

**REPORT OF THE COMMITTEE ON ENERGY, ENVIRONMENT AND TOURISM
ON THE FAMILIARISATION TOUR OF KAFUE GORGE AND KARIBA NORTH
BANK POWER STATIONS, FOR THE SECOND SESSION OF THE TENTH
NATIONAL ASSEMBLY, APPOINTED ON 17TH JANUARY 2008**

Consisting of:-

Mr G G Nkombo, MP (Chairperson); Mr S Sikota, MP; Mr G Chazangwe, MP; Mr A Simama, MP; Mrs F B Sinyangwe, MP; Mr P P Chanda, MP; Mr J Mulyata, MP; and Mr A Mbewe, MP

The Honourable Mr Speaker,

National Assembly,

Parliament Buildings,

LUSAKA

Sir,

Your Committee undertook a tour to Kafue Gorge and Kariba North Bank Power Stations from 8th to 10th March 2008. The tour was supported by the Ministry of Energy and Water Development in conjunction with the Zambia Electricity Supply Corporation Limited (ZESCO). They now have the honour to present their Report on the tour.

Background

2. On 19th, 21st and 22nd January 2008, Zambia experienced national blackouts and was plunged into total darkness. In the light of this and other problems affecting the electricity sector, the Ministry of Energy and Water Development, in conjunction with ZESCO, took the opportunity to familiarise your Committee with the progress made on the Power Rehabilitation Project (PRP) that was being undertaken by ZESCO.

The delegation comprised your Committee, the Deputy Minister in the Ministry of Energy and Water Development, the Permanent Secretary, Ministry of Energy and Water Development and other officials from the Ministry; and members of the ZESCO Board, the Managing Director of ZESCO and other officials.

Kafue Gorge Power Station

3. Your Committee visited the intake gates, dam, powerhouse and administration building of the Station. They inspected all the rehabilitation works that were going on in the powerhouse. They were informed that some of the equipment, including generators, that were being replaced were in working order and could work for over ten years. However, spares for the equipment were no longer manufactured and, therefore, whenever there was a breakdown, ZESCO found it difficult to source replacement parts. It was learnt that there was no concrete plan yet for disposing of the said equipment.

In the powerhouse, your Committee inspected the control room. This is where all the operations of the Power Station are monitored. Although the old manual monitoring system continues to be partially in use, it was, however, slowly being phased out and being replaced with a new computerised system.

Your Committee learnt that Kafue Gorge Power Station had six generating units, which had a full generating capacity of 900MW of electricity. However, because of the on-going rehabilitation works, the Power Station was only generating 600MW. The scope of works at Kafue Gorge Power Station included rehabilitation and up-rating of all the units.

Rehabilitation works on all the units had been completed, while three units had been up-rated. Up-rating works on two units were in progress and were scheduled to be completed by the end of June, 2008. Thereafter, the last unit would be up-rated and the works were scheduled to be completed by December, 2008.

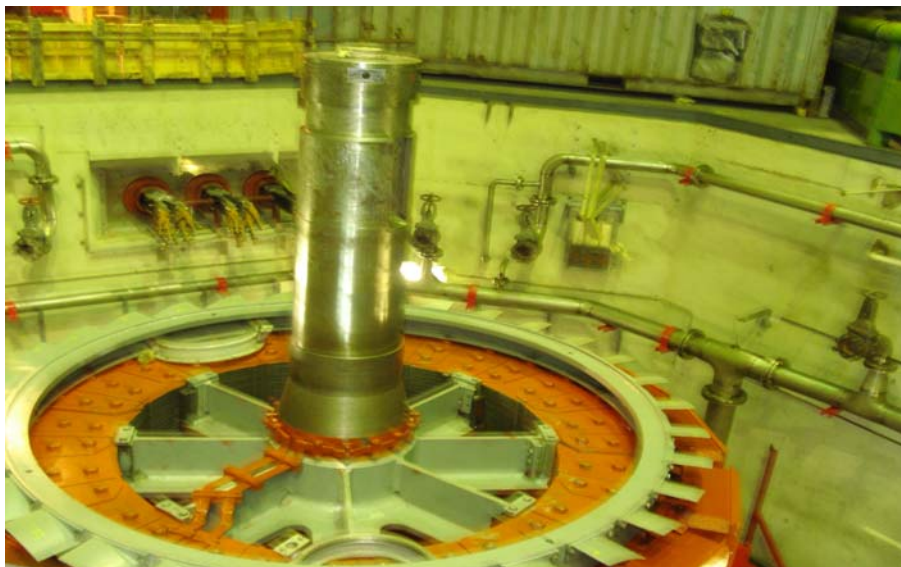
Your Committee were informed that it was hoped that once the works were completed, the Power Station would be operating at a new full generating capacity of 990MW.

