

Securing continuity of supply

What is load shedding?

When there is insufficient power station capacity to supply the demand (load) from all the customers, the electricity system could become unstable, possibly resulting in a national blackout. To avoid this, Eskom can either increase supply or reduce demand.

To increase supply, Eskom runs its power stations at maximum available capacity. In addition to the coal and nuclear plant, hydro and gas turbine stations are used at peak times when demand is high.

To reduce demand, Eskom will first call on customer contracts that allow for supply to be reduced or interrupted for specific periods and durations. If this is not enough, Eskom is forced to cut supply to all other customers. This could be done through either scheduled or emergency load shedding.

During scheduled load shedding, parts of the network are switched off according to a predetermined schedule, with the impact spread equitably over the customer base. Load shedding is predictable and allows for customers to plan accordingly, as opposed to blackouts that are not.

In exceptional circumstances, such as many unplanned outages at power stations, additional emergency load shedding could be required. Control centres will then shed load using emergency switching in order to protect the network. This will be less predictable and all customers may be affected at any time.

Load shedding – demand exceeds supply

Introduction

Between October 2007 and February 2008 South Africa suffered major supply interruptions, as load shedding had to be implemented to manage the energy shortage.

Load shedding is carried out by Eskom, together with redistributors (municipalities), when the demand for power on the national grid exceeds the available generation capacity. Failure to manage this would result in the possibility of massive power blackouts across the nation. To avoid this, Eskom monitors the demand for power and sheds (shuts down) sections of the grid to reduce the load and ensure network stability.

Electricity cannot be stored to act as a buffer against any unforeseen events. An adequate reserve margin¹ acts as a buffer against such circumstances. With the decline in the reserve margin the only option available is to reduce the load through load shedding and reduced demand by customers.

Why the energy shortage?

From 1996 to 2004, both the private sector and government felt that Eskom should not build new capacity, although they were warned that a decision was required by 2000. Government wanted to bring independent power producers into the market. Eskom's low prices, however, dissuaded independent power producers from investing in the power-generation sector. We were only given the go-ahead to start building new plant in October 2004. Taking into account the long lead times to build new stations, there was not sufficient time to build new power stations to ensure adequate generation capacity in the short term.

¹ A cushion of spare capacity that can be used when planned maintenance is necessary and when the system is impacted by unexpected technical faults that demand unplanned maintenance, such as poor coal quality, sudden peaks in demand, or "acts of God", such as extreme weather conditions. Reserve margin is measured as a percentage of maximum generating capacity.

Eskom's reserve margin has decreased to about 8%, well below the accepted international norm of 15%.

As a result, Eskom's reserve margin has decreased to about 8%, well below the accepted norm of 15%¹. When generator units are taken out of service for planned maintenance², the lower reserve margin means that the remaining generator units need to run harder to meet the demand for electricity. This makes the units more vulnerable to faults caused by accelerated wear and tear. As a result, we experienced an increase in technical faults during this period.

The situation was worsened by a reduction in the quality of the coal received, which necessitated the burning of increased volumes of coal for the same output of electricity. The unusually heavy rains during January and February 2008 also caused production delays at the collieries. In addition wet coal, which turns to sludge, created coal handling problems both at the collieries and the power stations. As a result of these coal problems, a number of power stations were unable to operate at full production.

Government and Eskom have apologised for these events. We acknowledge that load shedding is very disruptive and we are extremely concerned about its impact on our customers. Many difficult lessons have been learnt.

Managing demand

Eskom has the challenge of optimally balancing the supply of, and demand for, electricity to ensure a more reliable supply of energy for all consumers.

The solution is to improve the operational performance of our power stations and at the same time find sustainable short-, medium- and long-term solutions to the current situation. A number of initiatives have been implemented such as the construction of two open-cycle gas turbine power stations and the recommissioning of three mothballed coal-fired power stations, and further alternatives are being developed to address the challenges. Another supply-side solution is co-generation. In the short term the primary focus is on demand-side initiatives to reduce the demand for electricity, which unfortunately currently includes load shedding.

¹ Nersa has recommended a reserve margin of 19%.

² Planned maintenance is mostly scheduled in the summer months, as electricity demand is traditionally lower in summer than in winter.



Major transmission line construction strengthens the national grid.

Eskom is confident that it can address the challenges, but this is only achievable with the support and assistance of all stakeholders. It is, however, important that emergency load shedding and other demand reduction initiatives should be implemented in a transparent manner to fairly share the load and responsibility among all consumers.

We have developed a set of guiding principles to assist with the optimal planning and effective execution of national load shedding:

- maintaining network stability
- integrated national approach to the crisis
- minimising the safety risk
- minimum disruption to our customers and the community:
 - predictability of disruption
 - fairly share load shedding among customers
 - rotation of load shedding times
 - accommodating special customer needs where possible

The rationale for exporting electricity

Eskom is frequently asked why it exports electricity to neighbouring countries when there is a power shortage in South Africa. Eskom's exports amount to 5,7% of the total energy available in the Eskom system and imports account for 3,9% – giving a net export of 1,8% of total energy.

