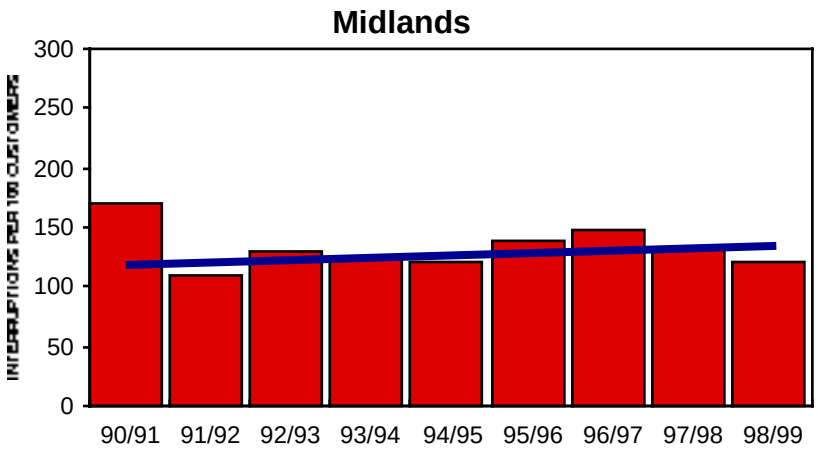
January 2000

Report on Distribution and Transmission System Performance 1998/99

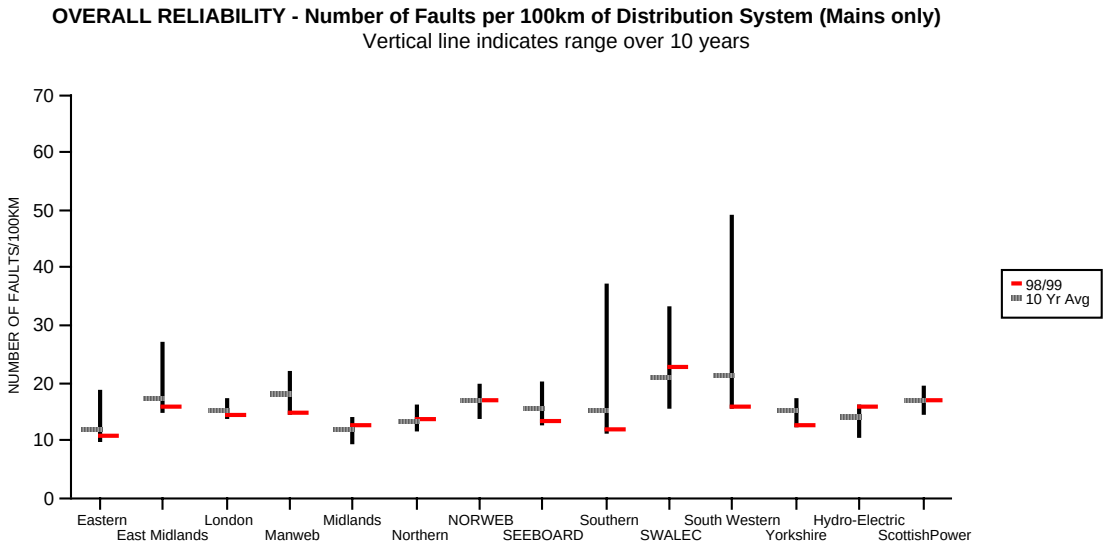
Distribution and transmission system performance report 1998/1999

Erratum - the graphs below replace those included in the main body of the text

1. Page 6 Security Trends – Midlands Electricity



2. Page 12 Overall reliability – Midlands Electricity



INTRODUCTION

All licensees who operate transmission or distribution systems are required to report annually on their performance in maintaining system security, availability and quality of service. This information provides a picture of the continuity and quality of supply experienced by final customers. Information is now available for each of the years since Vesting. This year s report continues to incorporate year-by-year comparisons to help identify trends in companies performance.

The figures submitted by the companies for 1998/99 show that, in general, the standard of supply for customers has been maintained. There are nonetheless differences between companies.

There are also differences within companies. From 1995/96 companies have supplied disaggregated performance data as part of their Quality of Supply Reports. This enables customers to get a better picture of how different parts of company networks perform. As in previous year s reports, instead of single average performance figures for companies, this report contains performance data for each separate operating area within each company.

As part of the recent review of distribution price controls, consideration has been given to quality of supply including the way in which standards are set and data is reported. In particular, it will be important to ensure that robust and consistent data is available from all companies in the future.

Each company s Quality of Supply report for 1998/99 is publicly available. The reports give more detailed information about company targets and spending plans.

SECURITY AND AVAILABILITY OF SUPPLY

This report begins with information on the overall security and availability of supply, measured in terms of the number of interruptions and supply minutes lost experienced by customers connected to the distribution systems of the fourteen distribution companies. Information is also given on the quality of service, in terms of restoration times achieved, provided by these companies.

The quality of supply experienced by customers is influenced by the performance of all stages of electricity supply: generation, transmission and distribution. However, the number of supply failures caused by failure or lack of generation has usually been extremely small, and the contribution from transmission system failures has also been minor. Distribution systems are by far the most significant determinant of the quality of supply experienced by final customers.

Distribution Systems

The numbers of interruptions on each company s distribution system in 1998/99 are examined and compared. The performance of the High Voltage (HV) network is particularly significant. Further analysis shows how this performance varies for the overhead and underground HV networks for each company.

Transmission Systems

There are three transmission licensees in Great Britain - The National Grid Company (NGC) in England and Wales and the two Scottish companies, ScottishPower and Hydro-Electric. Transmission systems transport large amounts of energy and are normally designed to continue to provide supply in the event of single or even multiple circuit failures. The number of incidents that result in a loss of supply to final customers is extremely small. Information is given for 1998/99 and this is compared with previous performance for NGC and the two Scottish companies. The average energy that would have been supplied without such outages is also given.

One measure of the performance of a transmission system is the percentage of the time during which the system is not available for use. System unavailability is shown for the three transmission systems and for the three interconnectors.

Transmission companies have given a classification of the causes of transmission system unavailability. These causes are system maintenance, system construction, connection of users and system faults

STANDARDS OF SUPPLY QUALITY

It is a statutory requirement on the transmission and distribution companies to keep voltage and frequency within prescribed limits, in all but exceptional circumstances. Transmission system operators reported on incidents which caused excursions outside the prescribed limits for both frequency and voltage. Distribution system operators provided details of complaints by customers who were receiving voltage outside statutory limits. In these instances, companies need to consider whether local reinforcement of the distribution system or other measures may be needed.

ANALYSIS

The figures supplied give an overview of system performance in 1998/99. Statistics extracted from companies figures have been used to provide diagrammatic comparisons of performance. Figures 1 to 15, and 25, relate to security and availability experienced by customers, and the factors affecting these aspects of performance. Figures 16 to 24 show transmission system performance.

The format chosen for many of the graphs is similar to that used previously. The 10 year average and 1998/99 results for each company are shown as horizontal bars. Vertical bars indicate ranges, either highs and lows of performance in the last 10 years, or the different performances of different operational units within each company.

SECURITY

Figure 1 SECURITY Supply Interruptions per 100 connected Customers

Vertical line indicates range over 10 years

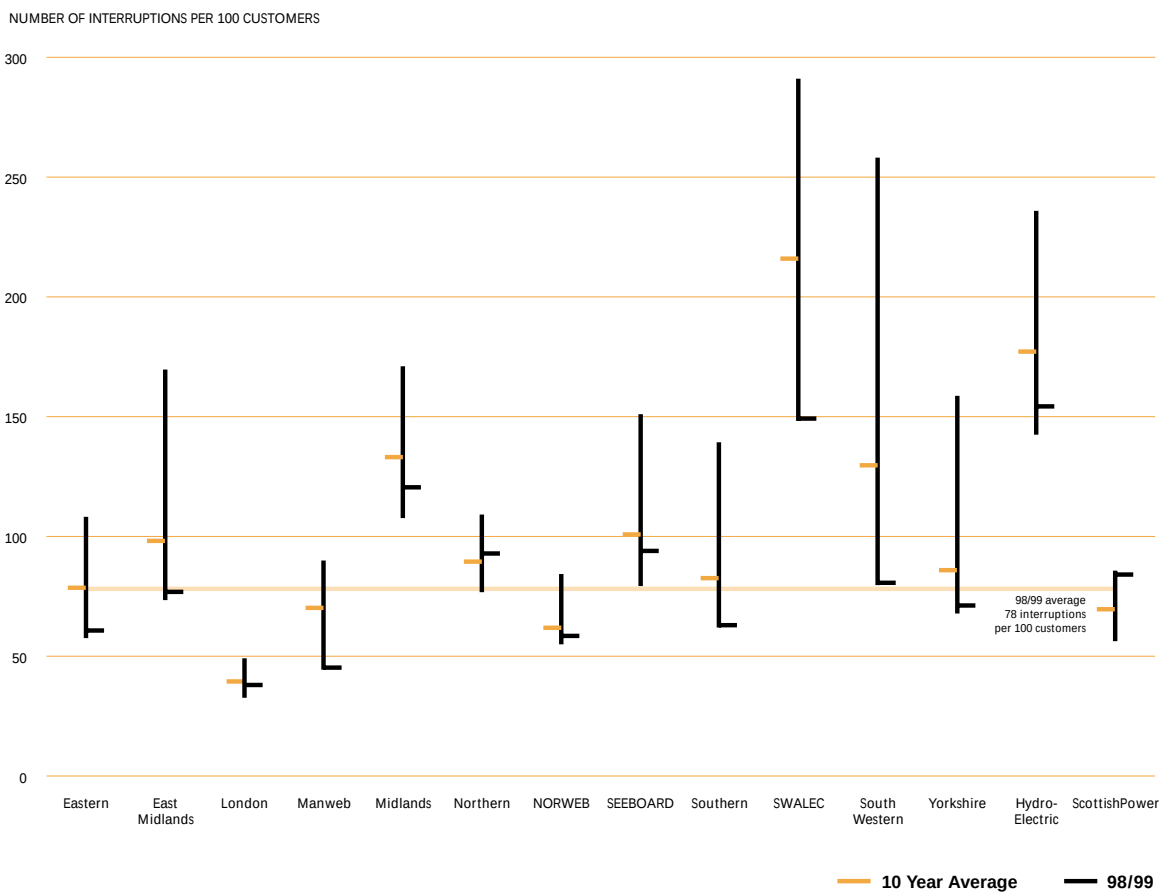


FIGURE 1 SECURITY presents data on interruptions of supply. For each company, the figure shows the number of supply interruptions per 100 customers in 1998/99, the average for the last 10 years and the range of annual figures over the last 10 years.

