



PERFORMANCE OF ETSA UTILITIES' ELECTRICITY DISTRIBUTION NETWORK DURING THE HEATWAVE OF JANUARY 2006

*PRELIMINARY REPORT TO THE
MINISTER FOR ENERGY*

28 January 2006

ELECTRICITY

TABLE OF CONTENTS

1. Introduction	1
2. Description of the Heat Wave Event	1
2.1 Extent of the Heatwave	1
2.2 Supply and Demand	1
3. Performance During the Heatwave Event	3
3.1 Technical	3
3.2 Preparedness & Operational Response	4
3.3 Reliability	5
3.4 Restoration	7
3.5 Commission observations	7
3.6 Call Centre	8
4. Conclusions	11
5. Next Steps	13

1. INTRODUCTION

This Preliminary Report, prepared by the Essential Services Commission of SA (the Commission), for the Minister for Energy, provides an overview of the reliability performance, customer service performance and quality of supply performance of ETSA Utilities,¹ the operator of the South Australian electricity distribution network, during the heatwave conditions experienced from Thursday 19th to Sunday 22nd January 2006 (the heatwave event).²

This Preliminary Report has been compiled from information provided by ETSA Utilities on 25th and 27th January in response to specific information requests from the Commission, together with some anecdotal evidence and material from other sources. As investigations are still be undertaken by ETSA Utilities, and the Commission has yet to commence a more detailed review, this Preliminary Report does not address the question of compliance with regulatory obligations.

During the heatwave event, there were power outages across the State. ETSA Utilities has advised that these affected approximately 63,000 of the 760,000 electricity distribution network customers. Although power was restored to most customers within a few hours, approximately 1,000 customers experienced prolonged supply interruptions, in excess of 12 hours.

Preliminary advice provided to the Commission by the Electricity Supply Industry Planning Council (ESIPC) indicates that the actual loss of load during the heatwave event appears to have been relatively small. At the time of system peak on Friday 20th, only about 1 MW of load was not being supplied³.

ETSA Utilities' call centre, which has handled an average of 470,000 calls per annum (approximately 1,200 per day) for the past five years, handled 50,000 calls over the 4-day period of the heatwave event. On the 21st (20,000 calls) and 22nd (18,500 calls), callers to the call centre experienced long delays when waiting to speak to an operator. In addition, the information provided via the call centre interactive response system (IVR) and by call centre staff was not up-to-date and accurate.

¹ ETSA Utilities: is a partnership comprising CKI Utilities Development Limited (ABN 65 090 718 880) HEI Utilities Development Limited (ABN 82 090 718 951) CKI Utilities Holdings Limited (ABN 54 091 142 380) HEI Utilities Holdings Limited (ABN 50 091 142 362) CKI/HEI Utilities Distribution Limited (ABN 19 091 143 038) each incorporated in The Bahamas

² A heatwave is a period of abnormally hot weather lasting several days. For Adelaide, the Bureau of Meteorology defines a heatwave as 5 consecutive days or more at or above 35°C or 3 consecutive days or more at or above 40°C.

³ As noted in section 2.2 of this report, peak demand on the distribution network on 20th January was 2,633 MW.

2. DESCRIPTION OF THE HEAT WAVE EVENT

2.1 *Extent of the Heatwave*

South Australia experienced a 4-day heatwave from Thursday 19th to Sunday 22nd January 2006 inclusive, with 4 continuous days over 40°C in the Adelaide metropolitan region.

During the heatwave, the Adelaide metropolitan region's highest daytime temperature during the heatwave was 43.1° C and lowest nighttime temperature was 27.7° C, (as recorded at the Bureau of Meteorology's Kent Town recording station). The recorded daytime maxima and night-time minima during this period were:

DAY	19/1/2006	20/1/2006	21/1/2006	22/1/2006	23/1/2006
Day-time max	40.2°C	41.8°C	43.1°C	40.8°C	---
Night-time min	21.5°C	27.9°C	27.7°C	33.1°C	19.2°C

A cool change progressively moved across the State from the west on Sunday 22nd January 2006, arriving at the metropolitan region around 2:00pm. The cool change was accompanied by strong winds and resulted in a gradual drop in temperature.

