

## NSW Electricity Information Paper No 1/2007

# Reliability and quality of supply of electricity to customers in NSW

For the period 1 July 2002 to 30 June 2006

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

## Introduction

This Information Paper is one of a series of papers published by the Independent Pricing and Regulatory Tribunal of NSW (the Tribunal), which aims to ensure that all stakeholders in the distribution and retailing of electricity in NSW have ready access to some pertinent information.<sup>1</sup> This current paper updates Information Paper no. 3 from 2006 with data for 2005/06.

The licensing regime under which NSW electricity distributors operate requires them to *publish information* on reliability and quality of the supply of electricity to NSW customers.<sup>2</sup> 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*.

Most people and businesses that 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 they might face in a year, and for how long in each case.

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<sup>1</sup> Other information papers include: no.4/2006: *Retailers' performance against customer service indicators*; no. 5/2006: *Distribution businesses' performance against customer service indicators*; and no. 2/2007: *General and financial information on the electricity distributors in NSW*.

<sup>2</sup> The three distributors are Country Energy, EnergyAustralia and Integral Energy. Each distributor's website contains their annual *Electricity Network Performance Reports*.

# Defining and measuring reliability of electricity supply

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 disrupted unexpectedly. The principal causes of unplanned outages are external factors related to such things as lightning strikes, trees falling, birds or possums, 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 can include 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 can be 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. The new Department of Energy, Utilities and Sustainability (DEUS) licence conditions do not require the DNSPs to report on MAIFI.

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

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

All these 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.

Minutes lost through interruptions have been broadly stable in recent years, especially for the normalised interruptions that are within the control of the DNSPs. The one exception is Country Energy's SAIDI, which has increased significantly in 2005/06. The company attributes this increase to improved data capture rather than to a decline in performance.

**Table 1 Duration (minutes) of interruptions per customer (SAIDI)**

	2002/03	2003/04	2004/05	2005/06
<b>EnergyAustralia</b>				
Planned	5	6	6	6
Unplanned	113	142	143	111
Normalised	91	107	112	90
Total	120	148	154	117
<b>Integral Energy</b>				
Planned	35	30	29	31
Unplanned	182	396	176	99
Normalised	120	117	86	99
Total	219	426	211	130
<b>Country Energy</b>				
Planned	48	67	52	53
Unplanned	239	295	296	350
Normalised	230	248	269	301
Total	308	371	355	413

Source: *Electricity network performance reports* published by the DNSPs.

Notes to Table 1:

1. From 2005/06, Country Energy data include Australian Inland data. The two companies merged on 1 July 2005.
2. 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.
3. Under the new licence conditions, reliability data using the normalised distribution network for the years 2005/06 and onwards will be based on the Institute of Electrical and Electronics Engineers (IEEE) standard 1366-2003, rather than the Standing Committee on National Regulatory Reporting Requirements (SCNRRR) standard. SCNRRR excludes natural events with a SAIDI impact of greater than three minutes, while the IEEE standard excludes natural events which are more than 2.5 standard deviations greater than the mean of the log normal distribution of five years' SAIDI data. In practice, there is a difference of around +/- 5 to 10% between the two measures. The data in the table for 2005/06 are not therefore strictly comparable with those for previous years.

Different customer types had very different average interruption experiences. 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 of interruptions is highest for rural customers whose feeder supply lines are long.

**Table 2 Duration (minutes) of interruptions by customer location (normalised SAIDI)**

	2002/03	2003/04	2004/05	2005/06
<b>EnergyAustralia</b>				
CBD	48	106	10	13
Urban	72	79	96	69
Rural - short	309	402	298	337
Rural - long	502	1,131	820	342
Organisation*	91	107	112	90
<b>Integral Energy</b>				
CBD	na	na	na	na
Urban	77	81	54	67
Rural – short	129	202	170	184
Rural – long	116	116	900	856
Organisation*	120	117	86	99
<b>Country Energy</b>				
CBD	na	na	na	na
Urban	82	97	106	103
Rural – short	236	249	276	304
Rural – long	482	599	635	609
Organisation*	230	248	269	301

Source: *Electricity network performance reports* published by the DNSPs.

na = not applicable or not available.

\* 'Organisation' in Tables 2 to 5 refers to the overall measure for the DNSP. The organisations' overall SAIDI (or SAIFI in Table 3) is the percentage weighting of their CBD, urban and rural feeders

#### 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.

The most common number of interruptions per customer has averaged between close to zero and six in recent years (Table 3) with the highest frequency in rural areas.

SAIFI has shown a slight improvement for EnergyAustralia and Integral Energy but has slightly increased for Country Energy. As with its SAIDI data in Table 2, Country Energy attributes the rising trend to better data capture rather than a deterioration in performance.