The data covers all interruptions, including those caused by bad weather, faults and pre-arranged shutdowns for maintenance and construction.

For 12 companies, the number of interruptions in 1998/99 was lower than their 10 year average. SWALEC, Midlands and Hydro-Electric continue to have the highest proportion of supply interruptions. London, Manweb, and Norweb have the lowest. Manweb, Southern, SWALEC and SWEB reported figures which are equal to or better than those of the last nine years. As in previous years, some companies (Manweb, Norweb and ScottishPower) submitted additional data which excluded the effects of particular periods of bad weather. These are not significantly different from the figures shown in Figure 1.

The broad horizontal band shows the average for all companies for 1998/99 (78 interruptions per 100 customers). This is lower than the average of 88 interruptions per 100 customers in 1997/98.

Figure 2 DISAGGREGATED COMPANY RESULTS 1998/99

SECURITY Supply Interruptions per 100 connected customers

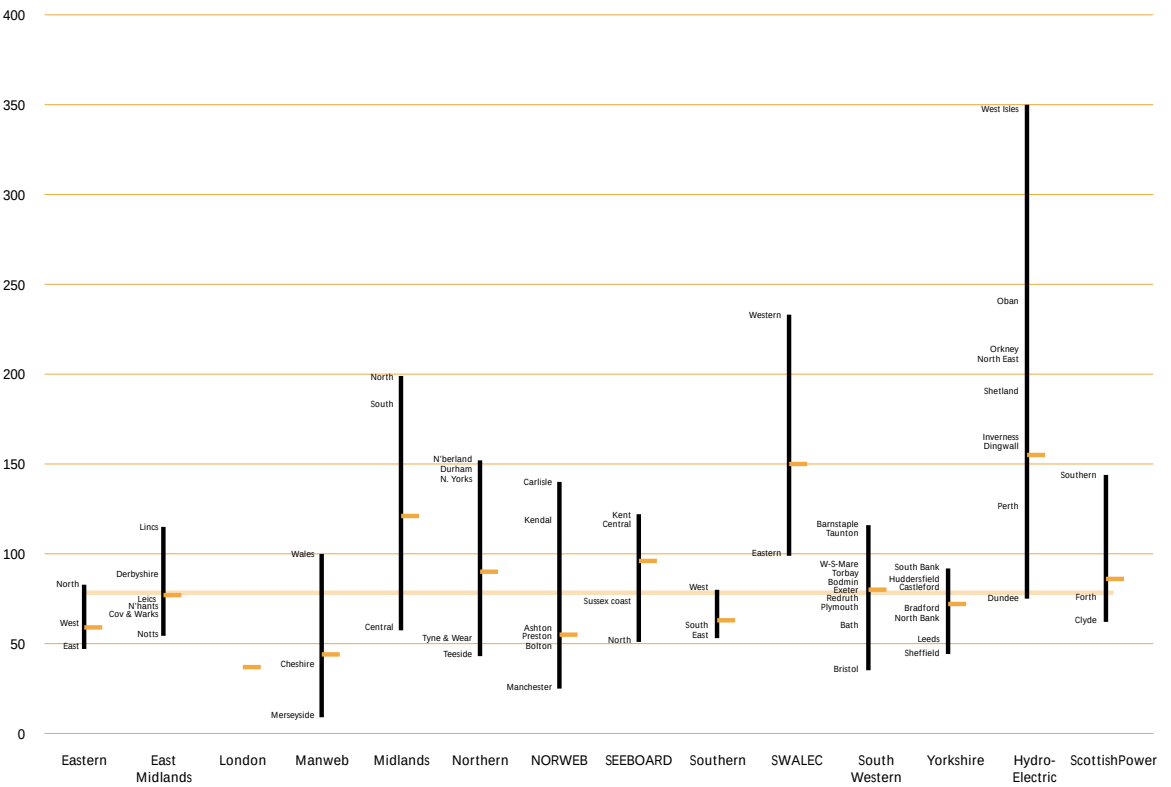


Fig 2 SECURITY DISAGGREGATED BY COMPANY ORGANISATION UNIT Companies provided security data broken down by company operating units. All companies except London have more than one operating unit, varying between two for SWALEC and ten for SWEB.

Customers can experience varying performance depending on where they are in a company s area. The management units which exhibit the best performance tend to be those which include a larger proportion of urban territory.As in last year s report, Merseyside region (MANWEB) shows the lowest number of interruptions (9 per 100 customers) for 1998/99. Various regions of Midlands, SWALEC and Hydro-Electric show the highest numbers.

The horizontal band shows the average for all companies in 1998/99 (78 interruptions per 100 customers).

Figure 3 SECURITY TRENDS Supply Interruptions per 100 Customers

FIGURE 3 SECURITY TRENDS shows the security of supply as measured by the number of interruptions per 100 customers served by each distribution company in the nine years since Vesting.
There have not been major changes in the security of supply for any company since Vesting.

In 1998/99 nine companies had a better performance than in 1997/98, four performed at a very similar level over the two years and one was worse in 1998/99.

This year these graphs each include a straight line which shows the trend in performance over the nine years since Vesting. The trend analysis for a company excludes years where the company s performance was affected by extreme weather. Five companies show an improving trend while the others show no improvement or a slight worsening in performance.

AVAILABILITY

Figure 4 AVAILABILITY Minutes Lost per Connected Customer

Vertical line indicates range over 10 years

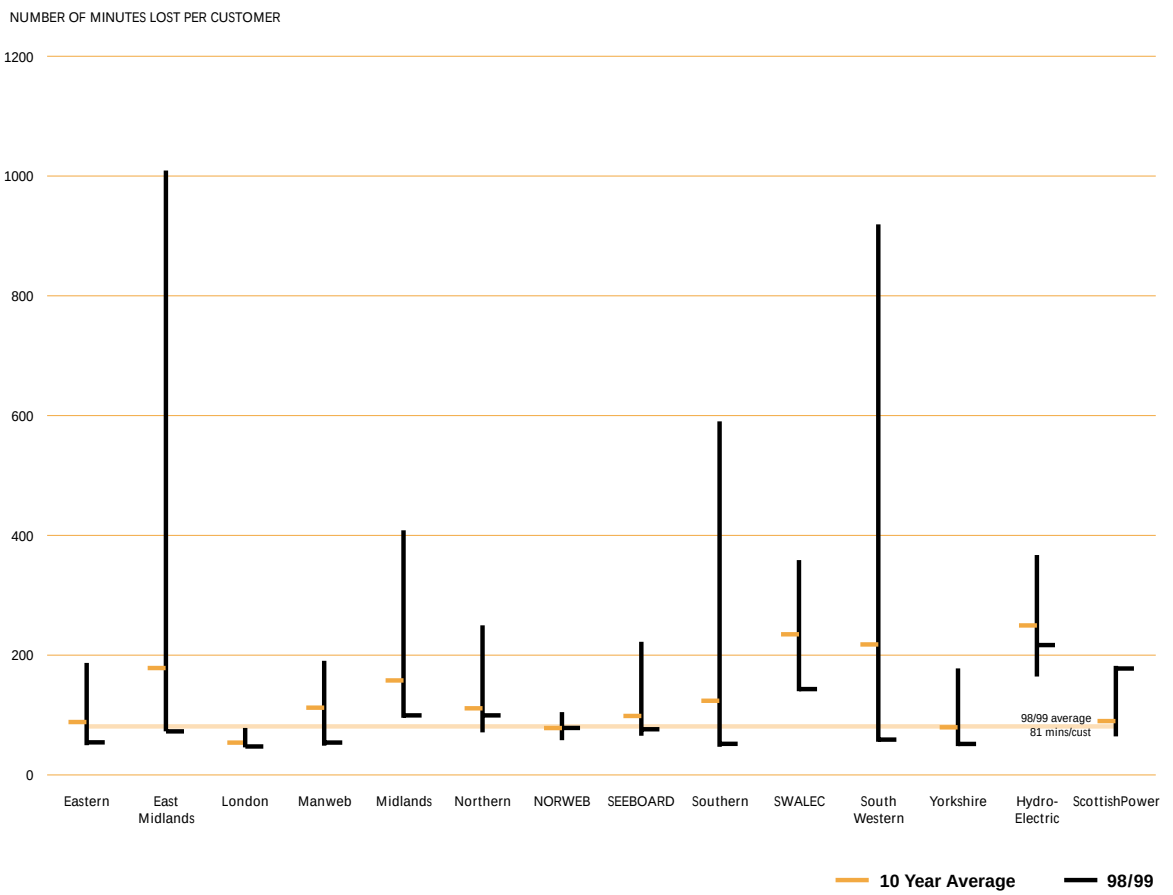


FIGURE 4 AVAILABILITY displays for each company the average number of minutes off-supply experienced by its customers. The figures for 1998/99 range between 45 (London) and 220 minutes (Hydro-Electric). All companies, except NORWEB and ScottishPower, reported figures which were better than their 10 year average result. Nine companies recorded their best results for 10 years. ScottishPower's result was its worst for 10 years.

