(1)

Briefing to the Portfolio Committee on Minerals and Energy on the Western Cape Power Outages

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Understanding the Cape outage incidents and the challenges that lie ahead

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  - Power supply to the Cape
- Outage incidents
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- Conclusion

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Power supply to the Cape

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Power supply to the Cape

- Koeberg Power Station and transmission transfers from the north
- 2 Koeberg units - 900MW each
- Transmission network carries 50% of load to the Cape when both Koeberg units are online
  - During peak demand periods, peaking generation (Gariep and Vanderkloof hydropower stations and Palmiet pumped storage power station) is utilised.
- During planned maintenance outage of one of the units, the transmission network carries about 75% of the load
  - The use of peaking generation is increased.
  - Emergency generation – Acacia and the Port Rex gas turbines
  - City of Cape Town - Steenbras pumped storage and Foreshore gas turbine

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Cape network

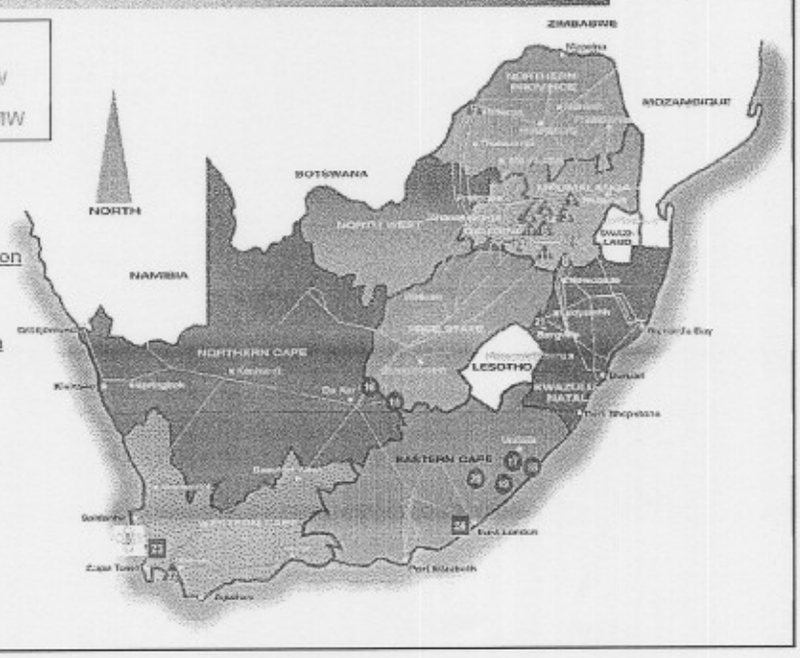
Cape Load
Winter Max : 5 650 MW
Summer Max : 5 100 MW

Transmission Capacity
3 500 MW

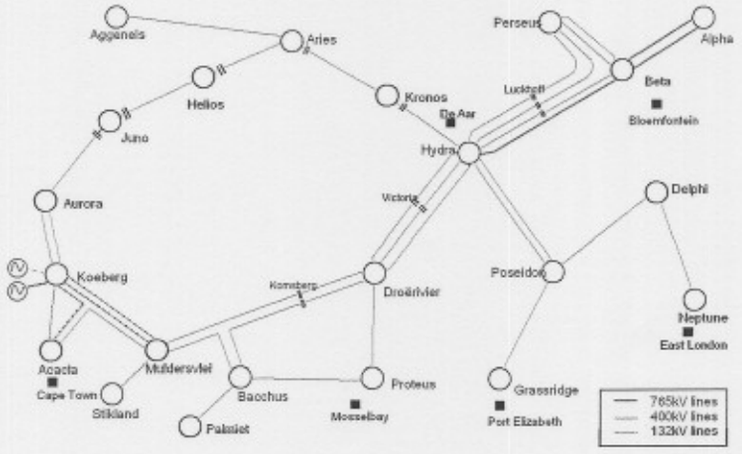
Available Koeberg Generation
1800 MW

Eskom Peaking Generation
400 MW Palmiet
600 MW Hydro
342 MW Gas

Note: The above excludes The City of Cape Town's generation



Cape Network



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November 2005 events

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11 November 2005 event

- Mechanical failure on 400kV switchgear during switching operations in the transmission sub-station at Koeberg
- Automatic protection - tripping of Koeberg generator and scram of the reactor
- Tripping of Tx lines, transformers due to voltage drop
- Loss of 1350 MW
- Within 90 minutes most customers reconnected by Eskom and the municipalities

