1. Introduction

Lake Victoria is the second largest freshwater Lake in the world, with a surface area of 68,800 km² shared between Kenya (6%), Uganda (43%) and Tanzania (51%). The catchment area of the Lake is 193,000 km², which extends to Republics of Rwanda and Burundi. The lake and its basin are endowed with abundant natural resources, which support livelihoods of the 33 million inhabitants found in the basin within the three East Africa countries. These resources namely water; fisheries and biodiversity make the lake in particular to be of great socio-economic importance to the East Africa Region.

The lake is the largest inland water fishery sanctuary in East Africa. The fishery resources from the lake are a major source of revenue to governments and a source of employment, which supports livelihoods for 3 million persons who are directly involved in the fishery industry. It is estimated that the annual fish catch from Lake Victoria is about 750,000 metric tonnes, generating more than US$ 400 million per year of which, US$ 250 million in export. There are 1433 fish landing sites, 51,712 canoes and 153,066 fishers operating in the lake.

Lake Victoria is also an inland water transport linkage for the three EA States. The lake water transport services are provided by the three companies namely Marine Services Company of Tanzania, the Kenya Railways Corporation and the Uganda Railways Corporation that ply between the major towns of Musoma, Mwanza and Bukoba in Tanzania; Port Bell and Jinja in Uganda and Kisumu in Kenya. However, there are several smaller vessels that provide transportation services between the various landing sites.

Furthermore, the lake is a major reservoir and source of water for domestic, industrial and commercial purposes. Three of the cities of East Africa namely Mwanza, Kampala and Kisumu, and several major towns and urban centres within the basin with a total population of nearly 5 million receive their water supply directly from the Lake. Besides the cities and urban centres several rural villages get their water supply from the Lake and rivers within the basin. The lake also acts as a repository for both treated and untreated wastes generated from various activities from within the basin some of which alternatively can be reused.

Lake Victoria and the rivers flowing into it form a major reservoir for hydroelectric power. In Uganda power generation capacity is 320 MW generated at Nalubaale and Kiira dams. Further downstream there is a potential for power generation at Bujagali (250 MW), Karuma (100 to 200 MW), and Kalagala (450 MW). In Kenya there is a potential to generate a total of 278 MW of electricity from rivers Sondu-Miriu, Kuja, Nzoia and Yala.

Besides the above-mentioned socio-economic values of the lake it has other added values, these being the climate modulation in the region and richness in biodiversity.

However, currently the lake is experiencing severe threats that are impacting negatively on the socio-economic and the intrinsic values highlighted above and contributing to losses amounting to millions of dollars annually. Key among the threats is declining water levels and prolonged droughts in the entire basin. As a result of this, for example, ships cannot
berth smoothly to the quays in most of the ports and in all cases ships calling on these ports are beaching; electricity production at Jinja declined by 30% in Dec 2005; fish landing structures constructed to ensure good quality of fish have been rendered useless and the intakes of the water treatment plants in Kisumu, Entebbe, Mwanza and other riparian towns have been severely affected resulting into a decrease in the amount of water in supply. Lake levels of other African great lakes have similarly declined during the same period, but given that the three countries share Lake Victoria, the partner states need to jointly understand and take remedial measures.

These threats and impacts need to be managed. The institutions at national and regional levels and existing legal frameworks provide the opportunities to address the threats and the impacts and they have to be fully utilized.

This paper outlines; the changing trends of the meteorological (rainfall, temperature, wind and evaporation) and hydrological (catchment rivers inflows) regimes in the lake; the declining water levels and its causes; the impacts of the reduced water levels on the economy and ecosystem and; proposals for immediate to long term interventions to mitigate the impacts and the threats.

The data and information used in the preparation is derived from the detailed studies undertaken by the Partner States under the Lake Victoria Environmental Management Project Phase I (1997-2005); Lake Victoria Water Resources Management study carried out by the Georgia Water Resources Institute, Atlanta, USA, for the Government of the Republic of Uganda; and other relevant reports including those by the media.

2. **Overview of the hydrology and meteorology**

The water levels of Lake Victoria over the last 104 years have exhibited striking changes in regimes, figure 1. From 1900 to 1961, the lake was at a regime that was different from the 1961-2002 regimes. The post 2002 regime has tended towards the pre 1961 regime. What baffles people is the direction the trend will head for!