The broad horizontal band shows the 1998/99 average for all companies, this was 81 minutes per customer, compared with 88 minutes per customer in 1997/98.

Figure 5 DISAGGREGATED COMPANY RESULTS 1998/99

AVAILIABILITY Minutes lost per connected customer

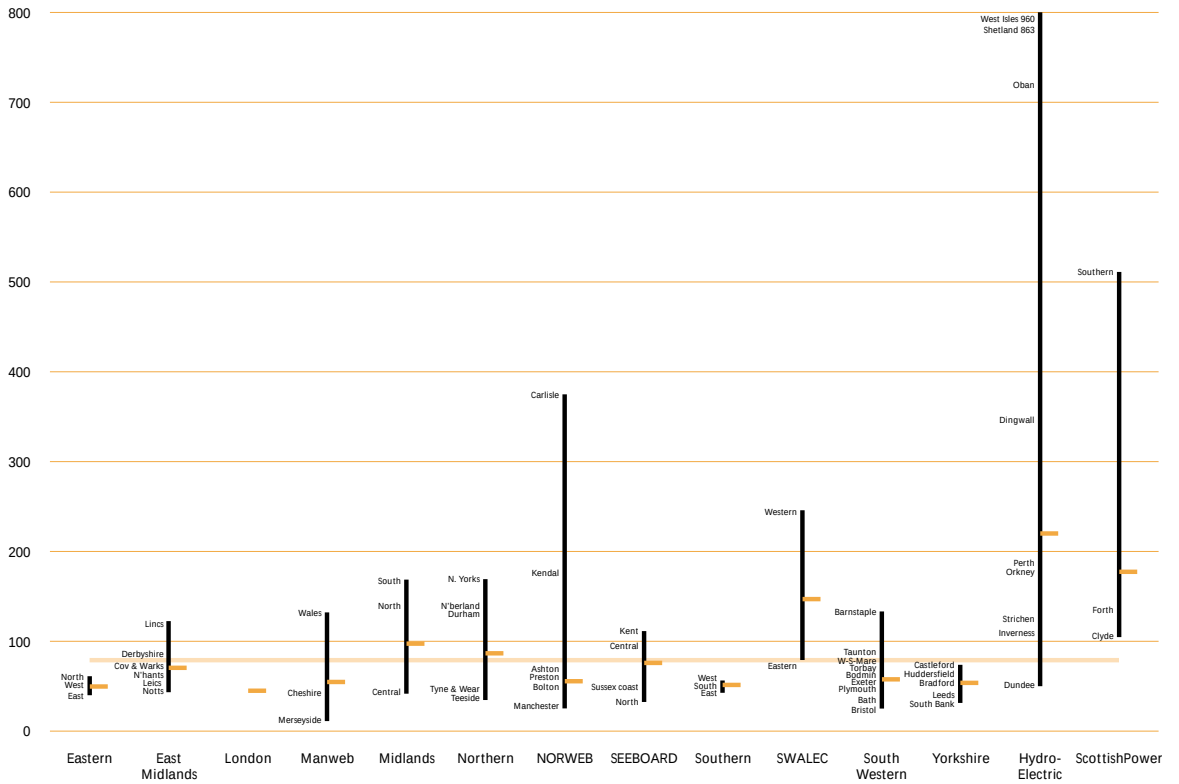


FIGURE 5 AVAILABILITY DISAGGREGATED BY COMPANY ORGANISATION UNIT.

As for security, companies provided availability data for each of their operating units expressed in minutes lost per connected customer. Restoration of supplies in remote areas and those with low population density can sometimes be delayed by difficult terrain and longer distances between company depots and customers. Some companies say they are targeting this by investing in network automation and remote control; details can be found in their Quality of Supply Reports.

The horizontal band shows the 1998/99 average for all companies (81 minutes per customer).

Figure 6 AVAILABILITY TRENDS Minutes Lost per Connected Customer

FIGURE 6 AVAILABILITY TRENDS shows the average number of minutes off-supply per customer served by each distribution company in the nine years since Vesting. Eastern, London, MANWEB, Southern, South Western and Yorkshire have the lowest minutes lost per customer, SWALEC and ScottishPower the highest. Three companies performed worse in 1998/99 than in 1997/98. ScottishPower reports that its performance was affected by severe winter storms in its area.

As with Security trends shown above, the underlying trends are represented by the straight line on each graph which excludes severe weather effects. Ten companies show an improving trend in availability performance in the nine years since vesting.

RESTORATION OF SUPPLY

Figure 7 RESTORATION OF SUPPLY Percentage of Interruptions Not Restored within 3 hours

Vertical line indicates range over 10 years

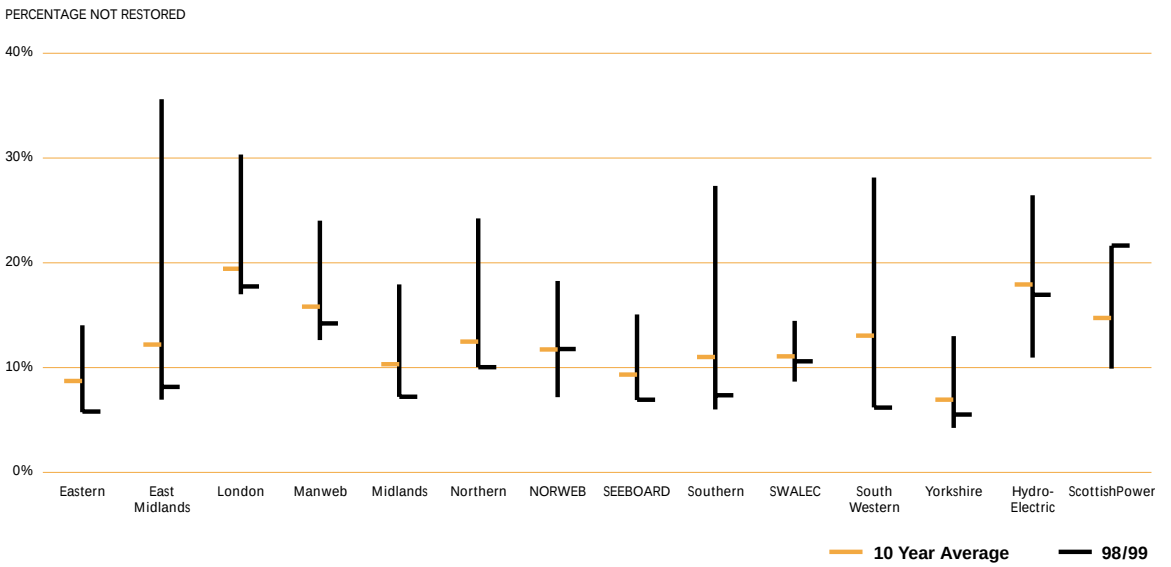
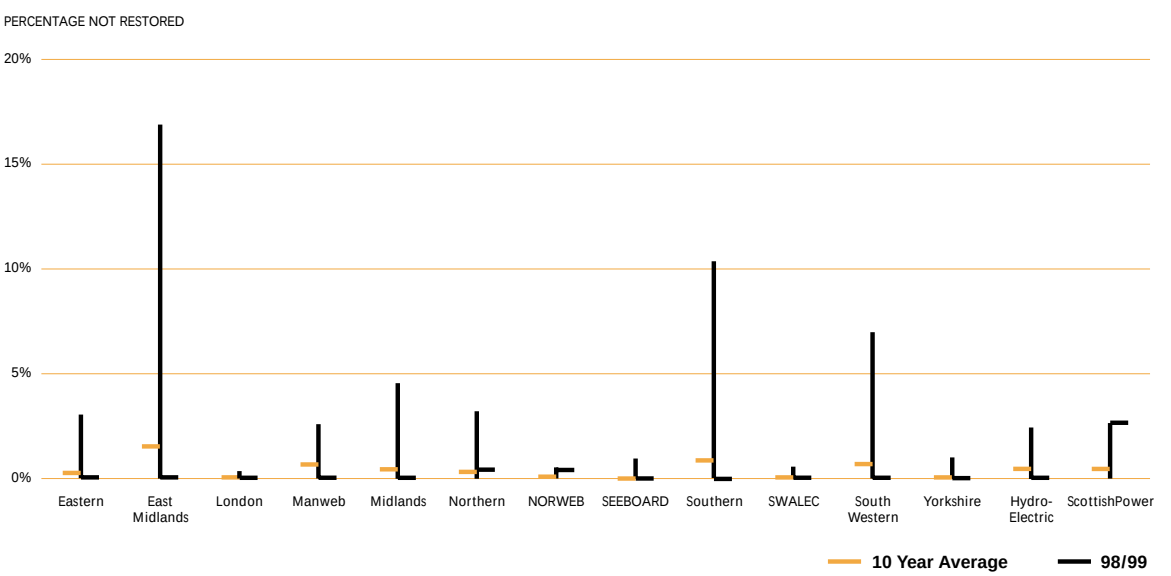


Figure 8 RESTORATION OF SUPPLY Percentage of Interruptions Not Restored within 24 hours

Vertical line indicates range over 10 years

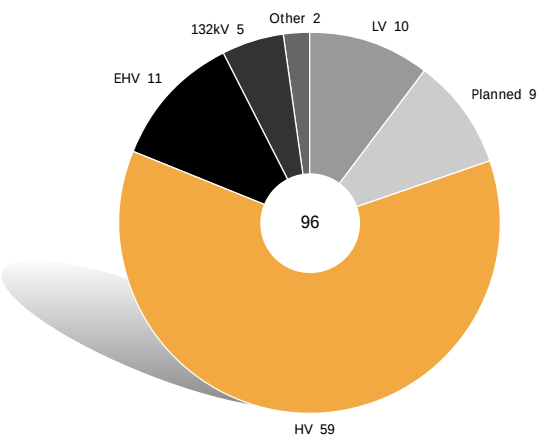


FIGURES 7 AND 8 RESTORATION OF SUPPLY show the companies performance in restoring interruptions to supply within three hours and 24 hours. Thirteen companies performed better than their 10 year average figure for three hour restorations. Eastern, Seeboard and South Western achieved their best performance figures in the last 10 years. Overall, 90% of interruptions were restored within 3 hours. Virtually all interruptions (over 99%) were restored within 24 hours, as shown in Figure 8.