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16 November 2005 event

- Fire under Muldersvlei – Droerivier 400kV line
- Flash-over (short circuit) between the lines, resulting in the line tripping
- Koeberg Unit 2 experienced a reactor scram due to the operation of the rod control supply protection circuit
- Loss of 1230 MW
- Power restored to most affected areas within 60 minutes
- Lessons learnt on November 11 enabled us to manage events of the 16 November more effectively
- Joint technical team established focusing on among others scheduled load shedding and maintenance, and management of supply to essential services.

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23 November 2005 events

- Controlled shutdown of Koeberg unit 2 due to concerns on a chemical concentration on a safety system
- Load shedding initiated because of network limitations
- Customer assistance was obtained to minimize the mandatory rationing
- Load shedding of 50 to 800 MW occurred for two days from 23 to 24 November 2005

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Current supply status

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Current status of power supply

- Currently supplying the Cape via:
  - Koeberg Unit 2 (unit 1 on extended outage)
  - Transmission transfers
  - Peaking generation (Palmiet, gas turbines)
- Risk of supply interruption will increase should any of the generation plant and/or transmission system fail
  - Doing everything possible to avoid this
  - Eskom will make a call to conserve electricity
- Eskom will communicate any changes

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Slides to 11, 25, 12

The future

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Cape System Supply under emergency

- Emergencies in the Cape could be due to:
  - Unplanned shut down of one Koeberg unit
  - Loss of one of the transmission lines, while one Koeberg unit is refueling, or when the load is high
- In the event of these emergencies occurring the following resources are available for supplying the load:
  - Palmiet Pumped Storage Scheme (400MW)
  - Emergency generating hours on the Orange River Hydro Scheme (600MW)
  - Eskom gas turbines (Acacia and Port Rex =354MW)
  - Demand Market participation (90 to 100MW)
  - Steenbras pump storage scheme (City of Cape Town) based on optimising the maximum demand for the Municipality(180MW)
  - City of Cape Town gas turbine (40MW)

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Challenges

- The challenges include:
  - Running out of water for emergency generation
  - Limited opportunities for pumping
  - Running out of fuel for the gas turbines
  - Limited energy from the demand market participants

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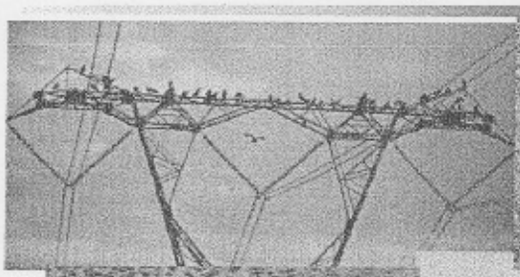
Transmission – Major causes of line faults



Endangered birds used our towers as nests

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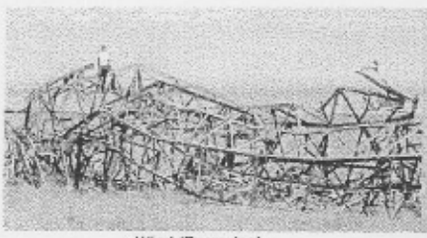
Transmission – Major Causes of Line Faults

Lightning

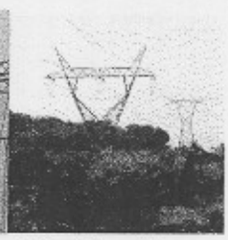
Snow

Veld Fires



Wind (Tornados)