![Figure 1](image_url) Variation in Lake Victoria levels from 1900 to 2004.

Generally the period 2002 to 2005 has seen a rapid and worrying decrease in Lake Victoria water level thereby arousing the present concern. River Nile outflow was naturally occurring until the commissioning of the Owen Falls Dam in 1954.

The decline in water level is normally attributed to several factors. The main factors influencing the water level depend on the meteorological factors (rainfall, evaporation,
wind and temperature) and hydrological factors (river flows). Water levels of Lake Victoria are very sensitive to moderate changes in rainfall over the lake and on the catchment. Changes in these factors influence the water balance of the lake. In order to understand the decline in lake water level, it is important to calculate the water balance of the lake as this considers the inputs into and outputs from the lake.

2.1 Meteorology

Lake Victoria basin falls under the equatorial hot and humid climate with a bi-annual rainfall pattern, where the long rains are experienced around March to May and short rains around October to December. Generally, July is the coolest month and the warmest month is variable and fluctuates in the period between October and February. In general rainfall amount increases from east to west, ranging between 600 to 2800mm annually. Meteorology Trends in Lake Victoria Basin shows that over the years, driest years had been observed in 1953, 1965 and 1996. Wettest years were recorded in 1961, 1968 and 1997.

Wind over Lake Victoria closely follows the pattern of the apparent movement of the sun across the equator through the Inter-Tropical Convergence Zone (ITCZ) as shown in Figure 2. The ITCZ and its influence affect the regime of most of the meteorological parameters including rainfall, wind speed and direction, and temperature. This pattern has not changed over the years.

![Figure 2. Seasonal wind patterns influencing hydrological processes in Lake Victoria Basin (adopted from LVEMP 2002)](image)

LVEMP studies have observed that there is a reduction in annual total rainfall by 4.2% for the period 2001-2004 compared to the previous period of 1950-2000, this makes the average annual rainfall for the long-term period 1950-2004 to be reduced by 6.6%. The scarcity of rainfall has persisted up to end of 2005, figure 3.
Temperature records show that temperature has increased by 1°C since 1950 to 2005. Evaporation from the lake depends a lot on temperature and wind. Comparatively, the highest Lake evaporation is recorded on the eastern and north-eastern shores of the lake (i.e. Mwanza, Musoma, Muhuru, Rusinga and Kisumu), while the islands, western and south-western shores have the lowest evaporation rates (i.e. Ukerewe, Kahunda, Bukoba, Bukasa, Entebbe and Koome), figure 4.

Lake evaporation is a process that occurs more uniformly in time and space. Over Lake Victoria, there was no noticeable change in trends for the period 1950 to 2005. Figure 5 shows little variation in evaporation and variation in the other factors. There is a substantial drop in rainfall and catchment inflow in the recent but an increase in the Nile outflow.
Figure 5. Time series showing inflow to and outflows from Lake Victoria

2.2 Hydrology

The main hydrologic processes in Lake Victoria include river inflows from catchments and outflow through the River Nile at Jinja. Figure 6 shows the Lake Victoria basin and the river catchments that contribute to the inflow.

Figure 6. Lake Victoria basin Sub-catchments

2.2.1 Flows into Lake Victoria

LVEMP studies show that on the average, there is significant decline in catchment inflows into Lake Victoria in the last 5 years from 2000 to the tune of 22%. The Kagera basin yield has also declined from the 33.5% of all catchment discharges to only 30.7% in the last 5 years giving a total decline of 8.4 % of relative catchment contribution.

Mean flows from individual catchments into Lake Victoria are summarized in table 1 including the proportion of total basin inflow from each river for each time period. Results show that on average, there is a significant decline in catchment inflows into Lake
Victoria to the tune of 14.8% for the 2001-2004 period compared to the long-term mean period of 1950-2000.

