



Press Statement

Committee of Inquiry into the Nationwide Power Blackouts Findings and Recommendations

16th April 2008

The Energy Regulation Board wishes to inform the general public and interested parties that the Committee of Inquiry, commissioned by the Board to investigate the power outages the country experienced on 19th, 21st and 22nd January 2008, has completed its work and submitted its findings and recommendations.

The Committee of Inquiry commenced its work on 6th February 2008 and was chaired by Prof. Jorry Mwenechanya. Other members of the committee were Mr. George Samiselo, Mr. Raphael Salasini, Mr. Chiteta Ching'ambu, Mr. Clement Sasa, Mr. John Muleya, Ms Ireen Musonda, Mr. Matthew Lindunda , and Ms. Nelly B.K. Mutti.

The main objective of the Committee of Inquiry was to examine the causes of the blackouts the country experienced and recommend measures to prevent a reoccurrence. In order to achieve this objective, the Committee of Inquiry conducted investigations that were primarily focused on ZESCO Limited and the Copperbelt Energy Corporation (CEC).

The Committee of Inquiry visited and interviewed staff at ZESCO Headquarters including the National Control Centre, Kafue Gorge Power Station, Kariba North Bank

Power Station, Victoria Falls Power Station, CEC Kitwe Offices including the Control Centre, the main ZESCO and CEC substations on the Copperbelt at Kitwe and Luano and also Michelo Sub Station outside Chililabombwe.

FINDINGS

The main findings of the Committee of Inquiry are as follows:

On the Nature and Source of the Disturbance on 19th January 2008

Finding 1:

The blackout was initiated by a disturbance in the Zimbabwean grid which resulted in the loss of a major load and shut down of the Kariba North Bank power station. This caused overloading and subsequent tripping of the machines at Kafue Gorge and Victoria Falls power stations, resulting in the blackout.

On the Nature and Source of the Disturbance on 21st January 2008

Finding 2:

The blackout was initiated by a spurious tripping on the only 330 kV transmission line available at the time [line No.2] from Kariba North Bank power station to Leopards Hill substation. The failure of this line completely isolated Kariba North Bank Power Station from the national grid because on 30th December 2007, a tower on the only other line [Line No.1] had collapsed due to heavy rains making this line unavailable. This situation caused an over loading of Kafue Gorge and Victoria Falls power stations leading to their automatic shutting down.

On the Nature and Source of the Disturbance on 22nd January 2008

Finding 3:

The blackout of 22nd January 2008 was caused by a collapse of the system voltage due to insufficient generation capacity. The Zambian system had been isolated from Zimbabwe and Kariba North Bank Power Station was not available on this day because both lines that transit power from this station were out of service, as indicated in

Finding 2 above. Kafue Gorge Power Station was operating at maximum available generation without any reserve margin at all and as the demand for power increased, it could not cope and therefore, shut down.

Recommendations by the Committee of Inquiry are as follows:

RECOMMENDATIONS

In making its recommendations the stance of the Committee of Inquiry is that while establishing the source of disturbances is necessary for reconstructing the events, it is far more important to prepare for abnormal conditions so that the adverse impacts caused by the non availability of electricity are minimised.

The recommendations of the Committee of Inquiry are as follows:

(i) Automatic Under-frequency Load Shedding

On all the three days when the blackouts occurred, the Committee is persuaded that the absence of an effective automatic under-frequency load-shedding scheme played a major role in the failure to contain the scope of the disturbances. Such a system would enable Zesco to respond to the loss of generation by automatically switching off appropriate loads, thereby balancing demand with the available generation. This matter was subject of a recommendation after the blackout of 4th June 2006. This Committee re-emphasised the recommendation that Zesco immediately reviews the control of loads under emergency conditions. Zesco should immediately engage its partners, especially the CEC, and the major industrial and mining consumers on this matter.

(ii) System Capacity and Spinning Reserve

The second most important factor for the building up of faults into total blackouts had to do with the failure to maintain a generation spinning reserve (spare capacity at generation). While the Committee understands that Zesco is currently under pressure to minimize load-shedding, the absence of a spinning reserve contributed to the inability

of the system to contain the abnormal conditions that arose during the three days. The Committee recommends that Zesco reviews system operation and ensures that a reasonable reserve capacity is always maintained to ensure that the power system is stable.

(iii) Power Rehabilitation Project

This recommendation is related to Recommendation **(ii)** in so far as it concerns the available generation capacity. For the duration of the Power Rehabilitation Project (PRP) the system has been operating with substantially reduced capacity. This is often compounded by faults on the available machines, some of them due to the changes implemented during the PRP, thus further reducing generation capacity. The Committee recommends that Zesco places the highest priority on the completion of the PRP. In particular, the payments to contractors should have first call on available resources.

(iv) System Reinforcement

The dynamic stability limit of the system is severely compromised by inadequate sources of reactive power. The Committee recommends that Zesco immediately undertakes an analysis of the system to determine the reinforcement that is required to improve stability. Zesco should work with its partners, mainly CEC, to determine the investment needed and how it should be shared. Both Zesco and CEC should also accelerate the enforcement of minimum power factor operation by the large industrial users and the mines.