Ice



Protected vegetation

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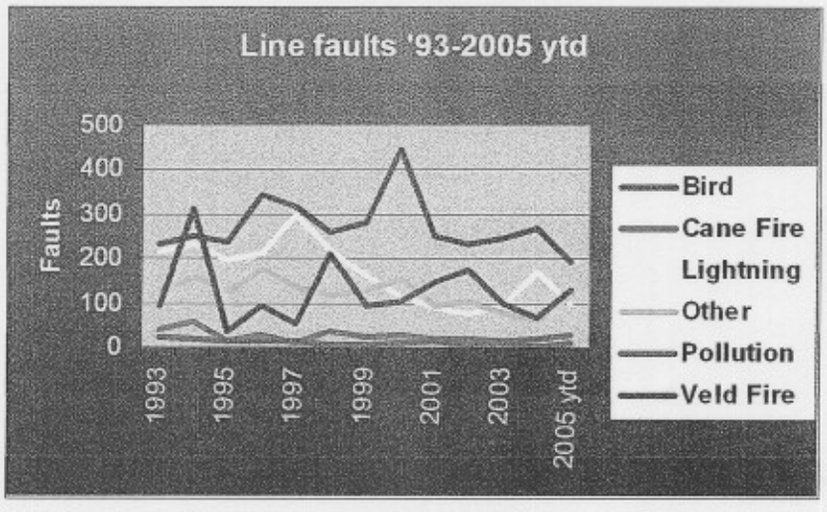
Transmission Line Fault - Causes



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Solutions and Investments

- North of Hydra Transmission: ***R657m***
  - Approved October 2002
  - Completed Dec 2004
- South of Hydra Transmission: ***R1.1b***
  - Approved June 2004
  - To be completed by April 2007
- Southern Cape Grid Strengthening: ***R463m***
  - Approved April 2005
  - To be completed by May 2007
- Open Cycle Gas Turbines ***R3.5b***
  - Approved June 2005
  - To be completed by June 2007

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Conclusion

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Conclusion

- Incidents were different in origin; Common denominator was one Koeberg unit was shutdown
- Risks to supply to Cape increases whenever one Koeberg unit is shutdown; Challenge is linked to higher demand and tightness of supply
- Immediate risks :
  - Unit 2 running, currently not in peak demand period;
  - risk of supply stable;
  - Unit 2 refueling delayed until April/May 2006;
  - Risk increases in winter during peak demand.
- To manage these challenges, a number of mitigating strategies are been implemented and investments are being made to upgrade and build infrastructure