Our neighbouring countries have a relatively small system demand for electricity, which makes it uneconomic for them to invest in generation capacity. Some of our neighbours rely on imported power for between 50% and 80% of their electricity needs. Such a situation cannot be reversed very quickly and a sudden cut in the electricity supply to them will have a crippling effect on the regional economy.

Firm power agreements are in place with the national utilities of Botswana, Swaziland and Lesotho, while an agreement with Namibia ensures their continued supply as well. In addition to national utilities, Eskom also has firm supply agreements with three large customers across the border in Mozambique and Namibia. These three customers make up the bulk of Eskom's total exports.

The SADC region has considerable coal and gas resources and hydro-electric potential that present attractive generation opportunities for the future. As South Africa's domestic electricity demand grows and production costs increase, there is a growing potential for electricity imports into the country, with environmental benefits if the hydro capacity is considered. Eskom already imports electricity from Mozambique, the DRC and at times the other countries in the region. The current and future imports could be severely jeopardised if exports of electricity from South Africa are restricted.

Ultimately, due to the relatively small size of the level of net exports, ceasing exports and losing imports would not result in a significant difference to the current South African energy situation. The short-term response to the energy situation has been to maximise purchases and reduce sales as far as possible. The load reduction required of the South African customer base (currently 10%) is also expected of the neighbouring countries, and when manual load shedding is necessary our neighbouring utilities also undertake proportional manual load shedding.

Stabilisation and recovery plan

National response plan

The Department of Minerals and Energy and the Department of Public Enterprises launched a national response plan to the electricity challenge on 25 January 2008.

This plan involves plans to increase generating capacity – Eskom's build programme (refer to page 62), as well as co-generation (refer to page 66) and a 1 000MW open-cycle gas turbine power station to be built by an independent power producer. On the demand side, the plan includes the medium-term power conservation programme (PCP) and demand-side management programmes.

Eskom stabilisation and recovery plan

Eskom has established a three-phase stabilisation and recovery plan for the next five years. In phase 1, we stabilised the supply of, and demand for, electricity. Phase 2 involves re-establishing an adequate reserve margin by managing demand; and then in phase 3, we plan to establish a sustained load reduction of 3 000MW through the power conservation programme.

The emergency load shedding at the start of 2008 enabled a 4 000MW load reduction by the end of February 2008. This enabled us to reduce generation load losses and to provide for more planned maintenance.

In response to a call for a sustained 10% reduction in demand, key industrial customers are already voluntarily providing 1 200MW in load reduction. Eskom itself achieved a 1 000MW reduction in load losses by stabilising coal supply.

Unfortunately, only limited reductions were forthcoming from other customers by the end of March 2008.

We acknowledge that load shedding is very disruptive and are extremely concerned about its impact on our customers.

Solar-powered traffic lights research

A research project was initiated in 2007, to evaluate a solar-assisted battery back-up energy supply solution for traffic lights. The project was a collaboration between Eskom research and innovation department and the National Energy Efficiency Agency. A pilot site, an eight-robot intersection, was identified in Cape Town, where the official launch took place on 1 October 2007.

The traffic lights at the intersection were retrofitted with energy-efficient LED lights, a monitoring unit, a solar panel and batteries. The pilot site was monitored and measured for three months to determine the success of the technology. The aim of this project was to evaluate and demonstrate the success of a solar-assisted battery solution for this application as an effective means of providing back-up power supply to large traffic intersections during power outages.

Refer www.eskom.co.za/annreport08/011 for more detail about the solar powered traffic lights.

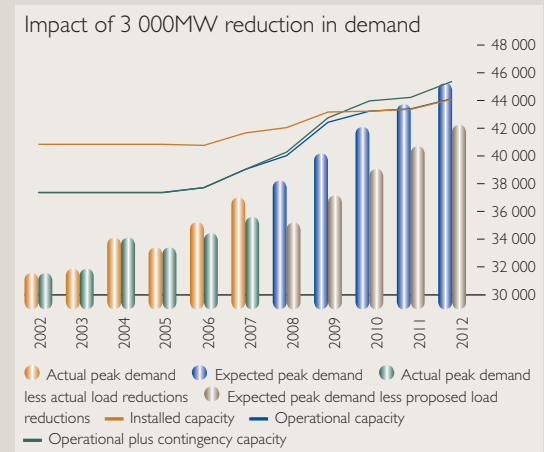
Implementing the recovery plan

Eskom has established a recovery task team around the supply and demand side of the business, focusing on six major streams: supply-side recovery; power buy-back; demand-side management (DSM); public confidence building and communication; employee morale and engagement; planning, risk and resilience management.

The aim is to re-establish our ability to provide a secure power supply by achieving a sustained reduction of 3 000MW over the next four years. This sustained reduction, together with the new capacity from the build programme, improved coal quality and quantity and plant performance, will enable the reserve margin to recover to about 15% between 2010 and 2012 and should provide sufficient energy to cater for the expected economic growth. We will need further interventions by 2012, when the reserve margin is expected to drop to about 9%.



Lethabo power station near Vereeniging.



Supply-side recovery

The supply-side recovery team is working hard to return coal stock to 20 days (refer also to page 58) and improve the generation plant reliability and availability, so that the UCLF (unplanned capability loss factor) and OCLF (other capability loss factor) are consistently within the reserve margin allowance (refer to page 54).