FACTORS AFFECTING SECURITY AND AVAILABILITY OF SUPPLY

Figure 9 Security 1989/99

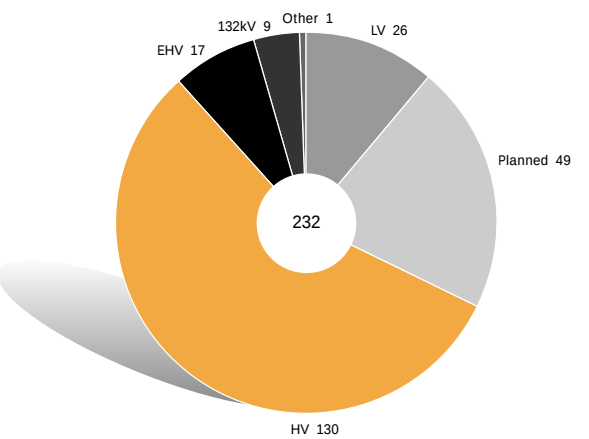
Number and sources of supply interruptions per 100 customers



Note: "Other" includes generation and transmission

Figure 10 Availiability 1989/99

Number and sources of minutes lost per customer



Note: "Other" includes generation and transmission

FIGURES 9 AND 10 NUMBER AND SOURCES OF INTERRUPTIONS AND MINUTES LOST show the contribution to the average number of supply interruptions and overall minutes lost per customer of lack of availability of different parts of the supply system. Generation shortfalls and transmission system failures are included in these figures together they account for only about one per cent of the shortfalls experienced by customers. These charts are based on the 10 year figures for all companies. They demonstrate the crucial role of the distribution system, particularly the HV (generally 11kV) distribution system, in the security and availability of supply experienced by customers. Almost all planned interruptions to supplies occur due to work on the LV and HV networks. These results are not significantly different from previous years.

The HV system has a large impact on overall system performance because much of it does not have duplicate or alternative supplies and each fault can affect a large number of customers. In general, the higher voltage systems (EHV, 132kV and transmission systems) do have duplicate supplies so that most faults at these voltages do not result in an interruption of supply to customers. Each LV fault does not affect as many customers as those at HV. Improvements in the control and operation of HV systems, to reduce the number and duration of circuit outages due to planned work and faults, could bring significant improvements in overall levels of performance. Some companies have reported initiatives in these areas in their Quality of Supply Reports.

OVERALL DISTRIBUTION SYSTEM PERFORMANCE

Figure 11 OVERALL RELIABILITY Number of Faults per 100km of Distribution Systems (Mains only)

Vertical line indicates range over 10 years

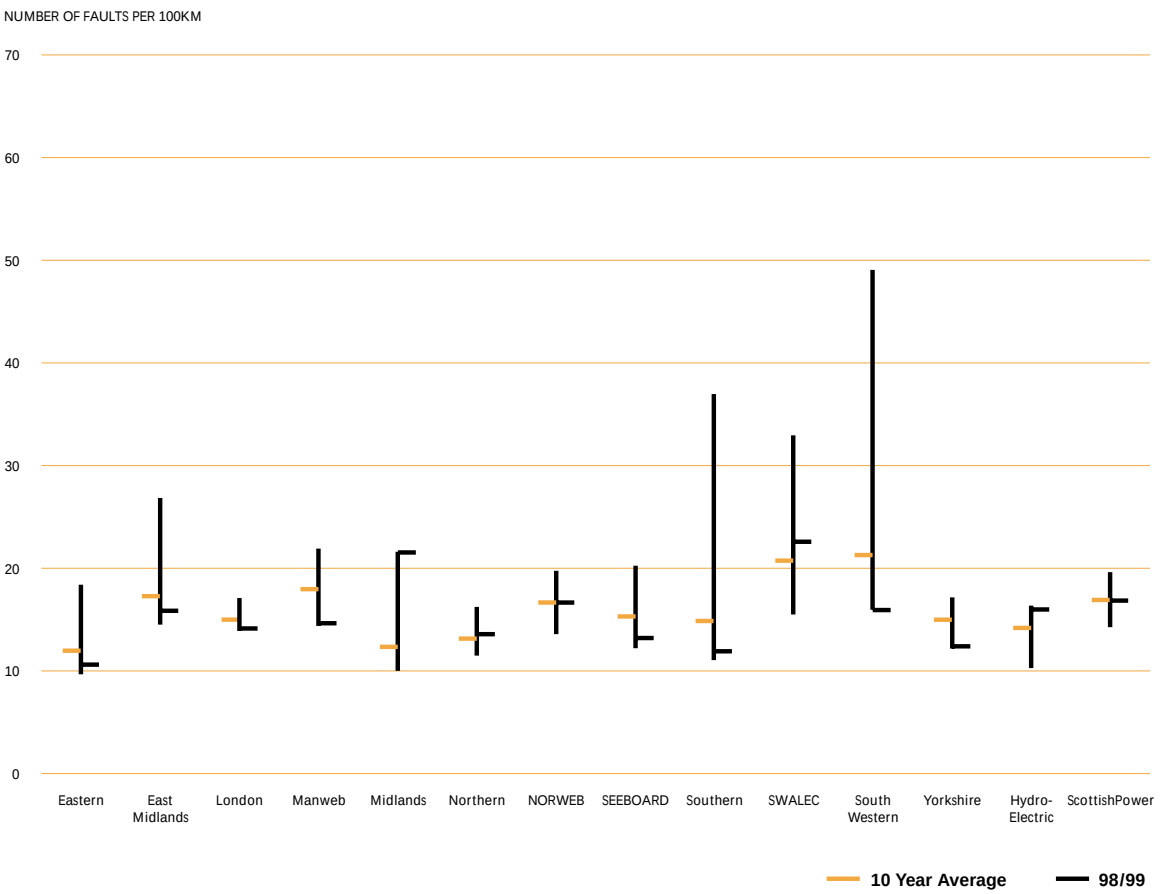


FIGURE 11 OVERALL RELIABILITY of distribution system performance is defined as the number of faults per unit length of network. This length of the network is taken as being the length of the mains only, excluding service cables which connect each customer to the mains. This is because reliable data on the length of service cables is not always available. In making comparisons between companies it should be noted that the Scottish companies 132kV circuits are classified as part of their transmission networks and are therefore not included in this analysis, whereas for RECs these circuits are part of their distribution networks.

Eight companies performed better than their 10 year average figure and Manweb, South Western and Yorkshire reported their best results for the 10 year period.