The overnight minimum of 33.1°C on Saturday was extremely high compared with the 29.9°C recorded in the last extreme heatwave (in February 2001).

Extreme temperatures were also recorded during this period over the whole of South Australia, ranging from 47.4°C at Ceduna, 45.9°C at Renmark, 40.8°C at Mount Gambier and 43.1°C at Victor Harbor.

The Commission's present understanding is that, based on the occurrence of 4 successive days with maximum temperatures in excess of 40°C, this was the most extreme heatwave event in Adelaide since 1943.⁴

2.2 *Supply and Demand*

On Friday, 20th January 2006, a new ETSA Utilities' electricity distribution network total peak load of 2,633 MW was recorded.⁵ This peak exceeded the previous peak of 2,529 MW recorded in the last extreme heatwave, in January 2001. In considering the impacts of this peak load on the distribution network, it is the localised impacts which are of most relevance. In this context, ETSA Utilities has advised the Commission that

⁴ The Commission understands the Bureau of Meteorology will shortly publish the January weather summary information that will describe the January weather in detail.

⁵ The peak load reported in relation to the ETSA Utilities' distribution network is lower than that reported by ElectraNet SA for the entire SA network as ETSA Utilities' figure does not include the loads associated with customers directly connected to ElectraNet SA's transmission network.



- ▲ the total state peak was 92% of ETSA Utilities' forecast for 2006; noting that the 92% figure is consistent with a non-peak industrial load period (January) and 2 of the 4 hot days falling on a weekend;
- ▲ the metropolitan ElectraNet connection points recorded up to 91% of 2006 forecast;
- ▲ one country ElectraNet connection point exceeded forecast (Hummocks by 5%);
- ▲ three metropolitan residential zone substations just exceeded 2006 forecast (Northfield, Blackwood and Clarence Gardens by 2-4%); and
- ▲ seven country zone substations exceeded 2006 forecast (Pyap, Loveday, Goolwa, Victor Harbor, Angle Vale, Keith and Port Augusta by 2-15%).

The relevance of these data to the supply reliability issues faced by ETSA Utilities during the heatwave lies in their usefulness in permitting an assessment of the adequacy of ETSA Utilities' distribution network to meet demand.

Under the terms of its electricity distribution licence, ETSA Utilities must comply with the technical standards set out in the National Electricity Rules (NER). In particular, the requirements relating to reliability and system security contained in Schedule 5.1 of the NER are relevant to planning for the electricity needs for South Australia.

ETSA Utilities has developed network-planning criteria based on the requirements of the NER. Forecast peak loads for future years are compared with the capacity of the network and this is used to develop a network augmentation plan.

Forecasts are based on historical peak loads and measured growth rates. The figures above indicate that loads exceeded forecast demand at various locations throughout South Australia during the heatwave. As a result ETSA Utilities will be required to revise its load forecasts. This is something ETSA Utilities does each year after the peak load summer period as part of the normal planning process.

The Commission notes that while the actual load exceeded the forecast load at some locations in SA this does not mean that there was inadequate capacity available at these substations or that there was shortage of electricity in SA. Most, if not all, of the heat related outages were very localized and not due to an electricity shortage.

The distribution demand, as highlighted by ETSA Utilities' preliminary work, was about 4% higher than in the heatwave of 2001. The peak demand was significantly below ESIPC's 10% Probability of Exceedance forecast (which is understandable given that the heatwave occurred during a holiday period) and generally below the Agreed Maximum Demand for connection points; it is noted that extreme conditions will always cause some local problems.

3. PERFORMANCE DURING THE HEATWAVE EVENT

This section reviews the performance of ETSA Utilities during the heatwave, primarily on the basis of information supplied by ETSA Utilities. The information provided has not, at this stage, been subject to audit or independent scrutiny, nor has it been assessed against the framework of longer-term network performance. However, on the basis that the information has been compiled using the systems normally employed by ETSA Utilities for compiling performance data, the Commission is satisfied, at this time, with the accuracy of the data for the purposes of this Preliminary Report.