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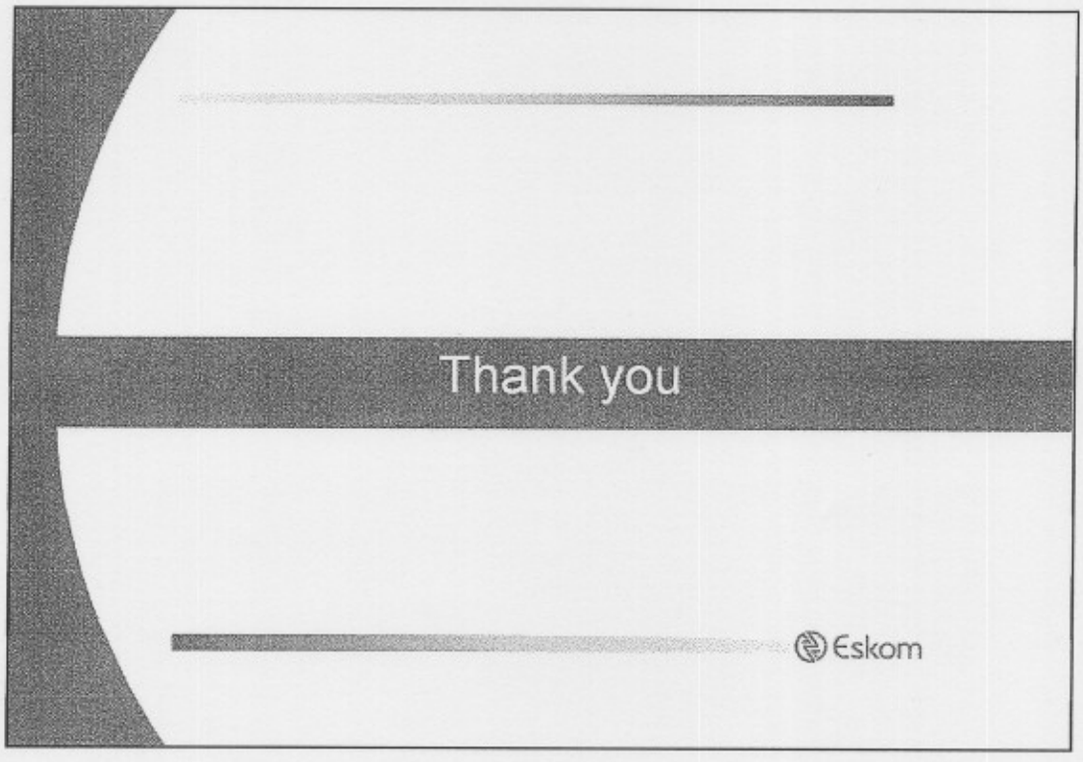
Thank you
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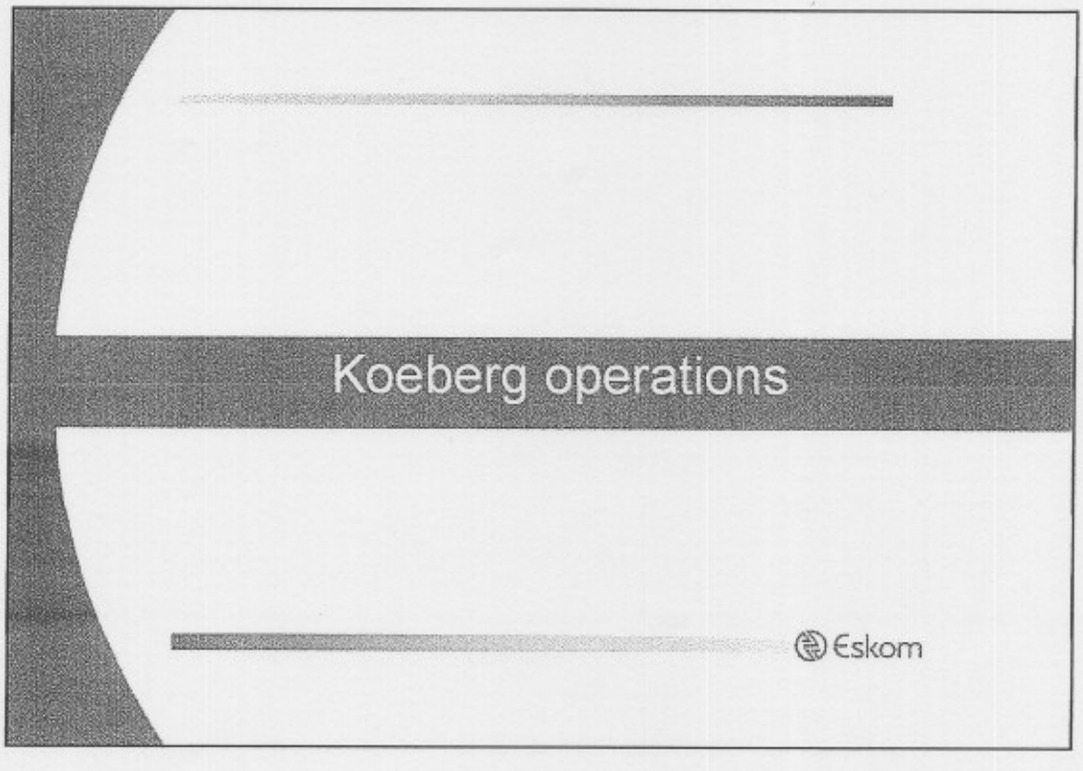
Koeberg operations
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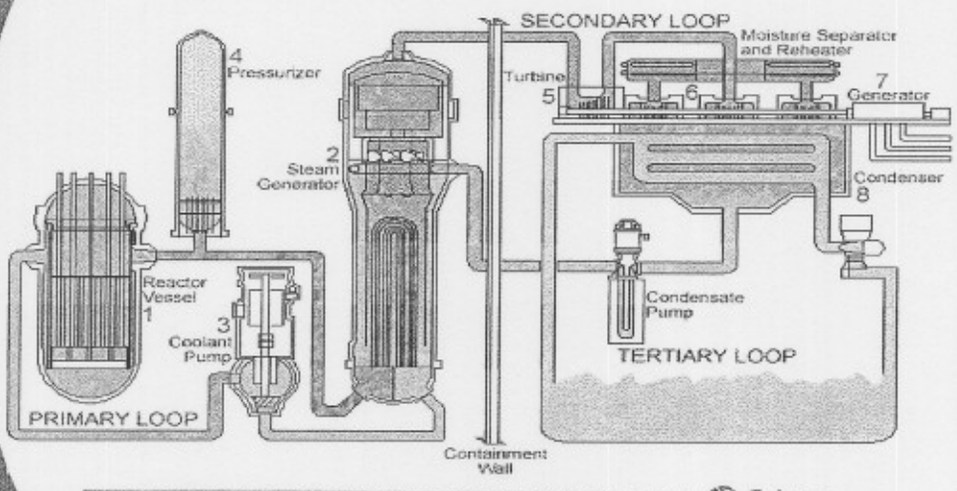
The Pressurised Water Reactor