Performance review continued

Power buy-back and demand-market participation (DMP)

The power buy-back team needs to obtain a 2 000MW to 3 000MW demand reduction from energy-intensive customers (furnace and smelting processes) and marginal producers. This is in the feasibility phase.

The DMP programme allows customers to offer Eskom flexible loads on a year-ahead or day-ahead basis, at a favourable predetermined price. When Eskom is experiencing a load shortage, we can first reduce or cut the load to these DMP customers before having to consider other load shedding options. The programme is approved by Nersa and has prevented load shedding on many occasions over the past year. DMP savings of 67MW were contracted for 2008.

Demand-side management (DSM)

Demand-side management involves the installation of energy-efficient and load-shifting technologies to alter the load profile of Eskom. As such it is "hard wiring" savings into the system thereby ensuring a higher level of security of supply in the short to medium term.

There is a need to remove a certain amount of energy, measured in GWh, from the system before 2012, when the supply side options will assist in energy supply. This can be achieved by co-generation, DSM and permanent behaviour change of customers. As a result of this analysis, it is apparent that DSM needs to be accelerated to achieve the required 10 000GWh saving by 2011/12. This requires 3 800MW of energy saving devices to be installed over the next four years. The main focus will be on lighting (residential, commercial and industrial), solar water heaters, smart meters and motor systems.

Mass rollout programmes will involve residential lighting, smart meters and solar water heating. The latter two options will be rolled out in the second half of 2009 and 2010.

In addition to these mass rollout programmes, smaller projects are driven by independent energy services companies (ESCOs). These projects yield valuable MWh savings by large industries and corporate customers. 2009 and 2010 will place a large emphasis on energy-saving initiatives, mainly lighting, by using these resources.

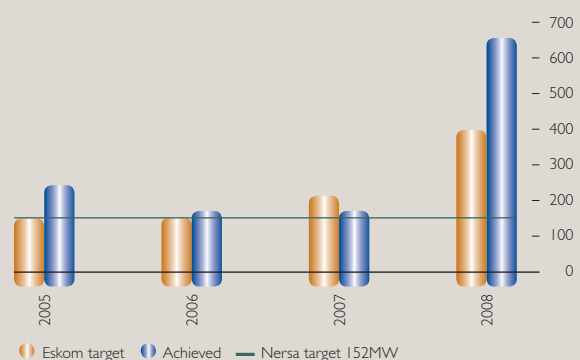
DSM implementation has been guided by Nersa, which includes verifiable short-term DSM savings in its multi-year price determination (MYPD) tariff setting process. Verified DSM savings of 650,4MW (which includes DMP contracted savings of 67MW) were achieved for the year against the Eskom target of 400MW (2007: 169,8MW verified against the Eskom target of 213MW). The mass rollout of compact fluorescent lamps (CFLs) in early 2008 contributed 389,9MW to these savings.

Should the DSM initiatives not result in these energy savings, there is an increased risk of load shedding from 2010 until the supply side options are available. The success of the programme to remove 10 000GWh out of the system by 2011/12, will depend on the correct funding levels being available over the next four years, regulatory support to ensure the correct projects can be implemented, as well as to allow flexibility in the implementation to ensure optimum deployment of DSM interventions.

Refer to www.eskom.co.za/annreport08/012 for more details on DSM initiatives.

DSM performance relative to Eskom and Nersa targets

Demand savings (MW)



The DSM programme saved 650,4MW against a target of 400MW.

Electricity savings tips

At home

There is a golden rule that applies to saving electricity in the home: *If you are not using it, switch it off.*

By partnering with Eskom and changing the way we use energy every day, you can make a difference to the electricity supply shortage in our country.

Geyser – it uses up to 39% of your monthly energy. Switch it off to reduce your energy demand. Don't forget to insulate the geyser and water pipes.

Shower – it uses less water than bathing, and using less hot water means less work for the geyser. Use an aerated shower head since it uses less water.

Lighting – replace all your incandescent bulbs with energy-saving compact fluorescent lamps (CFL) and switch off the lights in unoccupied rooms.

Standby electricity – don't leave your TV, DVD player, etc. on stand-by mode. They still use up to 50% of their operating power. Rather switch them off at the power button and don't forget to unplug your cell phone charger after your phone has been charged or it will continue to draw power.

Refrigeration – close your fridge door quickly so it doesn't use extra power to get back to its optimal cooling level.

Temperature control – keep the room temperature between 18°C – 22 °C – this is known as the "golden zone". Use extra clothes, blankets and hot water bottles to keep warm without using extra heaters.



Incandescent bulbs were replaced with compact fluorescent lamps in KwaZulu-Natal schools.