At the dam, your Committee learnt that although the water that was expelled downstream was very valuable, it was not used to generate more electricity and, therefore, flowed all the way to Mozambique to the Cabora Bassa Dam where it was utilised. They were further informed that the water could, however, be used to generate more electricity for Zambia, if the proposed Kafue Gorge Lower Power Station was developed downstream.

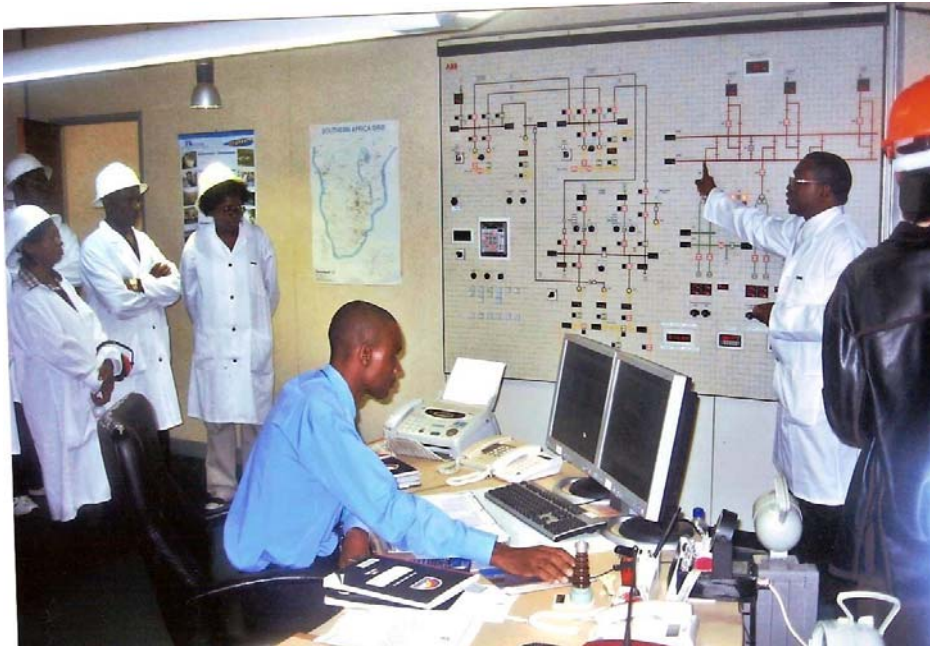
Committee on Energy, Environment and Tourism with other members of the tour delegation in the Powerhouse at Kafue Gorge Power Station



One of the generating units that was being rehabilitated and up-rated at Kafue Gorge Power Station



The Control Room at Kafue Gorge Power Station - though the new computerised system had been installed the old manual system was still partially in use