Figure 12 SECURITY HV Underground Networks

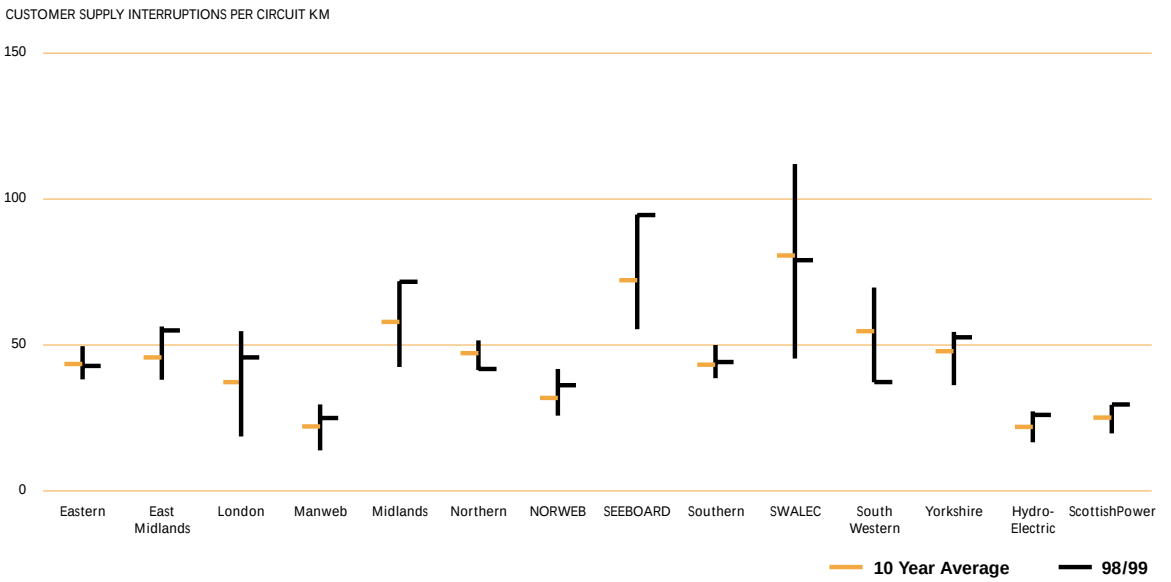
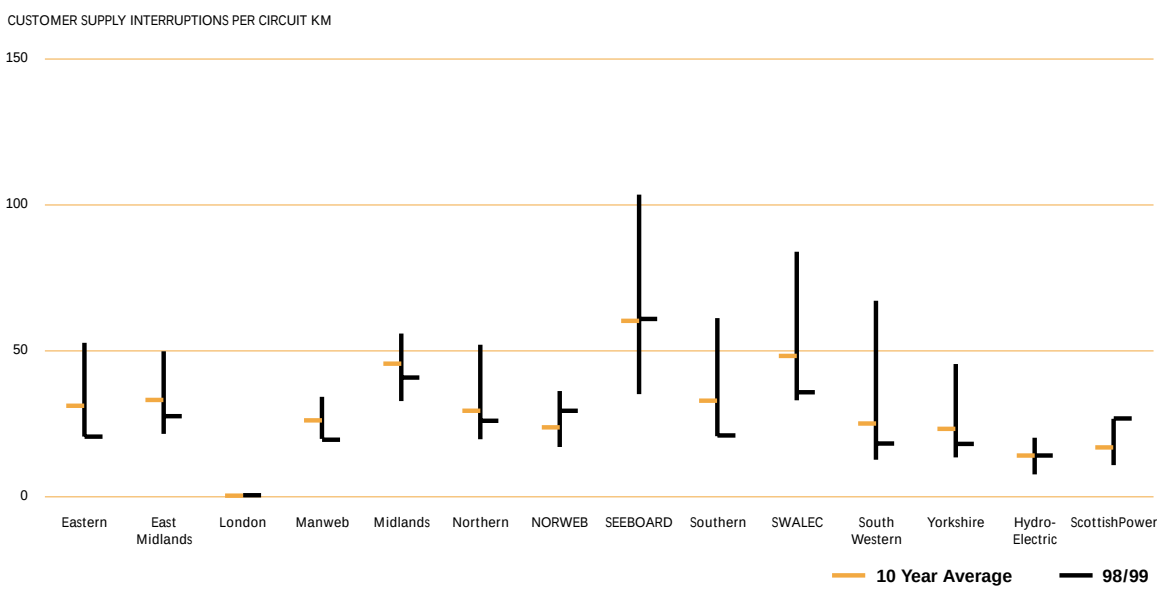


Figure 13 SECURITY HV Overhead Networks



FIGURES 12 AND 13 SECURITY OF HV UNDERGROUND AND OVERHEAD NETWORKS show the number of customer interruptions per circuit kilometre arising from faults on the HV underground and overhead distribution systems.

On underground systems ten companies reported worse results than their 10 year average. Midlands, Seeboard and ScottishPower reported their highest number of HV underground interruptions per circuit kilometre in the last 10 years. On the overhead networks, ten companies reported better results than their 10 year average. Eastern, Manweb and Southern reported their lowest number of HV overhead interruptions per circuit km in the last 10 years while ScottishPower reported its worst performance.

Figure 14 AVAILABILITY HV Underground Networks

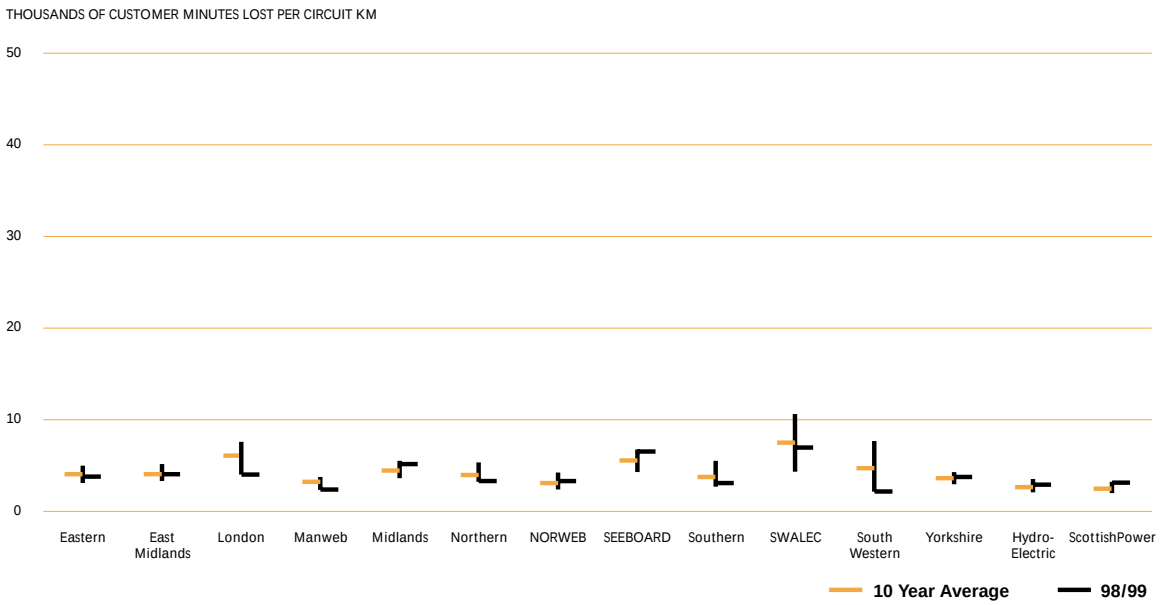
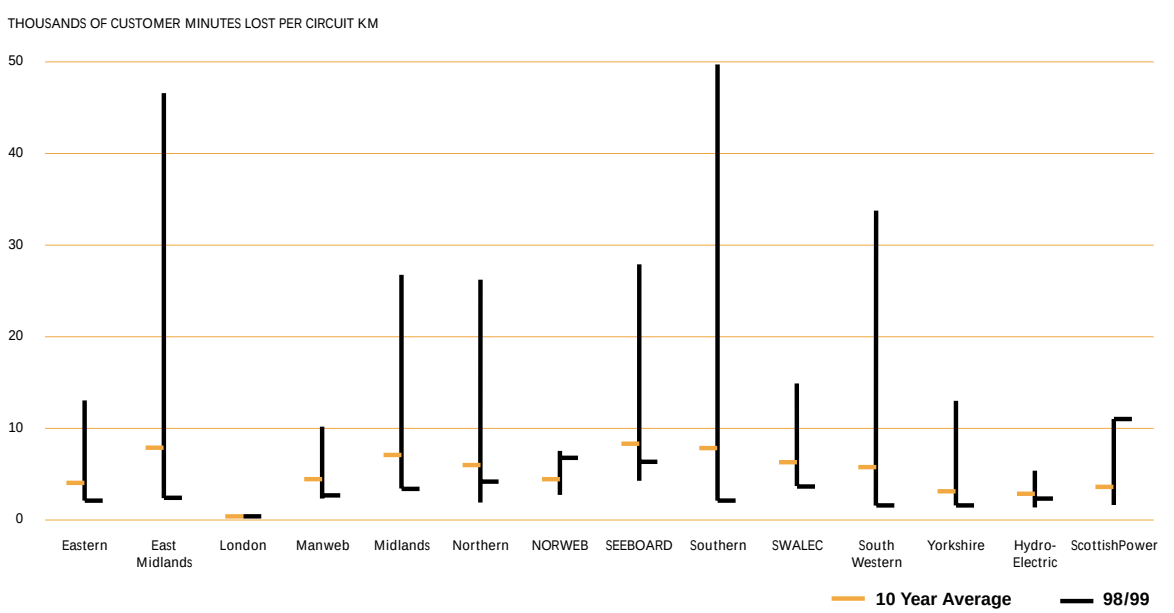


Figure 15 AVAILABILITY HV Overhead Networks



FIGURES 14 AND 15 AVAILABILITY OF UNDERGROUND AND OVERHEAD NETWORKS. Underground circuit availability performance in 1998/99 was better for most companies than their 10 year average performance. London and South Western reported their best performance in 10 years while ScottishPower reported its worst.

Over the past 10 years overhead circuit availability performance has been far more variable than underground circuit availability, reflecting the effects of weather conditions. Seven companies reported their best results in 10 years while ScottishPower reported its worst.