Electricity savings tips (continued)

Commercial tips

- ask an energy services company to perform an electricity audit
- install a building management system to automatically connect the lighting, and the heating, ventilation and air conditioning systems (HVAC)
- keep doors closed between conditioned and unconditioned spaces – use automatic doors, self-closing doors or air curtains etc
- install efficient lighting systems
- many companies and industries leave their lights on unnecessarily during the day/night. Lighting controls in buildings can make sure that energy is conserved during periods of low occupancy
- make use of the services of lighting specialists when making choices on lighting system design
- switch off equipment that is not used. They waste electricity and generate heat that has to be overcome by the HVAC system when cooling
- enabling power save mode on computers can reduce their electricity consumption by around 40%
- check insulation of cooling systems

Performance review continued

Public confidence building and communication

The objective is to create communication platforms that are frank, transparent, honest and consistent to:

- inform the South African public and our employees about the extent of the energy shortage and the reliability of supply situation and dispel misconceptions
- set out the scenarios that could materialise if South Africans do not work together as a nation to address the problem
- educate the public and our employees about their role in ensuring reliability of supply – now and in the future
- re-establish Eskom's reputation through the effective rollout of this communication strategy to prevent further reputational damage

Employee morale and engagement

Given the tremendous pressure that Eskom employees are currently under, this recovery initiative will focus on improving employee confidence and morale by:

- educating our employees so that they have an understanding of the current issues
- aligning and committing our employees to be part of the solution
- equipping them with the necessary skills (training, education and the filling of key vacancies)
- engaging with employees through initiatives such as road shows by the chief executive
- mobilising the long-term (three to five years) human resources programme to equip our employees to deal with any major crisis the organisation may face

Planning, risk and resilience management

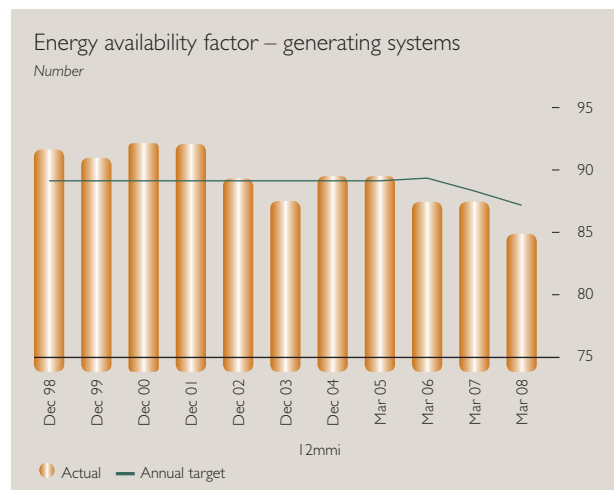
This stream will focus on:

- standards and inputs needed for the planning processes
- energy planning in various timescales
- power delivery planning in various timescales
- assessing vulnerabilities
- building adaptive capacity
- conducting stringent audits for business continuity

In addition to the six streams of the Eskom recovery programme, the following cross-cutting elements that impact the programme and the business overall were identified:

- finance
- economic research and support
- people and skills
- procurement
- legal regulation

The establishment of the Eskom recovery programme has started to contribute to the urgent need for system stability. Going forward, it is critical for all stakeholders to heed the call for savings. New capacity needs to be brought online urgently to stabilise the reserve margin to acceptable levels.



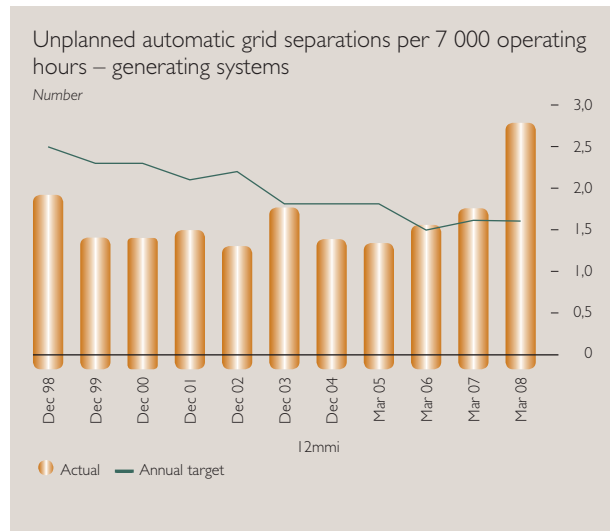
A recovery team is in place to address our system stability.

Generation plant performance

Measure	Description of measure	Unit of measure	Target 2008	Actual 2008	Actual 2007	Comments
Unit capability factor (UCF)	UCF measures the plant availability and provides an indication of how well the plant is operated and maintained	%	≥87,70	86,24	88,60	Not achieved, due to an increase in planned outages and higher-than-targeted UCLF
Energy availability factor (EAF)	EAF measures plant availability (UCF above), plus energy losses not under the control of plant management (external) and internal non-engineering constraints	%	≥87,00	84,85	87,50	Not achieved due to coal quality and coal shortage problems, as well as increased planned outages and higher-than-targeted UCLF (Note: the EAF is derived from the UCF reduced by an OCLF ¹ of 1,39%)
Unplanned automatic grid separations (UAGS/7 000 hours)	UAGS measures the reliability of service provided to the electrical grid and the number of supply interruptions per operating period (7 000 hours on average)	number	≤1,60	2,80	1,76	Not achieved
Unplanned capability loss factor (UCLF)	UCLF monitors the progress in minimising outage times and power reductions resulting from equipment failure and other conditions of plant	%	≤4,20	5,13	4,34	Not achieved due to the significant increase in the load factor which has a strong correlation with UCLF

¹ OCLF – other capability loss factor – factors not directly related to plant reliability.