Table 1. Mean flows from catchments around the lake (also expressed as percentages of total flow in the period)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Flow in Cumecs(^4)</td>
<td>% Flow in Cumecs</td>
<td>Flow in Cumecs</td>
</tr>
<tr>
<td>Kenya</td>
<td>Sio</td>
<td>11.4</td>
<td>1.4</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>Nzoia</td>
<td>116.7</td>
<td>14.5</td>
<td>107.4</td>
</tr>
<tr>
<td></td>
<td>Yala</td>
<td>37.7</td>
<td>4.7</td>
<td>47.9</td>
</tr>
<tr>
<td></td>
<td>Nyando</td>
<td>18.5</td>
<td>2.3</td>
<td>41.9</td>
</tr>
<tr>
<td></td>
<td>North Awach</td>
<td>3.8</td>
<td>0.5</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>South Awach</td>
<td>5.9</td>
<td>0.7</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Sondu</td>
<td>42.2</td>
<td>5.2</td>
<td>43.9</td>
</tr>
<tr>
<td></td>
<td>Gucha-Migori</td>
<td>58.0</td>
<td>7.2</td>
<td>39.9</td>
</tr>
<tr>
<td>Kenya and Tanzania</td>
<td>Mara</td>
<td>37.5</td>
<td>4.7</td>
<td>23.1</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Grumeti</td>
<td>11.5</td>
<td>1.4</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Mbalageti</td>
<td>4.3</td>
<td>0.5</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>E. Shore Streams</td>
<td>18.6</td>
<td>2.3</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td>Simiyu</td>
<td>39.0</td>
<td>4.8</td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td>Magogo-Maome</td>
<td>8.4</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Nyashishi</td>
<td>1.6</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Issanga</td>
<td>31.0</td>
<td>3.9</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>S. Shore Streams</td>
<td>25.7</td>
<td>3.2</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Biharamulo</td>
<td>17.8</td>
<td>2.2</td>
<td>18.3</td>
</tr>
<tr>
<td></td>
<td>W. Shore Streams</td>
<td>20.7</td>
<td>2.6</td>
<td>18.9</td>
</tr>
<tr>
<td>Burundi, Rwanda, Tanzania &amp; Uganda</td>
<td>Kagera</td>
<td>261.1</td>
<td>32.4</td>
<td>252.5</td>
</tr>
<tr>
<td>Uganda</td>
<td>Bukora</td>
<td>3.1</td>
<td>0.4</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Katonga</td>
<td>5.1</td>
<td>0.6</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>N. Shore Streams</td>
<td>25.6</td>
<td>3.2</td>
<td>28.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>805.3</td>
<td>100</td>
<td>686.2</td>
</tr>
</tbody>
</table>

2.2.2 River Nile Outflow/Release

River Nile outflow was naturally occurring until the commissioning of the Owen Falls Dam in 1954. The Dam was built to operate on the “Agreed Curve\(^5\)” Policy that determines the amount of water to be released by using the prevailing water levels in order to maintain natural flow. The operationalization of this policy maintained a natural pattern up to 2000. During the period 2001-2005, disparities began to occur between lake levels and Nile outflow. The Nile outflows have increased while lake levels have fallen. This can

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1 Integrated Water Quality and Limnology Study of Lake Victoria
2 Data collection period under LVEMP
3 Long term mean flows by catchments
4 Unit of flow in cubic metres per second
5 This is a mathematical relationship, agreed on between Egypt and Britain in 1954 on the management of Owen Falls Dam that relates water levels of L. Victoria to flows out of the lake in such a way that natural flows are simulated as if there was no dam.
partly be attributed to increasing outflow at Jinja and other climatic factors, e.g. periods of lower rainfall and river discharge into the lake than has occurred over the historic period.

The summary of flow characteristics for River Nile outflow in Table 2 indicate an increase in average flow out of the lake by 15% to 1057.6 Cumecs in the period 2001-2004 as compared with the long term average of 1046 Cumecs in the period 1950-2000 including the per cent of all losses with the remaining loss being evaporation. But this increase in outflow occurred during a period of falling water levels, which is a departure from the long-term relation between level and outflow. Although the recent record is for a shorter period than the long-term period, it nevertheless gives a general pointer to the new hydrologic trend that may emerge. The lake cannot maintain its water level if outflows of the past five years are maintained; unless substantial increases in rainfall and river discharge are realized.

2.3 Water Balance for Lake Victoria

Water budget is the comparison of input and output quantities of hydrologic processes that operate in a reservoir. Given a control volume in a reservoir, and then what comes out of it is compared to what enters it including what is lost to its surroundings then the ultimate effect is on the storage level in the control volume.