Nevertheless, some care needs to be exercised in the use of this data, as the data is preliminary and subject to possible revision by ETSA Utilities. In addition, it is difficult to draw any definitive conclusions on the basis of such preliminary data.

3.1 Technical

Electricity transmission and distribution equipment is protected from severe damage due to faults on the network (e.g. lightning, clashing of conductors) or if the equipment is subject to loads over the design capacity of the equipment.

This protection starts at the power stations that generate the electricity and continues through the transmission and distribution system down to the transformers supplying individual customers or small groups of customers.

Individual transformers may be protected via circuit breakers or fuses that interrupt the electricity supply to or from the transformer under fault or overload conditions.

The street transformers that suffered outages during the heatwave event are generally protected on the high voltage side of the transformer by glass fuses and on the low voltage side by high rupturing capacity fuses. These fuses are installed on individual wires (phases) to and from the transformer in order to protect the transformer and associated equipment.

During high load conditions it is possible for individual fuses to "blow" due to overload and the fact that the load on some phases may be higher than others.

When one low voltage fuse blows, all customers receiving single phase supply from that wire (phase) experience an interruption to their electricity supply, while all other single-phase customers will continue to receive electricity. Customers with three-phase supply are likely to note that some appliances and/or lights work but others do not. This is because this equipment is still receiving electricity from the phases that have not been interrupted. The equipment that stays on or the equipment that goes off depends on how the premises are wired. Three-phase equipment, for example large air conditioners, will not work when the fuse on one or more phases is blown.



Similarly, if only one high voltage fuse blows, the transformer continues to "work" with normal supply in one low voltage phase and significantly reduced voltage on the other two phases. Therefore, single-phase customers supplied by the "good" phase will not experience an outage and customers on the other phases will experience low voltage.

If two high voltage fuses blow, then supply is interrupted to all customers supplied from that transformer.

3.2 Preparedness & Operational Response

Preparedness

ETSA Utilities has advised the Commission that since 2001, when the last major heatwave leading to widespread power outages occurred, approximately 1,250 upgraded distribution transformers have been installed in the metropolitan region to mitigate future potential distribution transformer overloading.

In addition, as previously reported by the Commission, ETSA Utilities reviews the reliability performance of individual feeders to determine a detailed Reliability Improvement Plan for the subsequent year.⁶

ETSA Utilities advises that, prior to the 2005-06 summer period, the distribution network was prepared for possible heatwave conditions by completion of approved capacity upgrade projects, purchasing of system spares and the preparation of contingency plans and emergency response systems. ETSA Utilities has reported that these emergency systems were reviewed prior to the January 2006 heatwave event.

Operational Response

ETSA Utilities advises that, prior to and during the heatwave event, various meetings of operational managers were called to discuss the logistical and staffing responses necessary to meet the forecast heat conditions on the week-end. It suggests that the determination of response levels was in accordance with the ETSA Utilities' Emergency Procedures manual and the forecast conditions. However, ETSA Utilities notes that there were difficulties in sourcing additional staffing levels throughout the weekend of 21st and 22nd January.

Commission observations

At this stage, the Commission has not had the opportunity to assess the impact of ETSA Utilities' internal processes and procedures on its preparedness for the heatwave event, nor does it have details on the way in which internal systems and

⁶ See for example 2004/05 Annual Performance Report: Performance of South Australian Electricity Distributors, page 21, available from <http://www.escosa.sa.gov.au/site/page.cfm?u=27&c=47>.

processes were used for communication of information and the management and deployment of available resources.

Further, no detailed evidence has yet been provided to the Commission on the scope and detail of plans that ETSA Utilities may have in place to deal with extreme weather events such as the heatwave event.

As part of a more detailed review of ETSA Utilities' performance during the heatwave event, the Commission will examine these matters with the assistance of an independent consultant.

3.3 Reliability

ETSA Utilities has provided the Commission with a high-level overview of network reliability performance during the heatwave event.