Performance review continued



Reasons for deviations from the targets

The increased growth in demand over recent years, combined with limited operational capacity, has resulted in a significant increase in the production required from existing power stations. In order to deliver on the continued demand, this increased production has, in many instances, led to plant components being stressed beyond their design operating parameters. This increased level of usage, combined with exceptionally wet conditions in January and February 2008, contributed significantly to a culmination of conditions that resulted in forced capacity losses.

Benchmarking Generation's performance

The increased pressure on the available power stations highlighted the need to determine whether or not the existing coal-fired stations are performing at world-class levels. A benchmark study of coal-fired plant in Eskom and plants in international databases was conducted over the period 1998 to 2006. Results show that over a period of nine years, Eskom generating plant has performed consistently and markedly better than their international counterparts. The only point of caution is that the Eskom UCF (availability) showed a significant drop in 2007.

Despite the decline in performance over the past two years, our coal-fired plant performance continues to be among the best in the world.

Generation technical recovery plan

Generation launched the UCLF (unplanned capability loss factor) recovery action in February 2008. The aim is to stabilise power station performance to an acceptable level by winter 2008, and a predictable and sustainable power supply by the end of 2008. More recently, the Minister of Public Enterprises indicated that Eskom should restrict the total level of forced outages to within 2 500MW (2 000MW from UCLF and 500MW from OCLF). This relates to an annual average UCLF performance of 5,1% across the system.

Eskom power stations have been performing well when compared to international practice.

Condition monitoring

Any piece of equipment ages with time and use. As equipment ages, it is more prone to breakdown and failure, which is obviously not desirable. If the breakdown modes of the equipment are well understood, there are certain signals and events that can be used to pro-actively determine when the plant is close to failure. An analogy of this is the use of cholesterol measurements to give early warning of heart disease. Condition monitoring is the process of monitoring a parameter, or number of parameters, for equipment and to then use this information to indicate the condition or "health" of that item. Condition-monitoring information is used to identify a significant change that points to a possible failure which allows Eskom to take pro-active, preventative maintenance steps to prevent a breakdown.

The UCLF recovery strategy is therefore focused on addressing a multitude of factors, both skills and plant related. The following plant focus areas have been identified within which these issues are being addressed:

- Coal plant (focus on wet coal handling)
- Boiler plant (focus on boiler tube failures)
- Generator and other electrical systems
- Turbine and related plant
- Ash removal systems

The current plant performance recovery initiative will extend over many years. In order to minimise negative customer impact, only the most critical issues can be dealt with in the short term, while many others will be blended into the normal maintenance cycle over years to come. Any limitation on us achieving the minimum level of required maintenance will provide a severe setback to the recovery programme and lead to unpredictable plant performance. For now, the outlook for unplanned outages

The average age of plant in the transmission network is 31 years, calling for high levels of maintenance.

remains high, although these are being managed on an ongoing basis to reduce customer impact. The overall level will only show sustainable improvement as the above interventions show significant progress.

Refer to www.eskom.co.za/annreport08/013 for more details on the UCLF recovery strategy.



Apollo substation in Gauteng.

Transmission system performance

Measure	Description of measure (and unit)	Target 2008	Actual 2008 (include load shedding)	Actual 2008 (exclude load shedding)	Actual 2007	Comments
Number of interruptions	Interruptions affecting the continuity of supply	≤36	49	48	28	Not achieved. A significant deterioration from last year and worst performance since 2002. See comments below
Number of system minutes lost	Total number of system minutes lost (for incidents of less than one system minute)	≤3,90	3,56	3,56	3,67	Results within target, although the number of interruptions increased
Number of major incidents	Records number of incidents with a severity greater than one system minute					Not achieved
	– severity degree-one (≥1, but less than 10)	≤1	5	5	1	The five major incidents of degree-one severity were the result of equipment failure
	– severity degree-two (≥10, but less than 100)	0	0	0	1	
	– severity degree-three (≥100)	0	1	0	0	The degree-three incident was the result of load shedding
Number of line faults	Number of transmission line faults per 100km	≤2,2	2,31	2,31	2,43	Not achieved, although this is an improvement from last year's performance

Performance review continued

Comments on Transmission's system performance

Transmission's performance was significantly impacted by the high number of interruptions experienced during the financial year. This is Transmission's worst performance since 2002. Equipment failure contributed significantly to the poor major incident performance. Various preventative and corrective actions have since been identified to address the poor interruption performance.

Benchmarking Transmission's performance

Transmission is actively involved in the International Transmission Operations and Maintenance Study (ITOMS™) which compares performance and identifies best transmission industry practices worldwide. Benchmarking Transmission's performance against other similar utilities has proved to be challenging, since transmission businesses differ a lot in terms of network characteristics and processes and, therefore, performance levels vary as well. The end result is that benchmarking is nearly impossible.

Refer to www.eskom.co.za/annreport08/014 for more details on the major incidents.