TRANSMISSION SYSTEM PERFORMANCE

Figure 16 Incidents per year

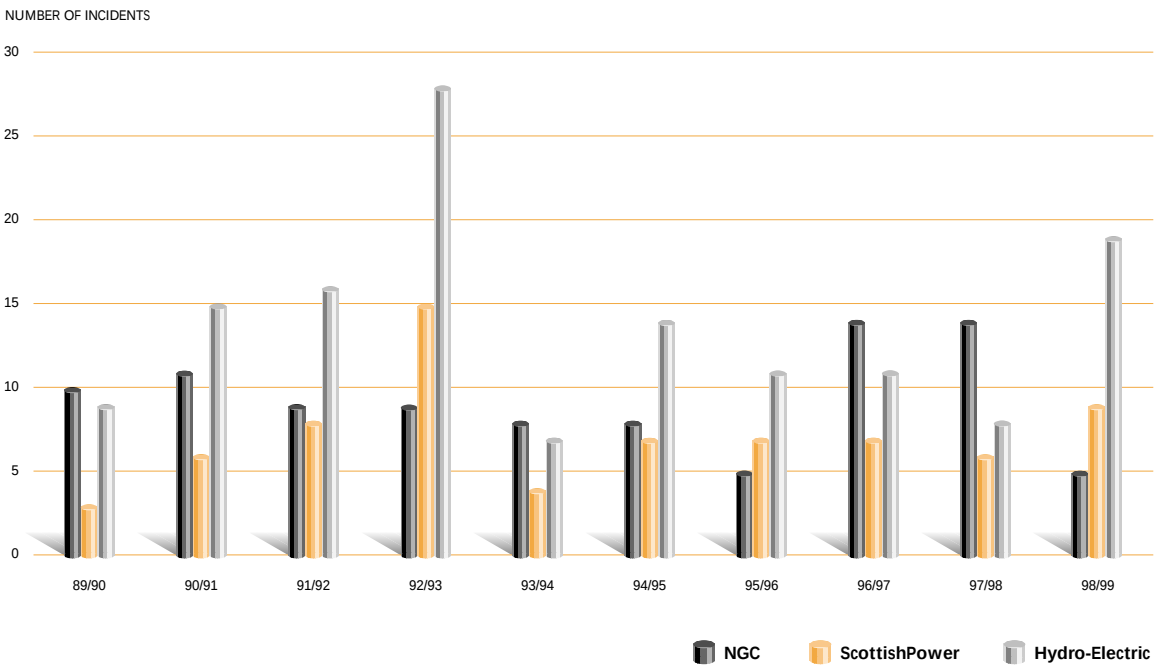


FIGURE 16 INCIDENTS PER YEAR shows the number of incidents when there was a loss of supply to one or more customers because of faults on the transmission system.

NGC said that, of the five incidents reported, two of the incidents were due to lightning and three incidents were due to connection arrangements chosen by customers at single customer sites, customer system configuration or faults on other adjacent systems.

ScottishPower and Hydro-Electric reported more incidents (nine and nineteen, respectively) than in recent years. Of the nineteen faults reported by Hydro-Electric, fifteen were due to severe weather.

Figure 17 Unsupplied Energy (MWh) per Incident - NGC

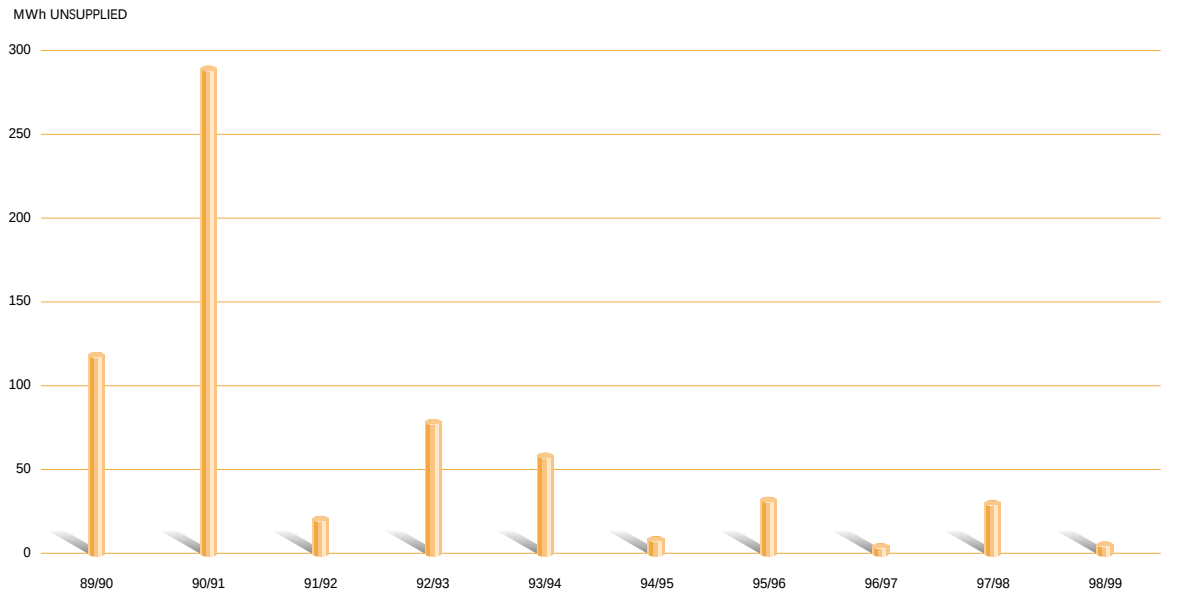
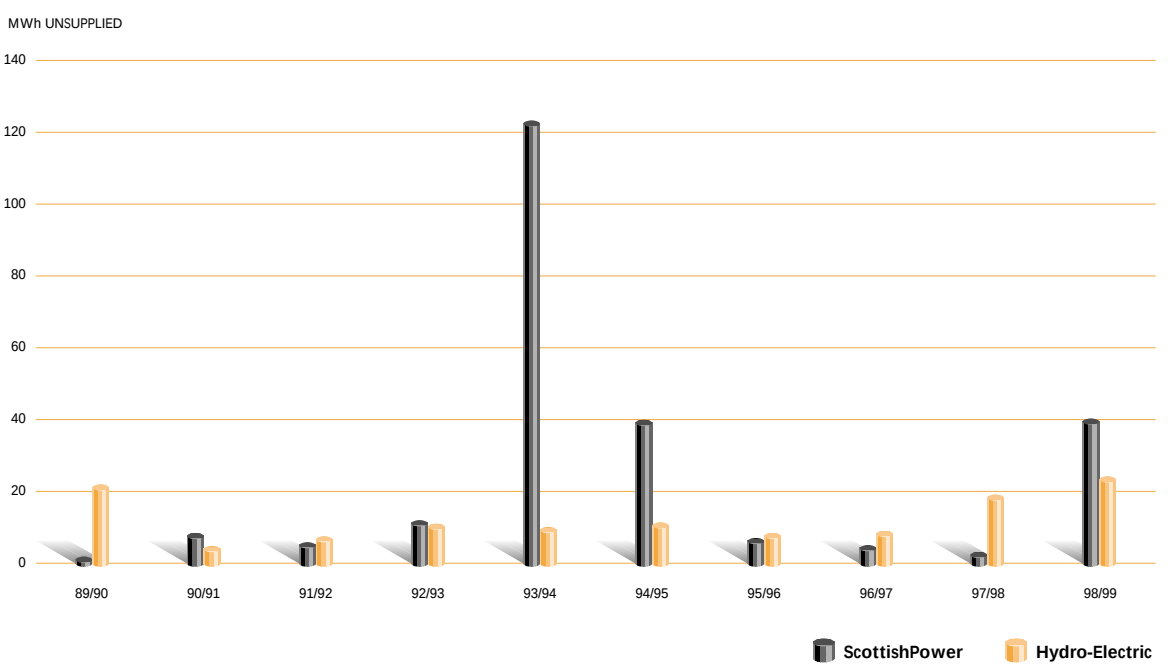


Figure 18 Unsupplied Energy (MWh) per Incident - Scotland



FIGURES 17 & 18 UNSUPPLIED ENERGY PER INCIDENT display the average amount of energy that is not supplied for the incidents recorded in Figure 16. In past years, the unsupplied energy per incident is generally higher in England and Wales than in Scotland, primarily reflecting the differences in load density.

Figure 19 Transmission System Unavailability

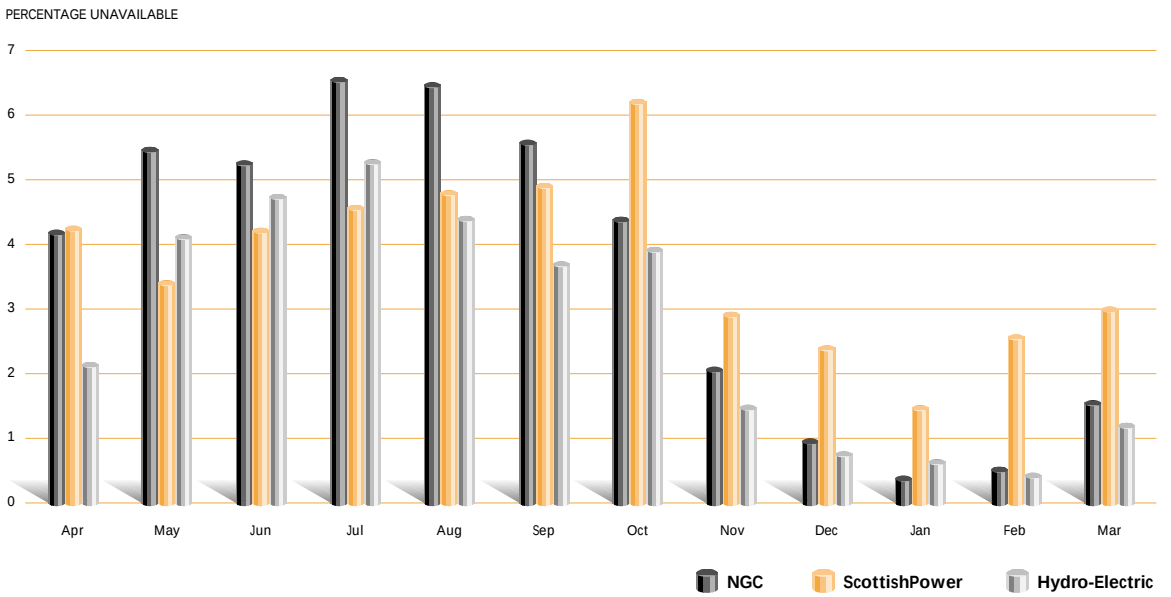


FIGURE 19 TRANSMISSION SYSTEM UNAVAILABILITY shows the monthly pattern of the time for which transmission circuits are out of service. The highest unavailabilities occur during maintenance work, which is generally scheduled for the summer when overall electricity demand is at its lowest.