(v) Line Maintenance

The transmission grid is critical to the security of supplies from the power stations. The immediate challenge concerns the susceptibility of glass porcelain insulators to catastrophic failure, and even to vandalism. While recognizing the limitations under the current conditions of high demand and reduced capacity due to the PRP, the Committee nevertheless recommends that every opportunity should be taken to continue the

programme of replacing the glass insulators with the newer rubber type. In this vein, the Committee further urges Zesco to review the temporary arrangements on the Kariba North – Leopards Hill line to ensure that the line is appropriately secured before the 2008/09 rainy season.

(vi) Protection System

An important objective of the protection system should be that, in the event of a severe fault, the protection should be such as to maintain supplies to those areas that can be isolated from the affected areas. Apart from maintaining supplies to some parts of the country, such measures reduce the time of restoration of the rest of the system. The Committee recommends that Zesco takes immediate steps to explore and determine such possibilities. In particular, the Committee recommends that the protection grading between Victoria Falls and Kafue West substation be reviewed so that in the event of a shutdown of the main power stations essential loads in Choma and surrounding areas can be maintained.

(vii) System Monitoring

The Committee had difficulty reconstructing some of the events that occurred during the disturbances because the recorders and protective relays on the system were not time-synchronized. The Committee further noted that Zesco faced the same difficulty. The Committee, therefore, recommends that Zesco takes immediate steps to acquire any equipment that is needed to synchronise the so-called ‘time stamping’ on all event recorders. This also applies to synchronization with the recorders on the CEC network. CEC should take similar steps on the Copperbelt network.

(viii) Black Start Procedures

Following a blackout it is necessary to minimize the period of restoration as this has a significant impact on the risk posed to human life, and on operational losses and inconveniences suffered by the consumers. The Committee recommends that Zesco and

CEC review their Black Start Procedures and ensure a continuous state of readiness of systems and personnel. In particular the following should be attended to immediately:

- (a) Ensure that all standby equipment is available at all times; the operation of all station diesel generators should be automatic, i.e. should not require human intervention.
- (b) Ensure continuous training of all power station and control room staff especially to take account of evolving technology, changes to plant configurations and the recruitment of new staff.
- (c) Ensure that all communications equipment remains in service during emergencies, including the Remote Terminal Units on the SCADA.
- (d) Ensure that staff in remote stations is adequately provided with transport and other logistics to facilitate their prompt availability during emergencies.

(ix) New Generation Capacity

The Committee recognizes that until significant new generation capacity is developed there will be difficulties and compromises in running the Zambian system. The Committee, therefore, recommends that the current efforts to build new power stations be redoubled. To supplement its own efforts, the Government requires the participation of the private sector. In this regard the Committee recommends that the Office for Promoting Private Power Investment (OPPI) and the Framework and Package of Incentives be urgently reviewed in the light of experience to date.

(x) Regulatory Framework

The Committee noted the progress made on the implementation of a Grid Code for the Zambian electricity system. The Committee recommends that, in view of the shortcomings evident from the experience of the blackouts, the Grid Code should be enhanced to provide detailed technical requirements for the operation of the system.

This may be through the expansion of the current provisions or by rules supplementary to the Code.

(xi) Enforcing license conditions

The Committee notes that regulating Zesco poses unique challenges for the ERB because the utility is publicly owned. This is a common phenomenon worldwide. Nevertheless, the Committee views the credibility and effectiveness of ERB as critical to the success of the industry as a whole. The Committee, therefore, recommends that the Government works with the ERB to identify areas in the institutional and legal frameworks that need to be reviewed in order to enhance the ERB's effectiveness as a regulator.

(xii) Economic Impact

The Committee was unable to fully assess the impact of the blackouts and, more generally, the current load-shedding regime on the economy. The Committee recommends that the Government and the ERB commissions a separate study on this matter in order to provide important planning information.

(xiii) Implementation of Recommendations

The Committee recommends that the ERB immediately institutes a mechanism for monitoring the implementation of recommendations made in this report and those from the Technical Team Report on the 4th June 2006 blackout. Time frames should be agreed with the concerned parties as necessary and the ERB should ensure compliance by the licensees.

(xiv) The Southern African Power Pool (SAPP)

The Committee recommends that the Government urges its counterparts in SADC to urgently review the virtual dismantling of the SAPP through the continued disconnection of critical interconnectors. Zambia's position should be one of keeping the sub-regional

grid connected while the issues brought to the fore by the generation deficit are urgently addressed by the utilities. Weighing the risk of system disturbances against the benefits of interconnection, the Committee's view is that such risks are outweighed by the benefits.

(xv) Regional Operating Standards

The Committee further recommends that the Zambian government leads efforts to develop enforceable operating standards among the members of SAPP. The Committee's view is that a body external to SAPP, such as the Regional Electricity Regulators' Association (RERA), should be tasked to work with SAPP in developing and administering an acceptable operating regime which should have the highest endorsement of the Southern African Development Community. The standard should set out the minimum operating requirements for the Operating Members of SAPP.

CONCLUSION

The Energy Regulation Board has adopted the recommendations of the Committee of Inquiry and as a result shall vigorously engage with stakeholders to ensure that the measures outlined above are implemented. By so doing, it is expected that the possibility of such events reoccurring shall be significantly curtailed and in the event they still occur, restoration of the Zambian electric power system is expected to take place within much shorter time frames.

The full report of the Committee of Inquiry is available on the ERB website www.erb.org.zm

Sikota Wina
CHAIRMAN