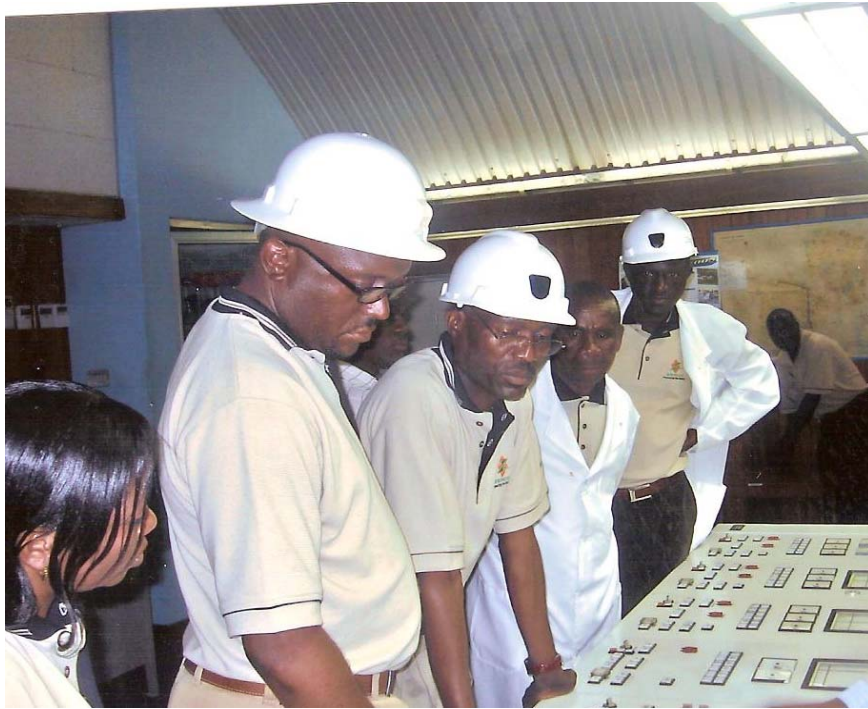
Kariba North Bank Power Station

4. Your Committee visited the dam, the powerhouse and the administration building of the Station. They were informed that Kariba North Bank had four generating units which had a full capacity of 600MW. With the on-going rehabilitation works, the Station was generating 400MW of electricity. Two machines had been up-rated. Rehabilitation and up-rating works were in progress on the third machine. This would be followed by the fourth and last machine, which would be completed by early 2009. It was anticipated that, after completion, the Power Station would have full generation capacity of 720MW.

As part of the tour of Kariba North Bank, your Committee also visited Kariba South Bank Power Station on the Zimbabwean side of Lake Kariba. The two power stations were considered to be 'twin' power stations and, therefore, the purpose of the visit was to do a comparative study.

The Managing Director of the Zimbabwe Electricity Supply Authority informed your Committee that rehabilitation and up-rating works at the Power Station were completed in 2003. The up-rating meant that Kariba South Bank could produce 750MW of electricity.

Chairperson of the Committee examining the manual monitoring system in the Control Room at Kariba North Bank Power Station.



ZESCO's Power Rehabilitation Project (PRP)

5. The Managing Director, ZESCO informed your Committee that the PRP included, among other things, maintenance and upgrading of existing power generation infrastructure. Under the PRP, ZESCO's approach was to:

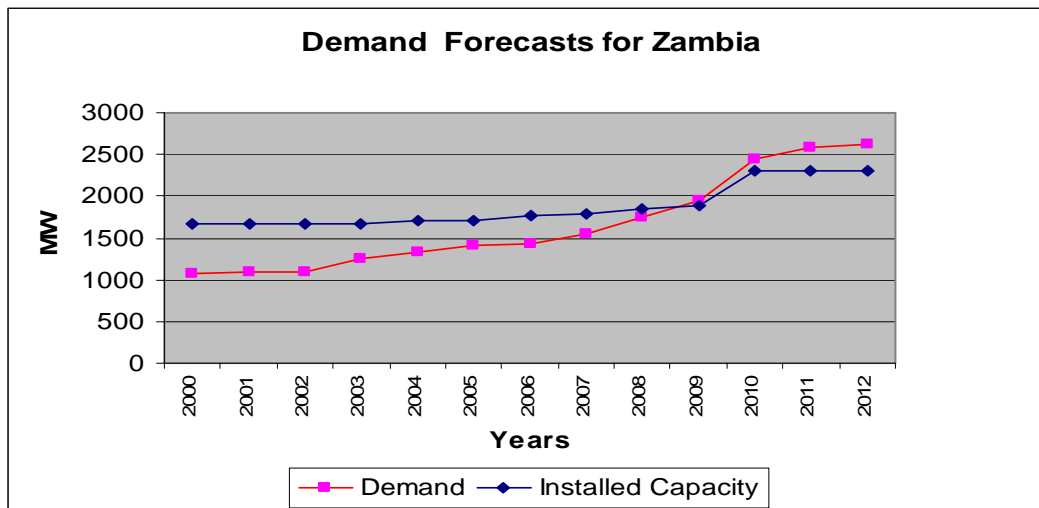
- i) refurbish existing infrastructure;
- ii) up-rate existing generation capacities where possible;
- iii) develop new power stations; and
- iv) embark on regional transmission line inter-connectors.