Trends of annual unavailability are shown in Figure 20 below. NGC s unavailability has fallen in recent years and is now similar to that of the two Scottish companies. NGC has said that its initiative to reduce transmission uplift is reducing annual unavailability through the better planning of system outages.

Figure 20 Annual Unavailailability

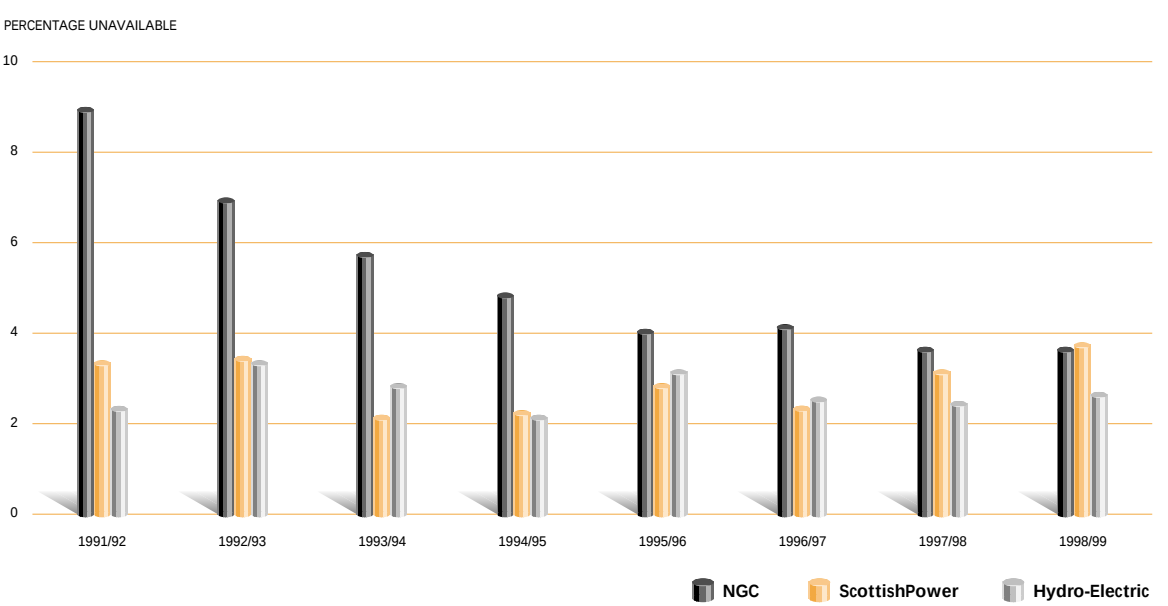


Figure 21 Transmission System Unavailability

Reason for Unavailiability NGC

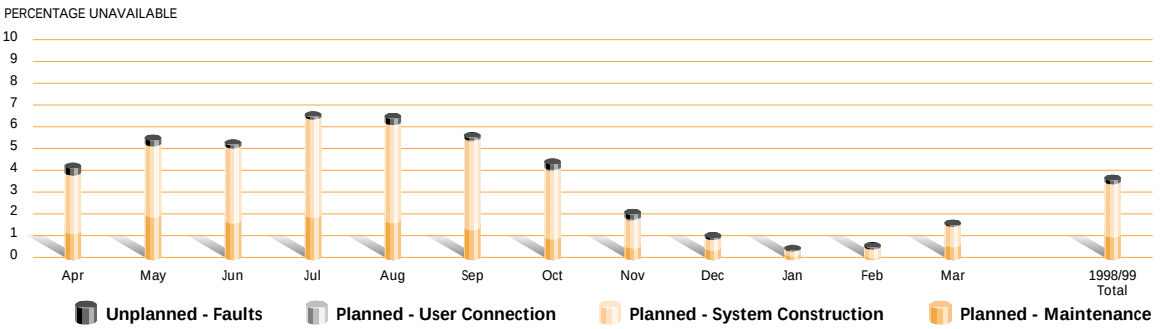


Figure 22 Transmission System Unavailability

Reason for Unavailiability ScottishPower

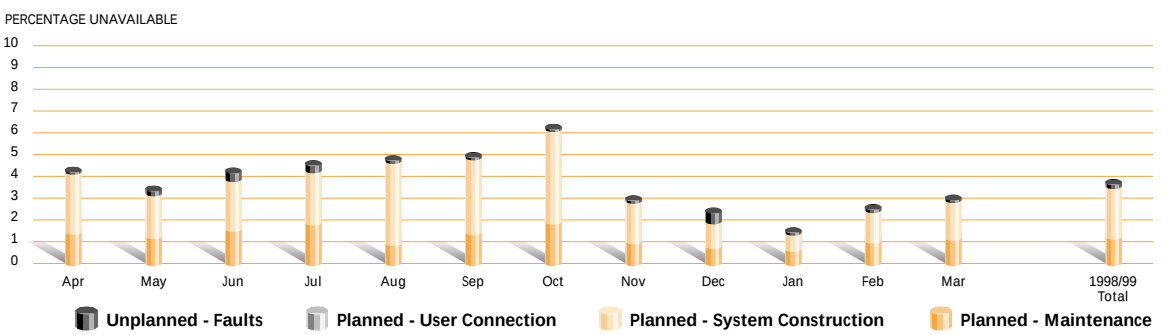
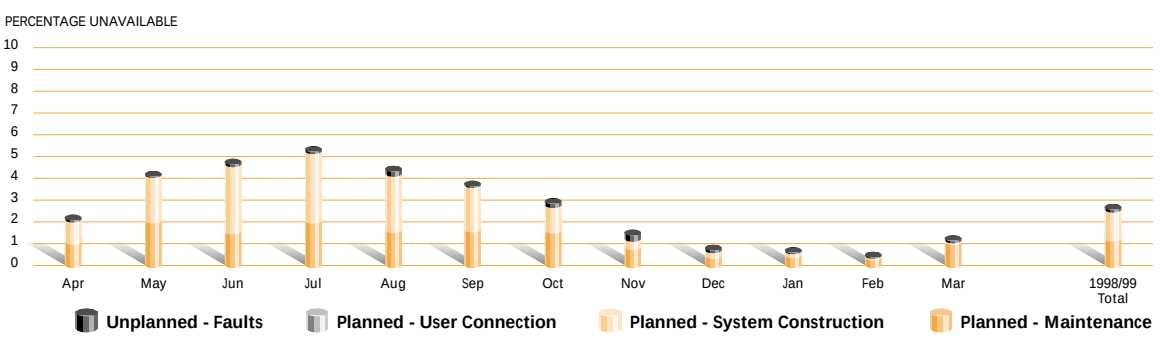


Figure 23 Transmission System Unavailability

Reason for Unavailiability Hydro-Electric



FIGURES 21 TO 23 REASONS FOR TRANSMISSION UNAVAILABILITY show the monthly unavailability for the transmission companies. These are categorised as follows:

Transmission system Maintenance
Transmission System Construction
User connection to the transmission system (i.e. work on assets dedicated to one user)
Transmission system Faults

Most of the unavailability results from factors which are planned and are within companies control, and these causes of unavailability are reduced during the winter months.

Figure 24 Interconnector Unavailability

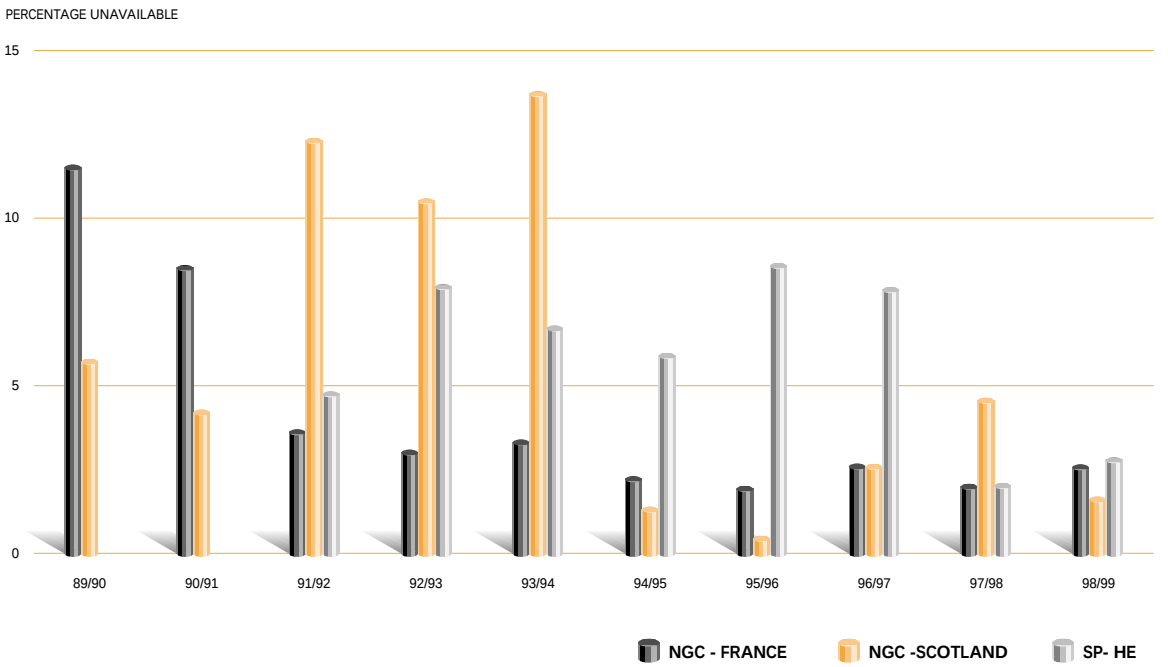


FIGURE 24 INTERCONNECTOR UNAVAILABILITIES presents the levels of unavailability of the transmission system interconnectors at the geographic boundaries of the three transmission systems.

