage' is multi-dimensional. It includes a number of technical measures such as sustained over-voltage, sustained under-voltage, voltage fluctuations, voltage dips, switching transients and other measures
- ▼ 'current' also has several dimensions, namely direct current, harmonic content and inter-harmonics
- ▼ 'other quality' includes mains signalling reliability, noise and interference, level of supply capacity, supply frequency and others.⁵

Table 6 presents valid complaints on quality of supply from 2002/03 to 2004/05. In general, the number of complaints fell in 2004/05.

⁴ A complaint is valid if the circumstances indicate non-compliance with published service and network standards.

⁵ All of these measures of quality are set out in the *Electricity Network Performance Report* of each DNSP.

Table 6 Complaints concerning the quality of electricity supply

	2002/03	2003/04	2004/05
Energy Australia			
Voltage	174	129	114
Current	-	1	1
Other quality	14	61	4
Total	188	191	119
% valid	23%	24%	50%
Integral energy			
Voltage	499	454	439
Current	1	1	-
Other quality	190	101	85
Total	690	556	524
% valid	np	np	30%
Country Energy			
Voltage	146	168	163
Current	-	-	-
Other quality	38	60	41
Total	184	228	204
% valid	63%	88%	53%
Australian Inland			
Voltage	27	35	28
Current	-	-	-
Other quality	-	-	-
Total	27	35	28
% valid	67%	66%	46%

Source: *Electricity Network Performance Report* of the DNSPs. np means not provided.