Your Committee were informed that ZESCO's electricity system was more than four decades old and lacked the desirable levels of maintenance and investment due to national economic problems. Technical audits of the major hydro-power plants concluded that major rehabilitation works would be needed to bring them to the design operation levels and extend the economic life of the assets. The need for similar rehabilitation works was also identified in the transmission system to ensure the reliability of electricity supply. Extensive audits and studies of the distribution system also exposed the need to carry out rehabilitation works to maintain the quality of supply to the customers.

The change in Zambia's economic performance, from the low economic activity of the 1990s to a suddenly high economic activity of the early 2000s had created further challenges because of the increased demand for energy in the country. A Load Forecast Study done in

2005 and 2006 showed that Zambia would have a power deficit by 2008 (Figure 1 on page 7). The load growth in Zambia was increasing faster than anticipated with the coming of new mining companies, commercial ventures, and developments in agriculture. Furthermore, power shortages were being experienced in most neighbouring and regional countries (South Africa, Zimbabwe, Namibia, Botswana, Tanzania, and Kenya). These countries were available export markets for Zambian power.

Figure 1- Load Forecast Study



The financiers of the PRP included the World Bank (IDA), the Development Bank of Southern Africa (DBSA), the European Investment Bank (EIB), the Norwegian Aid for Development (NORAD), the Swedish International Development Agency (SIDA), the Nordic Development Fund (NDF), the Finnish Development Agency (FINNIDA), the French Development Bank (CFD) and the Government of the Republic of Zambia/ ZESCO.

The PRP had been scheduled to be completed by 31st December 2002 as per the Development Credit Agreement (DCA) signed between the Government of the Republic of Zambia and the International Development Agency (IDA) dated 15th June 1998. Similarly, all other loan and credit agreements for co-financing the Project were signed by the end of December 2002. However, due to delays in the release of funds, the PRP continues to be in progress and was expected to be completed in June 2009.

The PRP envisaged that once these rehabilitation works were completed, ZESCO would be supplying electricity to its customers with the required quality and efficiency from hydro-power plants operating at their full installed capacity and through a reliable transmission system.

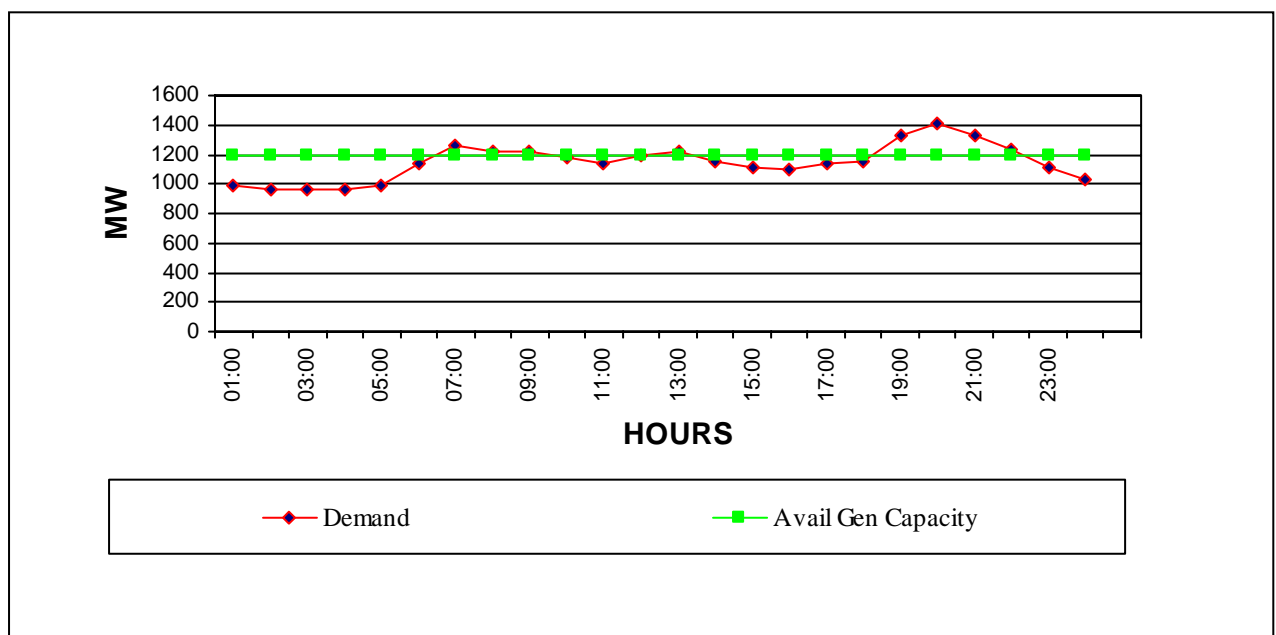
Your Committee were informed that, at the time of their tour, the total demand for electricity in the country stood at 1605MW and although ZESCO had an installed capacity of 1632MW, the company was only generating 1176MW. It was anticipated that an extra generation capacity of 210MW would be gained from up-rating. It was hoped that after completion of the PRP, the company would produce around 1842MW. The Managing Director pledged that ZESCO would endeavour to accelerate the remaining works under the PRP so that all power plants could be fully functional in the shortest period of time.