Transmission maintenance and refurbishment

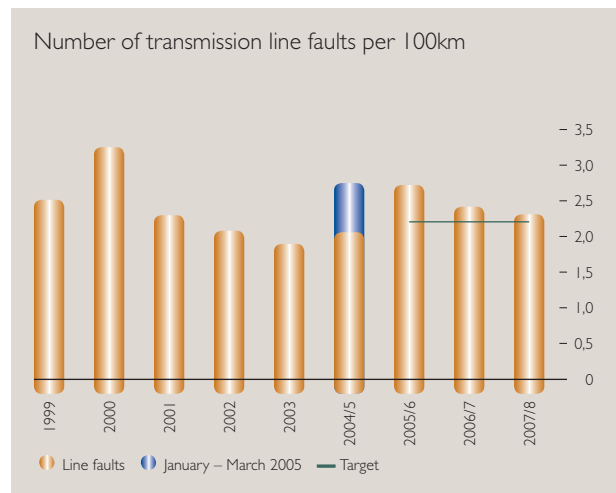
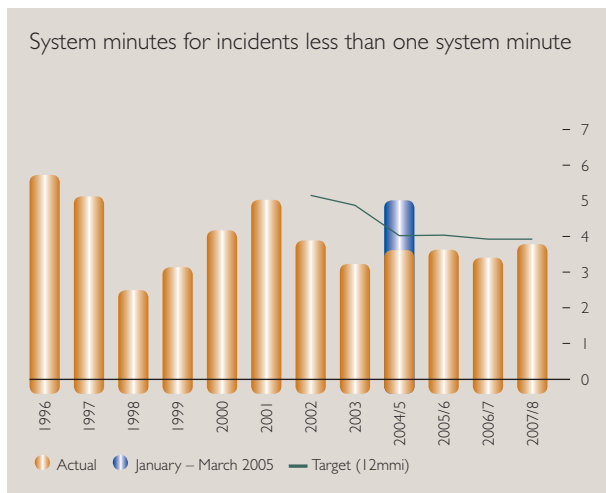
The average age of plant in the transmission network is 31 years. The oldest substations and lines are 52 years old. This calls for a high level of network plant and equipment maintenance and also refurbishment and replacement of plant that has reached the end of its useful life.

Transmission completed 94,7% of all planned and unplanned maintenance work for the year (2007: 95,6%). The main reasons for not completing all maintenance were skills shortages, delays in delivery of spares and outage constraints. The delays were mostly in the Western Cape, Southern Cape and KwaZulu-Natal.

During 2008 the following major refurbishment projects were carried out:

- upgrading of insulation on the west and southern Cape coastal substations and lines
- refurbishment of the Apollo converter substation
- refurbishment of 400kV shunt reactors
- refurbishment of power system protection schemes

Refer to www.eskom.co.za/annreport08/015 for details of transformer conditioning monitoring research.



Conductor theft, energy theft and bad weather affected the distribution infrastructure.

Distribution system performance

As the prior year performance and targets did not include major load shedding events, the current year performance has been adjusted and disclosed separately for analysis and comparative purposes.

Distribution network interruption measures

Measure	Description of measure (and unit)	Target 2008 (exclude load shedding)	Actual 2008 (exclude load shedding)	Actual 2008 (include load shedding)	Actual 2007 (include load shedding)	Comments
Distribution supply loss index (DSLII)	Transformer unavailability index (minutes per month)	≤ 5,10	10,36	31,50	9,10	
Reticulation supply loss index (RSLI)	Total transformer unavailability index (hours per annum)	≤ 1,55	2,24	3,39	1,95	
Reticulation supply loss index (RSLI)	Unplanned transformer unavailability index (hours per annum)	≤ 1,10	1,68	2,82	1,33	See combined explanation below for DSLII, RSLI, SAIFI and SAIDI
System average interruption frequency index (SAIFI)	Reliability of supply index (number per annum)	≤ 22,80	25,36	33,72	25,20	
System average interruption duration index (SAIDI)	Availability of supply index (hours per annum)	≤ 42,30	55,51	73,70	51,40	

Comments regarding SAIDI, SAIFI, DSLII and RSLI

Performance has not improved since the previous year and the business plan target was not achieved due to a higher number of planned interruptions for maintenance and refurbishment and an increase in unplanned interruptions, caused by an increase in conductor theft, energy theft and bad weather. Load shedding also had a negative impact on operational performance.

Benchmarking Distribution's performance

Distribution has participated in benchmarking panels in North and South America. The network characteristics and operational processes/practices of the distributors in the benchmarking panels are not the same, which results in a wide range of performance levels.

Eskom's network interruption performance is dominated by the performance of our rural lines, which have historically been built on a least-cost basis. In this respect, Eskom's distribution networks differ significantly from those of other distribution companies that have areas of supply that include large cities and towns. Most rural lines in South Africa are long radial lines with very limited redundancy and back-feed capability. This significantly distorts any comparison to North American distributors in the benchmarking panel.

SAIDI performance in South America (2007) is between 3,5 hours and 90 hours per annum and SAIFI performance between 2,5 and 60 events per annum. Benchmarks for DSLII and RSLI do not exist.