The study of water balance is used:
- To understand the variation in the quantities of water in the lake over time
- To help in allocation of water for different uses.
- To assist in managing the lake water resources.
- To understand water quality dynamics, pollutants transport and pollution loading into the lake.
- The main input hydrologic processes, which form the major sources of water into Lake Victoria, are rainfall over the lake and discharges into the lake from the catchments.

A summary of the water balance expressed as flow in m$^3$/s for Lake Victoria in 3 different periods as indicated in table 2 below.

<table>
<thead>
<tr>
<th>Table 2. Summary of water balance for Lake Victoria and Nile outflow statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>Inflow</td>
</tr>
<tr>
<td>Rainfall</td>
</tr>
<tr>
<td>Basin discharge</td>
</tr>
<tr>
<td>Outflow</td>
</tr>
<tr>
<td>Evaporation from lake</td>
</tr>
<tr>
<td>Victoria Nile</td>
</tr>
<tr>
<td>Sum</td>
</tr>
</tbody>
</table>

The above table show that in the period 2001-2004, the lake lost on average -209.2 Cumecs from its storage. This accounts for the fall in levels in the same period amounting to $0.39$m in the same period. The long-term water balance shows also a decline in the net storage as compared to the 1950-2000 period. This decline is caused by the negative net storage for the 2001-2004 period that is mentioned above.

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LVEMP Data collection period.
Although the outcome of the water balance in the long term period was positive since 1950, the current levels are now below the pre 1961 mean levels, the severity of the 2001-2005 trends if continued is devastating and worrying. This calls for a closer interest on the lake level trends by all the riparian states and address the causes of the levels fall.

3 Water levels of Lake Victoria

Data on the levels of Lake Victoria has been collected consistently since 1896. During this period, the levels have fluctuated in response to natural processes of input and output in and out of the lake. Of the input and output processes, it is only releases at Jinja that has been controlled by man since 1954. The rest are due to climatic variation. It also means that if there is more evaporation and release from Jinja than is rainfall over the lake and catchment inflows, the lake level will drop, and vice versa. Of the above, it is evaporation that generally varies the least. Rainfall is generally recognized as the most variable component in the water budget. With stable climate lake levels can be stable year to year as the lake level adjusts to the balance of those inputs and outputs.

Lake levels have followed a general but variable downward trend since 1964’s May 12th historic peak. But that long term trend has reversed several times over the last half century, e.g. the later 1970’s, the early 1990’s and the El Nino rains of 1997 when periods of high rainfall occurred and lake levels rose. Since the El Nino rains of 1997/98 when lake levels peaked in April of 1998 at 1135.77 metres above mean sea level (mamsl), the trend of the lake level has been dropping steadily.

The 2005/06 levels were the lowest experienced since the flood of 1961-62 but the current low level condition is just slightly above the recorded historic low level of the lake in March 1923 (Table 3) shows some key low flow periods in order of ascent (but the lowest ever recorded level was in March 1923 followed by the January 10 2006). A substantial drop of 0.2m occurred from October 2005 and January 2006 alone.

**Table 3. Historical lake level low periods**

<table>
<thead>
<tr>
<th>No.</th>
<th>Year</th>
<th>Month</th>
<th>Level in m.a.m.s.l.</th>
<th>Height above 1923, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1923</td>
<td>March</td>
<td>1133.19</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2006</td>
<td>January (10th)</td>
<td>1133.46</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>2005</td>
<td>October</td>
<td>1133.66</td>
<td>0.47</td>
</tr>
<tr>
<td>4</td>
<td>1961</td>
<td>January</td>
<td>1133.7</td>
<td>0.51</td>
</tr>
<tr>
<td>5</td>
<td>2004</td>
<td>September</td>
<td>1133.99</td>
<td>0.8</td>
</tr>
<tr>
<td>6</td>
<td>1994</td>
<td>February</td>
<td>1134.18</td>
<td>0.99</td>
</tr>
<tr>
<td>7</td>
<td>1997</td>
<td>October</td>
<td>1134.21</td>
<td>1.02</td>
</tr>
<tr>
<td>8</td>
<td>1986</td>
<td>September</td>
<td>1134.26</td>
<td>1.07</td>
</tr>
</tbody>
</table>

High and low levels recur in an approximately cyclic manner both in the post-1961 level and earlier in the century. However, the most recent drop in level is a record for the post-1961 period.