STANDARDS OF SUPPLY QUALITY

Frequency

The electricity system in Britain is interconnected and all customers experience a common frequency. NGC is responsible for keeping system frequency within the statutory limits of –1%. NGC reported that there were no frequency excursions outside statutory limits during 1998/99. Hydro-Electric reported a frequency excursion on a section of its transmission system which became separated from the rest of the system during a fault this event lasted less than one minute.

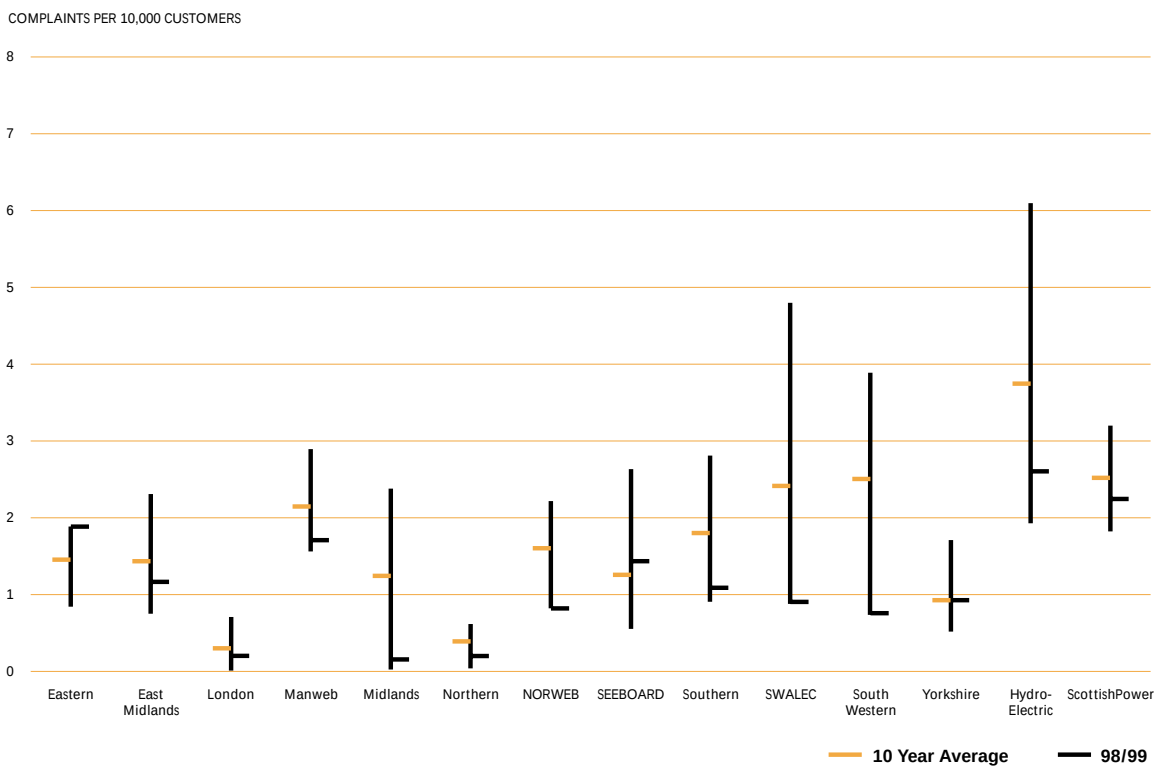
Transmission System Voltage

Transmission system voltages must comply with limits of variation set out in the Electricity Supply Regulations and Grid Codes. NGC reported no occasions when voltages went outside prescribed limits in 1998/99. ScottishPower and Hydro-Electric each reported one such voltage excursion.

DISTRIBUTION SYSTEM VOLTAGES

Figure 25 Verified Voltage Complaints per 10,000 Connected Customers

Vertical line indicates range since recording started



Number of years data available

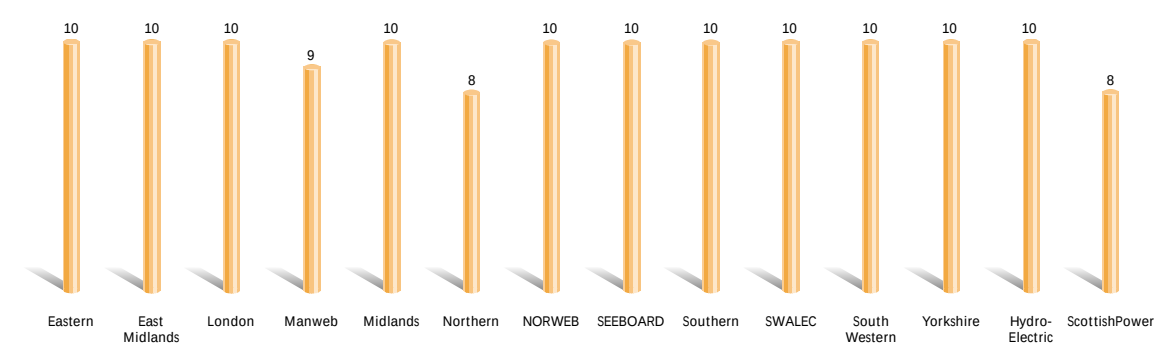


FIGURE 25 - VERIFIED VOLTAGE COMPLAINTS Companies reported the number of voltage complaints which they received during the year and which resulted from supply voltages being outside the statutory limits. Not all companies have statistics going back for the previous 10 years. Midlands, Norweb, SWALEC and South Western each reported their best year.

From 1 January 1995, the nominal supply voltage in Britain changed from 240V +/- 6% to 230V, +10%, -6%, that is, the permitted voltage range changes from 225.6V-254.4V to 216.2V-253V.

Distribution Systems Quality of Supply

As mentioned earlier, the Companies produce annual Quality of Supply reports which include their own targets for improved performance and details of actual capital expenditure compared with OFFER s assumptions made at the 1995 price control review.

Distribution Systems Quality of Supply Targets

The tables below show summaries of company targets for improvements in numbers of supply interruptions and numbers of customer minutes lost. Individual companies Quality of Supply reports contain fuller details of company objectives and also describe how companies intend to improve quality of supply for their worst-served customers.

SECURITY TARGETS

	Number of interruptions per 100 Customers	
		Company year 2000 targets
	94/95 number of interruptions per 100 customers	1999/2000 number of interruptions per 100 customers
Eastern	65	70
East Midlands	96	87
London	40	30
Manweb	70	Between 50 and 60
Midlands	121	109
Northern	89	Between 85 and 90
NORWEB	70	55
SEEBOARD	91	82
Southern	75	70
S WALEC	220	189
South Western	124	87
Yorkshire	85	78
Hydro-Electric	176	147
ScottishPower	61	Between 55 and 65

AVAILABILITY TARGETS

	Customer Minutes Lost per Connected Customer	
		Company year 2000 targets
	94/95 number of customer minutes lost per connected customer	1999/2000 number of customer minutes lost per connected customer
Eastern	94	66
East Midlands	105	73
London	58	40
Manweb	102	Between 65 and 75
Midlands	128	86
Northern	95	93
NORWEB	70	64
SEEBOARD	83	60
Southern	78	60
S WALEC	160 (Faults only*)	191
South Western	133	93
Yorkshire	69	56
Hydro-Electric	233	210
ScottishPower	70	Between 65 and 75

* Excluding planned interruptions

DISTRIBUTION COMPANIES NETWORK DATA

To assist in the evaluation of distribution system performance statistics the table below sets out details of the networks of the distribution companies as at 31 March 1999 (customer numbers are as at 30 September 1998).

COMPANY	Area sqkm	Customers ('000s)	Overhead (Circuit km)	Underground (Circuit km)	Transformers In Commission Number	Transformers In Commission Aggregate Capacity (MVA)
Eastern	20,300	3,322	35,158	54,589	62,505	38,385
East Midlands	16,000	2,300	24,118	43,633	39,673	32,069
London	665	2,011	40	30,120	13,498	20,369
Manweb	12,200	1,393	21,471	23,842	41,632	17,108
Midlands	13,300	2,260	25,471	38,331	48,800	24,495
Northern	14,400	1,451	17,230	26,707	24,341	13,588
NORWEB	12,500	2,140	13,955	44,817	32,030	30,678
SEEBOARD	8,200	2,126	12,285	32,488	32,272	23,855
Southern	16,900	2,652	27,913	44,021	51,429	42,174
S WALEC	11,800	980	18,659	14,214	38,618	12,262
South Western	14,400	1,344	29,304	18,705	48,957	19,372
Yorkshire	10,700	2,088	15,892	38,376	31,009	30,050
Hydro-Electric	54,390	640	30,362	19,561	47,524	10,107
ScottishPower	22,950	1,870	24,392	40,004	39,626	23,043
TOTAL	228,705	26,577	296,250	469,408	551,914	295,381

FURTHER INFORMATION

This report is a summary of the information provided by the distribution and transmission system licensees. In some cases, companies chose to submit commentaries and explanations in support of their figures.

Copies of the reports submitted by the companies are available at cost from the Ofgem library, Hagley House, Hagley Road, Edgbaston, Birmingham, B16 8QG.

The data given by the companies and used in this report is also available via the Internet in Lotus 1-2-3 spreadsheet format (WK3) suitable for further analysis at www.ofgem.gov.uk. Requests should be directed to the Ofgem library at Birmingham.

Details may also be obtained from each reporting company.