Performance review continued

Distribution quality of supply measures

Measure	Description of measure (and unit)	Target 2008	Actual 2008 (exclude load shedding)	Actual 2008 (include load shedding)	Actual 2007	Comments
Regulation ¹	Waveform quality of supply index (%)	≥97,00	96,20	96,20	99,00	Not achieved – deviations from nominal supply voltage at a few sites.
Unbalance ²		≥94,00	95,20	95,20	99,50	Exceeded – the three phases of supply voltage are electrically balanced
Harmonics ³		≥94,00	91,20	91,20	98,90	Not achieved – unable to avoid higher-order frequencies at a few sites
Type X dips ⁴	Disturbance quality of supply index (%)	≤51,00	29,70	29,70	30,50	Exceeded – faults and breaker operations at the various voltage levels are under control
Type S dips ⁴		≤48,00	28,70	28,70	18,90	
Type T dips ⁴		≤48,00	25,30	25,30	28,70	
Type Z dips ⁴		≤48,00	22,70	22,70	24,40	

Refer to www.eskom.co.za/annreport08/016 for more information on the distribution performance measures.

Primary energy

Coal

Eskom has long-term coal supply contracts with collieries to ensure a continual supply of coal to its power stations. All coal requirements above those of the long-term contracts are supplied through short- to medium-term contracts, which usually have a road or rail transport element associated with the purchase.

Coal procurement and coal stockpile management have been extremely difficult during the review period, with both coal production and quality issues negatively impacting the supplies to the power stations. Increased international demand for coal, by India and China, creates export opportunities for local suppliers

at international market prices. This resulted in increased pressure on both price and quality of contractual and marginal coal requirement. Below specification coal in turn leads to inefficient combustion and increased maintenance requirements.

Coal production and delivery were severely affected during January 2008 as the above factors, combined with wet conditions, led to capacity constraints.

Refer to www.eskom.co.za/annreport08/017 for research into the coal quality effect model.

Recovery plans have been agreed with suppliers to normalise the situation, despite the significant increase in production requirements due to growth in demand.

¹ Regulation reflects the ability to control deviations from the nominal supply voltage contracted with customers.

² Unbalance reflects the ability to keep the three phases of the supply voltage electrically balanced, that is, displaced by 120° relative to one another and the same magnitude.

³ Harmonics reflects the ability to avoid higher-order frequencies in the 50Hz supply voltage.

⁴ Disturbance quality reflects the ability to minimise faults and breaker operations at various voltage levels.

The coal stockpile levels have shown a vast improvement since January 2008.

The increased dependency on road transport significantly impacted road infrastructure. Eskom is assisting with the repair of roads where necessary in order to facilitate coal transport and road safety. The transport of coal by rail has improved significantly compared to the previous year.

The increase in demand for electricity, combined with the constrained supply of coal, resulted in coal stockpile levels being significantly lower than targeted levels. Added to this, the abnormally high rainfall, and the resulting wet coal, caused coal handling issues both at the collieries and at the power stations. Coal with a high ash content and a high degree of fines¹ turns to sludge when wet, causing blockages on conveyor belts and in the grinding mills, which restricts the flow of coal to the boilers.

Recovery plan – coal stockpiles

The focus is now on rebuilding coal stockpiles at the power stations to levels of at least 20 days by the winter of 2008. Eskom plans to secure an additional 45 million tons of coal over a two-year period to supply power stations with additional coal for their normal burn, as well as to rebuild the stockpile. By March 2008,

contracts had been concluded for 37 million tons. Eskom and the coal suppliers jointly committed to resolving production and delivery constraints.

Looking ahead – impact on Eskom's future coal supply

A detailed study is being conducted to ensure that Eskom's fuel supply agreements are appropriately positioned to ensure a sustainable coal supply at reasonable prices and of acceptable quality. At the same time, optimised and flexible transport solutions are being investigated.

Eskom is totally dependent on the South African coal mining industry to supply it with coal. The changes in the global market are placing Eskom under increasing risk in terms of securing future supplies from the local market, in which the production capacity has not kept pace with increases in both local and international demand. It is critical that local production be facilitated to ensure long-term security of supply for electricity production. (Refer to the market and industry overview on page 24.)

Performance – coal purchased and burned

(million tons)	Actual 2008	Target 2008	Actual 2007	Target 2007	Actual 2006	Target 2006
Coal burned	125,3	122,2	119,1	115,3	112,1	113,6
Coal purchased	119,6	129,7	117,4	120,1	111,7	125,3

¹ Pieces of coal less than 1mm in diameter.

Performance review continued

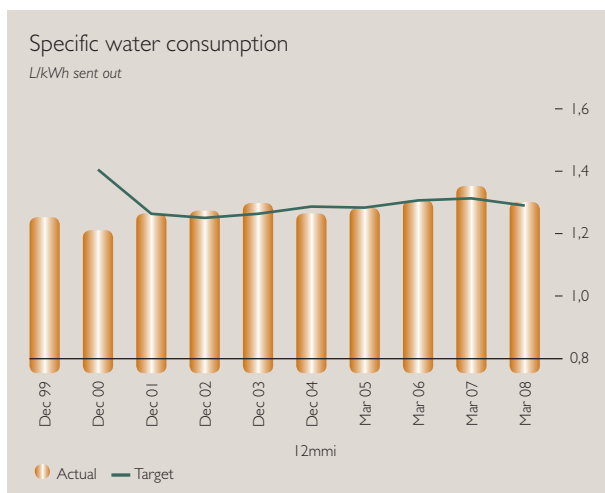
Water

Water used in the production of electricity

	Unit of measure	Actual 2008	Actual 2007
Water used at Eskom power stations (including Koeberg)	ML	322 666	313 064
Electricity produced (including hydro and nuclear)	GWh	239 108	232 443
Specific water consumption (excluding Camden and Grootvlei power stations) (target 1,29)	L/kWh sent out	1,32	1,35

Eskom largely uses freshwater resources from government water schemes. In the period under review, approximately 8 000ML of mine water was used at Tutuka and Lethabo power stations. We are implementing a mine water recovery project to use approximately 6ML/day of mine water at Duvha power station.