Key Points

Key points noted by ETSA Utilities are as follows:

- ▲ although in a few isolated cases the load exceeded the 2006 forecast, no connection points or zone substations were overloaded;
- ▲ as the heatwave continued into the third and fourth day, with extreme day and night time temperatures, the number of distribution transformer and fuse supply interruptions rapidly escalated;
- ▲ the supply restoration times for restoring distribution transformer faults and low voltage fuse operations did not meet ETSA Utilities' normal standard of performance in the greater metropolitan region; and
- ▲ the supply restoration times for distribution transformer faults and fuse operations are largely dependent on the availability of restoration crews, and the available metropolitan supply restoration crews were overwhelmed by the number of these interruptions.

Metropolitan Distribution Network Performance

A summary of the metropolitan distribution network performance in the heatwave event is set out below (and includes events due to the heatwave and "normal" disturbances such as vegetation and lightning):

- ▲ no sustained interruptions of connection points or 66kV sub-transmission lines;
- ▲ 1 zone substation lost supply for approximately 1 hour at Hillcrest (6,900 customers), due to failure of an under-frequency relay (not related to the heatwave event);



- ▲ 16 high voltage 11kV feeders were interrupted, affecting an estimated 500-4,000 customers per event for 0.5 to 4.5 hours; 8 of these were not linked to the heatwave event;
- ▲ 14 distribution transformer faults (8 of which caused caused the high voltage feeder to trip), affecting an estimated 600 customers;
- ▲ 201 distribution transformer fuse operations (166 low voltage and 35 high voltage), affecting an estimated 3,800 customers; and
- ▲ additional interruptions associated with the high winds that accompanied the cool change.

ETSA Utilities' comments: Metropolitan Performance

ETSA Utilities provided the following commentary on the performance of its metropolitan distribution network during the heatwave event:

- ▲ The number of metropolitan high voltage (HV) feeder interruptions was above average. Of these interruptions, 8 may be linked to the heatwave (typically as a result of a distribution transformer fault).
- ▲ The number of metropolitan distribution transformer faults (14) and fuse operations (201) exceeded the average, but were considerably less than the 2001 heatwave (about 500 fuse operations). Each event affected typically 15 to 45 customers.
- ▲ Preliminary analysis has shown that the supply restoration time for distribution transformer and fuse operations ranged from 2 hours to 34 hours, with about 35 events exceeding 12 hours, affecting approximately 1,000 customers.

Country Distribution network performance

A summary of the country distribution network performance in the heatwave event is detailed below (and includes events due to the heatwave and normal disturbances such as vegetation and lightning):

- ▲ no sustained interruptions of connection points or 66kV sub-transmission lines;
- ▲ 1 zone substation (Balhannah, 14,400 customers) lost supply for approximately 1 hour, due to failure of 33kV circuit breaker failure;
- ▲ 18 high voltage 11kV feeders were interrupted, affecting an estimated 500-4,000 customers per event for 0.5 to 4.5 hours;
- ▲ 23 high voltage feeder sections were interrupted, affecting an estimated 2-500 customers per event for 0.5 to 4.5 hours;
- ▲ 13 distribution transformer faults, affecting an estimated 500 customers;

- ▲ 80 distribution transformer fuse operations, (53 low voltage and 27 high voltage), affecting an estimated 3,400 customers; and
- ▲ additional interruptions associated with the high winds that accompanied the cool change.

ETSA Utilities Comments: Country Performance

ETSA Utilities has estimated that about 50 customers located in country regions were without supply for longer than 12 hours.

3.4 Restoration

ETSA Utilities has advised the Commission that its current estimate of the impact of all events, (those due to heatwave and other causes such as vegetation and lightning, country and metropolitan) over the four day period Thursday 19th to Sunday 22nd January 2006 are detailed below:

- ▲ approximately 60,000 (8%) customers were affected by high voltage interruptions with 96% restored within 3 hours;
- ▲ approximately 4,000 (0.5%) customers were affected by high voltage transformer fuse operations (these are a subset of the 60,000 affected by high voltage interruptions) with 93% restored within 2 hours; and
- ▲ approximately 3,300 (0.4%) customers were affected by low voltage interruptions with an average restoration time of 5.5 hours.
- ▲ approximately 1,000 customers affected by low voltage interruptions did not have supply restored for 12 hours or more.