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Koeberg: maintenance regime.

- The Koeberg units have to be refuelled at approximately 18 month intervals
- Outage cycles are planned such that one unit should always be operating, with both units operating during winter.
- Planned outages also used to do routine maintenance and modifications.
  - Modifications are carried out continually to keep abreast of international developments in the nuclear power generation industry.

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Koeberg: governance

- SA is a founder member of International Atomic Energy Agency
- Koeberg operates in terms of the National Nuclear Regulator's licensing requirements
- Member of World Association of Nuclear Operators (WANO)
- Member of International Nuclear Power Operators (INPO)
- International peer review every 2 years
- Eskom Holdings Board oversight committee

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Koeberg: performance record

- In 2005 Koeberg recognised by EdF (France) as No 1 performer in their International Safety Challenge
- In 2005 Koeberg reached top quartile of International Nuclear Power Operators (INPO) Index
- In 2004, both Koeberg units synchronised to the grid for 147 days, the previous best run was 144 days during 2000.
- Koeberg Unit 1 holds first place as unit with longest uninterrupted running days in Eskom (454 days).
- Recognised as the best run station in Eskom (two consecutive years)

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Koeberg unit 1 extended outage

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25 December 2005

- Koeberg unit 2 operating at full power (900 MW)
- Koeberg unit 1 returning to service from its planned shutdown
- Unit 1 generator experienced an earth fault on Sunday 25 Dec 2005
- Reactor was placed in controlled shutdown pending further investigations into the generator fault
  - ❖ There were no problems in the reactor and turbine
- Project team established

Next

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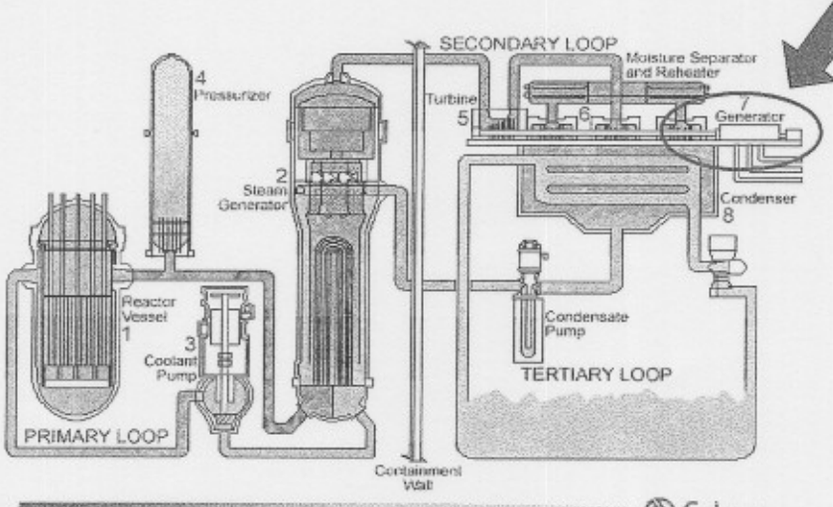
The Pressurised Water Reactor