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

	2002/03	2003/04	2004/05	2005/06
<b>EnergyAustralia</b>				
CBD	0.16	0.17	0.10	0.20
Urban	0.97	1.09	1.14	0.96
Rural – short	3.73	4.06	3.16	3.32
Rural – long	5.30	9.18	6.22	3.30
Organisation	1.18	1.32	1.30	1.15
<b>Integral Energy</b>				
CBD	na	na	na	na
Urban	0.87	1.10	0.83	0.91
Rural – short	1.22	2.19	2.13	2.00
Rural – long	0.99	0.82	4.34	5.05
Organisation	1.30	1.43	1.18	1.2
<b>Country Energy</b>				
CBD	na	na	na	na
Urban	1.25	1.58	1.5	1.45
Rural – short	2.18	2.47	2.74	2.75
Rural – long	3.83	4.27	4.85	4.25
Organisation	2.16	2.39	2.6	2.67

Source: *Electricity network performance reports* published by the DNSPs.

Note: Data for Country Energy for 2005/06 is not directly comparable to that for 2004/05 due to the incorporation of Australian Inland feeders and reallocation of customers amongst feeder classes

## Measuring reliability against standards of performance

It is important to monitor both average and minimum performance standards. This is so that improvements to *average* performances standards can be incentivised while *minimum* performance standards can be guaranteed.

The new licence conditions imposed by the Minister on 1 August 2005 set *minimum* reliability performance standards for the DNSPs<sup>3</sup>. These standards are shown in the columns headed 'SAIDI standard' and 'SAIFI standard' in Table 4. In 2005/06, all three DNSPs met the standards, both for duration and frequency of interruptions, for all class of feeders and for their organisational averages.

<sup>3</sup> The new licence conditions have also rationalised the existing reporting requirements. For example, there is no longer a requirement on the DNSPs to publish reliability of electricity supply *by region* so this information is no longer included in this information paper.

**Table 4 DNSPs' actual performance and standards in 2005/06 (normalised)**

	<b>SAIDI standard</b>	<b>SAIDI actual</b>	<b>% better (+)/worse(-) than standard</b>	<b>SAIFI standard</b>	<b>SAIFI actual</b>	<b>% better (+)/worse(-) than standard</b>
<b>EnergyAustralia</b>						
Organisation	98	90	<b>8%</b>	1.25	1.15	<b>8%</b>
CBD	60	13	<b>78%</b>	0.35	0.20	<b>43%</b>
Urban	90	69	<b>23%</b>	1.3	0.96	<b>26%</b>
Rural short	400	337	<b>16%</b>	4.4	3.32	<b>25%</b>
Rural long	900	342	<b>62%</b>	8.5	3.30	<b>61%</b>
<b>Integral Energy</b>						
Organisation	117	99	<b>15%</b>	1.24	1.20	<b>3%</b>
CBD	na	na	<b>na</b>	na	na	<b>na</b>
Urban	90	67	<b>26%</b>	1.3	0.91	<b>30%</b>
Rural short	300	184	<b>39%</b>	2.8	2.00	<b>29%</b>
Rural long*	na	856	<b>na</b>	na	5.05	<b>na</b>
<b>Country Energy</b>						
Organisation	329	301	<b>9%</b>	3.1	2.67	<b>14%</b>
CBD	na	na	<b>na</b>	na	na	<b>na</b>
Urban	140	103	<b>26%</b>	2.0	1.45	<b>28%</b>
Rural short	340	304	<b>11%</b>	3.3	2.75	<b>17%</b>
Rural long	750	609	<b>19%</b>	5.0	4.25	<b>15%</b>

Source: *Electricity network performance reports* published by the DNSPs

na = not available or not applicable. Percentage changes have been calculated based on unrounded numbers

\* The Minister did not set SAIDI and SAIFI standards for Integral Energy rural long feeders

## Defining and measuring the quality of supply

Customer complaints are investigated by DNSPs and valid ones<sup>4</sup> 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.<sup>5</sup>

Table 5 presents numbers of complaints and the percentage which were valid for the quality of supply from 2002/03 to 2005/06 for the DNSPs. For 2005/06, EnergyAustralia and Integral Energy show increased complaints (Integral attributes this to an increasing number of low-quality air conditioners installed in its area which cause a fall in household voltage when first turned on). By contrast, Country Energy reports a sizeable fall in the number of valid complaints.

**Table 5 Complaints concerning the quality of electricity supply**

	2002/03	2003/04	2004/05	2005/06
<b>Energy Australia</b>				
Voltage	174	616	114	406
Current	0	5	1	0
Other quality	14	176	4	49
Total	188	797	119	455
% valid	23%	24%	50%	25%
<b>Integral Energy</b>				
Voltage	499	454	439	607
Current	1	1	0	0
Other quality	190	101	85	52
Total	690	556	524	659
% valid	np	np	30%	np
<b>Country Energy</b>				
Voltage	146	168	163	97
Current	0	0	0	0
Other quality	38	60	41	32
Total	184	228	204	129
% valid	63%	88%	53%	52%

Source: *Electricity network performance reports* of the DNSPs  
 np means not provided. na means not applicable

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

<sup>5</sup> All of these measures of quality are set out in the *Electricity network performance report* of each DNSP.