3.1 Decline in levels from 2001 – 2005

During the period 2001-2005, disparities began to occur between lake levels and Nile outflow. The hydrograph in figures 7 and 8 for the period 2001-2005, show that Nile outflows have increased while lake levels have fallen. This can partly be attributed to increasing outflow at Jinja that is used for the new hydropower units and other climatic factors, e.g. periods of lower rainfall than have occurred over the historic period.
The characteristics of River Nile outflow indicate an increase in average flow out of the lake by 15% to 1057.6 Cumecs in the period 2001-2004 as compared with the long term average of 1046 Cumecs in the period 1950-2000 including the per cent of all losses with the remaining loss being evaporation. Although the statistics have fewer samples than the long term, period, it nevertheless gives a general pointer to the new hydrologic trend that may emerge.
3.2 Causes of the decline in levels in the period 2002 – 2005

To understand the recent drop in water level, cumulative deviations from the normal regimes of rainfall, Nile outflow, evaporation and catchment discharges were developed. It was found that, of all the processes above, rainfall and Nile outflow varied significantly to warrant their use in explaining the drop in levels.

After analysis it can be concluded that the observed fall in lake level is a result of a combination of two factors:

a. Reduced input in terms of rain and inflows into the lake system; and
b. Increased outflows caused by excess releases at Jinja.

There has been a general decline in the rains on the lake and its basin in recent years resulting in falling of lake levels by 2.3m from 1998 to November 2004 with the year 2004 having been severely hit by this shortage of input. Also increased outflows for power generation resulted in a further fall in lake levels by 0.34m for the period June 2001, when the lake was in balance, to 3rd January 10th 2006, when the lake was at its lowest at 1133.47 mmsl only 0.47m above the historic lowest of March 1923.

3.3 The operating policy for hydropower generation at Owen Falls Dam (Nalubaale and Kiira Power Stations)

Since the completion of Owen Falls Dam (Nalubaale) the policy that has been used for releasing water for hydropower generation has been based on the “Agreed Curve”. This is a mathematical equation with a corresponding rating table (see annex) that relates a prevailing lake water level to a flow magnitude to be released, that was agreed on by the British and Egyptian Governments in 1954. In other words, releases through the dams must be determined by the prevailing water level in such a way that flow of water from the lake into R. Nile would be natural as if there was no dam.

This policy operated well until recently when disparities started (2001-2006) appearing between expected and observed releases. After the commissioning of the new dam (Kiira), and a consecutive period of below normal lake rainfall, it became increasingly clear that the Agreed Curve operating policy is no longer tenable. This scenario was partly caused by increased demand for hydropower leading to over release despite reduced net basin supply of water. The Agreed Curve imposed a constraint that could not allow the lake to be used as a reservoir in times of a positive net basin supply. This means that useful water would be spilled. In times of low water levels, the Agreed Curve encourages violation as excess water is released to meet demand gap. That is why this has accounted for a significant cause of the decline in levels.

The Kiira Power station at Jinja was constructed to utilize the water, which was being released to meet the Agreed Curve flows for a period of over 30 years. The 200 MW power plant located parallel to the existing Nalubaale Power Station, is meant to replace the ageing Nalubaale Power Station eventually. It also has a larger spillway capacity for protection of the dam in case of a big flood. Due to power supply constraints in Uganda and in the wake of a protracted drought situation in the region, both Nalubaale and Kiira Power Stations have been stretched to meet the growing demand for electricity thus using water flows in excess of Agreed Curve figures.

A study on the Lake Victoria Water Resources Management was commissioned by the Government of Uganda to examine ways of adopting and implementing a new operating
One of the key findings of the study was that a new and adaptive modified agreed curve should be developed in such a way that in times of excess, water is stored and in terms of deficit, that stored water can be used. This operating policy therefore requires further development and testing with a possibility of adoption.

3.4 Implication / effect of the decline in levels

Below are highlights of effects and implications of the declining levels on ecological, environmental, social, economic and political aspects that can likely be faced if the decline progresses further.