The Managing Director further informed the Committee that one major challenge ZESCO had in maintenance and upgrading of existing power generation infrastructure was low tariffs. The Managing Director informed your Committee that these made it difficult for ZESCO to reinvest in existing infrastructure, and attracted little or no interest for private sector participation.

Short term measures that had been put in place under PRP included:

- i) demand side management (DSM) in order to ensure efficient utilisation of the available energy; and
- ii) load shedding as a means of DSM whenever necessary to balance supply and demand(*Figure 2*).

Figure 2- Typical daily load curve



Your Committee were informed that in the medium to long term, that is, over a five year horizon, the following measures were planned:

- i) development of the Itezhi Tezhi power station (120MW) through a public-private partnership between ZESCO and TATA of India;
- ii) development of Kariba North Bank Extension (360MW) by ZESCO with assistance from China; and
- iii) development of Kafue Gorge (750MW), under the Zambian Government which had since engaged a transaction advisor to advise on the structure of the development model and package the project to raise funding.

The Managing Director informed your Committee that the ultimate solution to power deficits was the development of new generation capacity. The Managing Director emphasised that a need to develop new generation capacity had been identified, however, power plants took time to build and could take up to ten years.

Regional Electricity Interconnectors

6. Your Committee were informed that regionally, there was diminishing energy available for importation. The Zambian electricity grid was interconnected to the Democratic Republic of Congo in the north and to Zimbabwe in the south, through which Zambia was connected to the rest of Southern Africa under the Southern African Power Pool (SAPP). This meant that ZESCO could obtain power support from the DRC or Zimbabwe and it could wheel power for other countries from the DRC to Zimbabwe and South Africa.

SAPP was created in 1995 and comprised twelve countries that were mainly hydro-based including Congo DR, Zambia, Mozambique and partly Zimbabwe, and those that were predominantly thermal (coal and nuclear) such as South Africa and its neighbours Botswana, Swaziland, Lesotho and Namibia. The other three members (Tanzania, Angola and Malawi) were not yet connected to the SAPP grid, but plans were underway to do so through various interconnector projects.

At the time of your Committee's tour, the interconnection to Zimbabwe and consequently South Africa had been opened (disconnected) because of the power problems that the region had experienced on 19th, 21st and 22nd January, 2008. Zambia was, however, connected to the DRC. After the opening by ZESCO of the interconnector to Zimbabwe Electricity Supply Authority (ZESA), Zimbabwe suffered a further three national blackouts. This prompted Zimbabwe to open the interconnector to South Africa. Your Committee were informed that this was proof of the fact that the region as a whole was operating on a constrained power system.

Although there was urgent need to close these interconnectors, SAPP, to which Zambia belonged, collectively decided to take a cautious approach and resolved that the situation would be subjected to a technical study to establish the problem and offer a sound solution to ensure that there were no further disruptive disturbances once the interconnectors were closed (connected).

Your Committee were informed that the Southern African Development Community (SADC) region was experiencing a supply deficit exacerbated by the following:

- a) economic growth of more than 5% in most of the SADC member countries resulting in unprecedented growth in electricity consumption and demand which was driven by factors such as:
 - increased demand for base metals resulting in high metal prices on the world market;
 - establishment of new mining companies;
 - growth in other sectors such as commerce, agriculture and industry; and
 - country electrification programmes, which include rural and township electrification; and
- b) inadequate investment in generation and transmission infrastructure over the last 20 to 30 years.