3.5 Commission observations

The Commission notes that the reliability data provided by ETSA Utilities is very preliminary and high level. There is presently very little disaggregation of the data into the specific interruptions that occurred over the four days.

While ETSA Utilities has provided information indicating that about 1,000 customers were without power for more than 12 hours, anecdotal evidence would suggest some of these customers were without power for a considerably longer period.

The Commission observes that it is highly unusual for metropolitan customers to experience power outages of the length reported, even in heatwave conditions, particularly when the given cause is a low voltage fuse operation.

While the Commission notes ETSA Utilities explanation of insufficient human resources to fix the blown fuses, the Commission also notes that ETSA Utilities has asserted the number of low voltage fuse operations (201) was considerably less than the 500 low voltage fuse operations which occurred in the last major heat wave in 2001. The Commission is aware that ETSA Utilities has installed an extensive Outage Management



System (OMS) and anecdotal evidence appears to indicate that ETSA Utilities has more line staff now than at that time.

The Guaranteed Service Level (GSL) scheme implemented by the Commission from July 2005 (under the Commission's 2005-2010 Electricity Distribution Price Determination⁷) requires ETSA Utilities to make payments to customers who experience more than 9 interruptions per year or more than 12 hours off supply for any single interruption.

Based on the information provided by ETSA Utilities, at least 1,000 customers will be entitled to a GSL payment.

The Commission notes that, in the past 5 years, ETSA Utilities' performance against annual reliability performance targets has generally met target levels, with the number of severe weather events occurring in any one year being a key driver in relation to the meeting of targets.

As part of a more detailed review of ETSA Utilities' performance during the heatwave, the Commission will examine these matters in more detail with the assistance of an independent consultant.

3.6 Call Centre

The operations of the ETSA Utilities' call centre during the heatwave event have been the subject of particular public criticism.

It appears that the call centre, which has handled an annual average of 470,000 calls per year (approximately 1,200 per day) over the last 5 years, handled 50,000 calls during the 4-day heatwave event. On the 21st (20,000 calls) and 22nd (18,500 calls), callers to the call centre experienced long delays when waiting to speak to an operator and the information provided via the call centre interactive response (IVR) and call centre staff was not up-to-date and accurate.

ETSA Utilities has advised the Commission that:

- ▲ the procedure for updating information on the IVR worked as normal on Thursday 19th and Friday 20th January: the timeliness and accuracy of the information on the IVR and provided by the call centre staff on these days was good.
- ▲ as resource constraints began to emerge on the weekend, the flow of information back to the Network Operations Centre (NOC) from the field became problematic.
- ▲ fewer crews were available to undertake the increasing workload, and with the trying physical conditions, demands on field-based personnel began to mount. As this happened, focus was on the pressing need to restore supply in an efficient and safe manner rather than on communicating the status of work back to the NOC.

⁷ See 2005-2010 Electricity Distribution Price Determination Part A Statement of Reasons Chapter 3, available from <http://www.escosa.sa.gov.au/site/page.cfm?u=163>

- ▲ as the process for updating the IVR and the outage webpage relies on frequent and quality information from the field to the Network Operations Centre (NOC) in order to keep customers informed about the location, cause and likely duration of interruptions, on Saturday 21st and Sunday 22nd, the flow of good quality information to the call centre was patchy at best.
- ▲ of particular concern to customers was the inability of the IVR or the call centre staff to provide advice as to the status of particular work and estimated restoration times, despite sometimes repeated calls. This led to longer average talk times as customers vented their understandable frustrations to the call centre staff. This in turn led to higher average wait times for callers in the queue.
- ▲ the call centre had all available resources working throughout the weekend including staff in the back-up call centre in Melbourne.
- ▲ in addition to dealing with an unrelenting high call volumes, a lack of information and many irate customers, the call centre used by ETSA Utilities was also dealing with high call volumes for Powercor and Citipower because of the bushfires in Western Victoria, and Victorian heat wave problems.