The increase in water usage was partially influenced by the quality of raw water received, the deteriorating thermal efficiency at some power stations and the considerable load generated at power stations that are not as water efficient as the modern wet-cooled power stations.



Although the 2008 performance did not meet target, it has improved compared with the 2007 performance, even though production from wet-cooled stations exceeded planned levels. Water management studies have been commissioned with the aim of identifying improvement opportunities.

Increased demand for electricity is expected to result in higher water consumption over the next five years. Although the next generation of coal-fired power stations will be supercritical dry-cooled power stations, overall water consumption is expected to increase by about 14 million cubic metres per annum. This includes the use of water in the flue gas desulphurisation process.

Eskom continues to work with the Department of Water Affairs and Forestry (DWAF) to ensure the effective and efficient management of raw water supply infrastructure. This includes transfer schemes serving existing power stations, planning raw water supply infrastructure projects for new power stations and the timely and efficient processing and authorisation of water-use licence applications. We have secured our water supplies through long-term water supply and payment contracts with DWAF.

DWAF, through its project funding and implementation arm, Trans Caledon Tunnel Authority, is implementing the Vaal River Eastern Sub-system Augmentation Project. This was approved by the South African government to augment raw water from the Vaal Dam to supply Eskom and Sasol's growing water demands in Mpumalanga. The project is due to deliver water by September 2008.

Plans are also well advanced to augment water supplies by transferring surplus effluent return flows from the Crocodile River (West)/Marico water management area, to the Mokolo catchment in the Limpopo water management area. This will enhance water supply to the Matimba and Medupi power stations in the Lephalale area.

Refer to www.eskom.co.za/annreport08/018 for further information on water.

Our next generation of power stations will use water much more efficiently.

Liquid fuels

Before 2008, Eskom operated only two gas-fired peaking stations. During 2007, two new open-cycle gas turbine (OCGT) stations were built and commissioned. The cost of electricity generated by the OCGTs is high due to fuel costs, so their use is ideally limited to peaking and emergency generation. However, with the power shortages in 2007/8, these plants were used much more than was budgeted. The two new OCGT stations used 318 million litres of diesel during the year:

Fuel procurement for the OCGT plant is particularly challenging because of uncertainty around the timing and extent of usage of the plant. With suppliers requiring long lead times for new orders of liquid fuel, it is particularly challenging to meet such production requirements, while at the same time maintaining economic stock levels.

The price of diesel fuel fluctuates with changes in the price of crude oil and the exchange rate. The effect of the increasing oil price combined with a weakening R/USD exchange rate has increased the cost of diesel by 60% during the financial year. The average cost per litre consumed has increased by 34% over the last year. Hedging opportunities for diesel fuel are being investigated.

	2008	2007	2006
Diesel usage (million litres)	345,9	11,3	25,3

Nuclear

Two government-authorised contracts for the supply of enriched uranium were negotiated and signed in 2004. These contracts, along with fuel-fabrication contracts concluded in 2002, ensure that Koeberg power station's nuclear fuel supplies are secured until the end of 2010. Commercial processes to secure supplies beyond 2010 are in an advanced stage.

Supply for the 2010 World Cup

An Eskom project team is working with the metro and municipal electricity departments to ensure the reliability of electricity supply to the stadiums, broadcasting centres, base camps and venues for the 2010 FIFA World Cup South Africa™.

Our process is comprehensive: besides checking equipment and facilities, we are also preparing simulation exercises to test readiness across all operations to prepare our teams for possible emergencies. Municipalities, through the AMEU – their



Lethabo power station in Vereeniging.

representative body – are co-operating with this planning and discussions are underway to form joint 2010 energy task teams with Eskom.

Eskom is also investigating the creation of dedicated 2010 electricity command centres to oversee regional delivery of power. We are working closely with the other members of team South Africa – government at national, regional and local levels, as well as representatives from the municipal and metro electricity departments; host cities; FIFA; the local organising committee; tourism authorities and the information and communication industries – to meet the demands of the main event and related events during the build-up.

FIFA and South Africa have stated that the 2010 FIFA World Cup South Africa™ will be an African celebration. As such, the event has received the support of the Southern African Power Pool (SAPP), who will contribute to powering 2010. The details of the SAPP contributions for the event are currently in discussion.

Eskom is concentrating its efforts on a combination of existing and new 2010-specific initiatives to improve the national power supply capacity. We are also continually reviewing the status of vital transmission and distribution networks across the country.

A successful 2010 FIFA World Cup South Africa™ also depends on a concerted national effort to use electricity more efficiently.