Your Committee were informed that because of the several system disturbances that had occurred on the SAPP network during the period January to February 2008, the SAPP grid was operating as three separate islands, namely:

- Zambia-DRC;
- Zimbabwe-Mozambique; and
- South Africa.

National Blackouts of 19th, 21st and 22nd January 2008

7. Your Committee were informed that the first national blackout occurred on 19th January 2008 at 19:38 hours. ZESCO identified the main causes of this blackout as:

- interconnected system frequency was too high;
- cascade tripping of generators at Kariba North Bank, Kafue Gorge and Victoria Falls power stations; and
- massive loss of load somewhere in the interconnected system.

The second national blackout occurred on 21st January 2008 at 19:27 hours. The main causes of this blackout were identified as:

- tripping of the first 330kV line from Kariba to Lusaka due to a tower that had collapsed at Shangwemu on 30th December 2007;
- tripping of the second 330KV line due to overload; and

- increased flow of power on the Zambian system.

After this blackout, the Zambia – Zimbabwe interconnectors were opened.

Your Committee were further informed that the third national blackout occurred on 22nd January 2008 at 17:50 hours. The main cause of this blackout was identified as non-availability of the two 330KV lines from Kariba to Lusaka as indicated above. As a result of this, Kariba North Bank was not connected to the national system and resulted in excessive loading of generators at Kafue Gorge and Victoria Falls power stations. Hence, the entire system was severely constrained and consequently, the system tripped because of the rapidly rising load.

Your Committee were informed that several remedial measures were taken by ZESCO to minimise the chance of further national blackouts and these included:

- repair of the collapsed tower at Shangwemu;
- opening of the Kariba North Bank interconnectors to Zimbabwe;
- operating a system with increased spinning reserve; and
- initiation of a study at SAPP level to understand the instability of various interconnections so as to find technical solutions before interconnectors could be closed.

Committee's Observations and Recommendations

8. Your Committee note that the problems being experienced in the electricity sector are as a result of serious lack of foresight by the Government, especially in terms of investment. In this regard, your Committee urge the Government to expedite the corrective action as regards problems affecting ZESCO and electricity provision. Your Committee further urge the Government to be more proactive, rather than reactive when dealing with problems affecting the energy sector.

However, your Committee are pleased to note the efforts that are being made by ZESCO under the PRP. Your Committee also note that ZESCO has identified and completed feasibility studies for new power stations at Kafue Gorge Lower (750MW), Itezhi Tezhi (120MW) and Kariba North Bank extension (360MW). Development of new generation capacity is the key to averting any future power deficit crises.

In addition, your Committee wish to commend the Government on the recently announced measures to suspend taxes on the importation of energy saving equipment.

Your Committee further observe that there is urgent need to close the regional interconnectors.

In the short term, your Committee recommend that:

- i) rehabilitation and upgrading works under PRP should be completed in the shortest possible period of time so as to put to an end the load shedding exercise that is being carried out;
- ii) there should be a continued steady flow of finances to the PRP so that on-going works are not disrupted;
- iii) the Government should consider introducing and implementing more energy efficiency measures country-wide in order to reduce energy consumption; and
- iv) the technical study to establish what caused the blackouts that occurred in January, 2008, that is to be carried out under SAPP, should be expedited.

In the long term, your Committee recommend that the Government should, as a matter of urgency, decide on the mode of implementing the development of new power stations.

A timely solution to the problems being experienced in the electricity sector by ZESCO is imperative. Given the importance of energy to all sectors of the economy it is also important that all customers and stakeholders are made aware of these problems and the efforts that are being taken to mitigate them.

Conclusion

9. Your Committee wish to express their gratitude to you, Mr Speaker, and to the Office of the Clerk for the support rendered to them. Your Committee also wish to extend their gratitude to the Ministry of Energy and Water Development and the Board and Management of the Zambia Electricity Supply Corporation Limited for facilitating the tour. Your Committee are hopeful that the observations and recommendations in this report will go a long way in resolving the problems in the energy sector.

April 2008

LUSAKA

G G Nkombo, MP

CHAIRPERSON