The call statistics provided by ETSA Utilities are shown in the table below.

	19 TH	20 TH	21 ST	22 ND	TOTAL
A. NUMBER OF CALLS RECEIVED	2,993	8,928	20,105	18,488	50,514
B. NUMBER OF CALLS ABANDONED	83	488	3,854	4,204	8,629
(% OF CALLS ABANDONED)	3%	5%	19%	23%	17%
C. NUMBER OF CALLS ANSWERED BY IVR	1,859	6,790	13,795	12,224	34,668
D. NUMBER OF CALLS ANSWERED BY CALL CENTRE OPERATOR	1,051	1,647	2,337	2,175	7,210
E. NUMBER OF CALLS UNANSWERED	N/A				
F. AVERAGE WAIT TIME FOR AN OPERATOR (MIN:SEC)	1:00	3:06	15:34	11:04	

Notes

- (a) these call statistics are preliminary, and subject to final confirmation.
- (b) the previous maximum call volume associated with a heatwave, in Feb 2001 was 14,500 calls on the 7/2/2001. This was significantly exceeded on the 21 and 22 January 2006.
- (c) the number of calls for the four days of the heatwave exceeded the number of calls for both months of January and February 2001 by 10%.

Commission observations

The Commission notes the extremely high level of calls handled by the call centre during the heatwave event amounting to nearly 10% of the yearly average of calls taken in just 4 days.

Like other Australian distribution businesses, ETSA Utilities uses an interactive voice response system (IVR) as the primary means of providing information to the vast majority of customers who call. The provision of accurate and up-dated



information via the IVR is therefore key to any distribution business having the ability to handle the high number of customer calls, which occur during any severe weather event.

The Commission will examine in more detail, with the assistance of an independent consultant, a number of aspects of the call centre operations.

4. CONCLUSIONS

It is clear that the 4-day heatwave event from Thursday 19th to Sunday 22nd January 2006 inclusive, with 4 continuous days over 40°C in the Adelaide metropolitan region, was an extreme weather event.

The South Australian demand for power reached a new all-time high on Friday 20th January 2006, resulting in a record distribution network total peak load.

There are a number of aspects of the reliability performance and customer service performance of ETSA Utilities during the heatwave event, which require further analysis. The data and information provided thus far to the Commission by ETSA Utilities is preliminary and high level, making it difficult to draw conclusions. The Commission expects that data refinements will continue to occur for some time.

In particular, the Commission considers the following matters require detailed consideration:

- ▲ whether the configuration, condition and operational characteristics of the network contributed to the customer outages;
- ▲ whether the preparation for the heatwave event was adequate and appropriate and comparable with businesses in other jurisdictions which have dealt with severe weather events;
- ▲ whether the response to the heatwave event (including time to restore supply and call centre operations) was reasonable and appropriate and utilized all available systems and processes (e.g. OMS and SCADA data) and human resources, and was comparable with businesses in other jurisdictions which have dealt with severe weather events;
- ▲ the performance in prioritizing field response to outages, restoring supply and providing information to customers; and
- ▲ payments made to customers under the GSL scheme and other compensation issues.

A full assessment of these matters will allow the Commission to determine whether the performance of ETSA Utilities is consistent with “good electricity industry practice” as defined by the National Electricity Rules, whether ETSA Utilities has complied with its regulatory obligations and whether those obligations should be amended.

5. NEXT STEPS

It is understood that the Commission will be asked to conduct a formal Inquiry into the performance of ETSA Utilities during the heatwave event, under Part 7 of the *Essential Services Commission Act 2002*.

The Commission has been advised by ETSA Utilities that it expects to complete its own internal review processes, analysis and data review associated with the heatwave event by 10th February.

The Commission is in the process of engaging an independent consultant to assist it to undertake further detailed research and technical analysis of ETSA Utilities' performance during the heatwave event.