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Investigation activities

- 5 day "forced cooling" of the turbine/generator
- Dismantle generator to get access to the stator and rotor (10 days work)
- Remove rotor from stator
- Stripping the bars in the stator – 105 bars in total
- Check for damage on every single bar
- Gather material for further technical analysis

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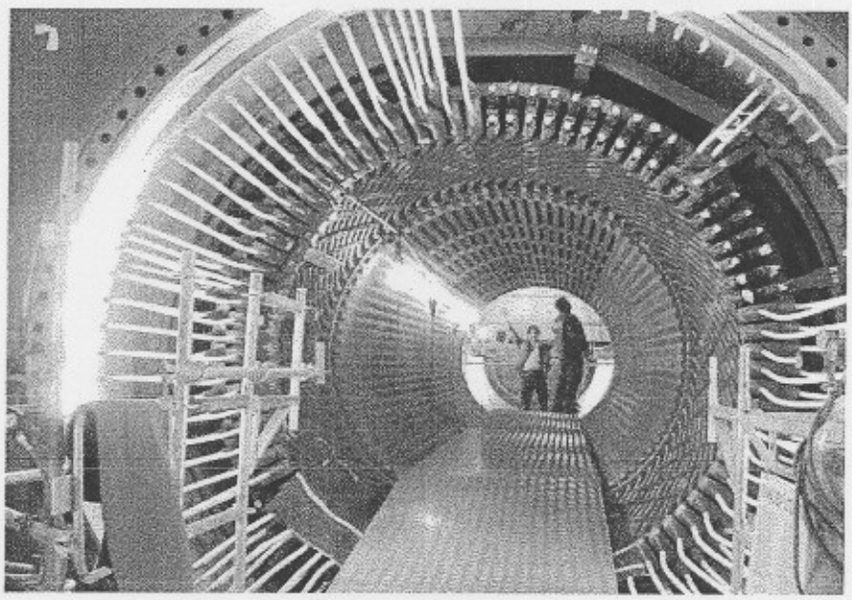
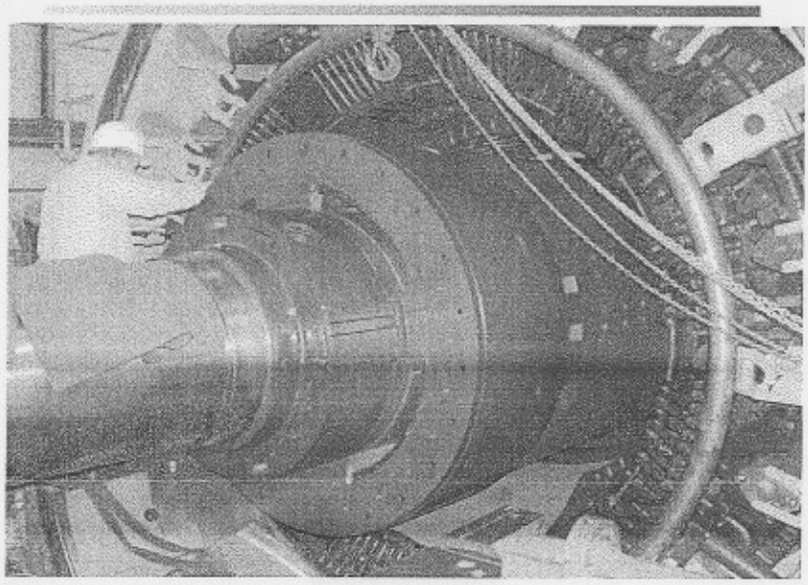
Example of large stator



Example of rotor being inserted into stator



Damage to Unit 1 Generator

- Foreign object (bolt) found in the generator
  - ❖ Based on available information, this is the cause of fault
- Cooling systems of the stator and rotor affected
- Ongoing detailed technical analysis
- More than half of the bars damaged
  - ❖ These have to replaced

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Repairing the generator

- Return unit back to service in the shortest possible time to meet electricity demand
- Minimum of 3 months to repair
  - ❖ This means acquiring a replacement rotor and stator
- Could take longer
  - ❖ Eskom will inform media and public in case it takes longer than current plan

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