3.4.1 Ecological / environmental

The habitat in and around the lake is zoned into shoreline, littoral and pelagic areas. Each zone supports a particular type of animal and/or plant life. The declining levels have slowly altered this zonation such that the fish breeding grounds and refugia (shelter from enemies) that existed in the littoral zones have been destroyed and turned into mud or very shallow waters. These areas are the most productive in fisheries. It is used for breeding, nursery, feeding and survival of a number of species, especially in rocky and sandy areas. The increased accessibility of these areas has exposed fish life to so many negative external factors and this can probably lead to reduction in fish population in the long run.

A recent photograph taken from one of the exposed shoreline tells it all in the figure 4 below. Conflicting uses at some points have cropped up ranging from water supply through livestock watering to car washing, all compounding the water quality situation at many shoreline areas.

![Figure 4: Conflicting uses facilitated by shallow shorelines as a result of low lake levels.](image)

3.4.2 Hydrological

The diminishing quantity and deteriorating quality of Lake Victoria waters have compromised the ability of the lake water resources to provide the basic functions of a water body. The sum total of all these is the reduced benefits of having a water body that should accrue to man and other life forms.

The most notable hydrological function of the lake is providing water pressure for hydropower production. The Construction of the Owen Falls Dam (Nalubaale) and later Owen Falls extension Dam (Kiira) dammed the outflow of Lake Victoria for electricity production. However, to maintain natural outflow out of the lake, the two facilities are to
release water according to the “Agreed Curve”. The falling levels have affected hydro-power production to an extent that only less than 150 MW of power is generated from the dam to date as a result of the lowering of levels of the lake.

3.4.3 Social-Economic

The social values of Lake Victoria can be innumerable and invaluable, and can range from water supply, transportation, and fishing among others. These services are getting disrupted as a result of declining levels of the lake.

Fisher folks who used to land their fish catch on the shorelines now dock in the lake. Fish landing structures that were constructed during LVEMP I in order to ensure good fish quality have been rendered less useful. This has increased the cost of production and undermined income of fisher folks. Well-constructed fish landing structures at some beaches have been left on dry land, figure 5 below, due to receding lake levels.

![Figure 5: Majanji Fish landing site, Uganda left on dry land due to lowering of lake level.](image)

Water supply to riparian communities is now a challenge. Communities now sail inside the lake to draw less muddy waters often in hired canoes. Clean water has become a true luxury paid dearly at about 10 US Cents equivalent of 20 litres.

This has increased the cost of living and reduced access to clean water. Many people are now risking unsafe but cheap water in shallow shoreline areas. This has posed a serious health hazard accruing from water based and water borne diseases.

A number of economic implications arise as a result of declining levels of L. Victoria. A part from other factors that are related to socio-economic impacts and have been mentioned under social impacts, reduced electricity supply that is characterized by increased load shedding by Umeme Ltd in Uganda have compounded the problem. A suspension of a 30 MW supply contract to Kenya and erratic supply to Bukoba from Uganda has extended the pinch to neighbours.

Indicators are beginning to show that there is a decline in revenues from electricity generation. Also consumers, although increasing in numbers are encountering a decline in supply, further increasing the pinch as summarised by the New Vision report By Sylvia
Juuko of Saturday 3rd December 2005 quoted below, “ELECTRICITY consumption in August and September recorded a 2.4% decline hitting Umeme earnings from power distribution, a central bank report has shown.

Umeme’s earnings slumped by 2.9% during the period, Bank of Uganda’s Monthly Economic Review Report for November 2005 says. Umeme earnings declined from Ush15.3b to Ush14.9b, i.e. from US$ (8.36 to 8.14) million. However, the total number of energy consumers increased between July and August by 1.8% says the report.

There are other more severe economic impacts of the dropping levels. Hydraulic and civil structures related to water use along shorelines are requiring abandonment or extension. Expensive plans are being prepared to extend water intake works at Kampala, Jinja and Kisumu. Transportation is affected as vessels that operate to dock at ports due to shallow waters. Docking facilities at Jinja, Mwanza and Port Bell require expensive modifications in order to continue to use them. These costs affect national budgeting and divert resources away from social expenditure.

4 RECOMMENDATIONS FOR THE MANAGEMENT OF WATER LEVELS

Having considered the above causes and impacts of the declining water levels, the East African Community (EAC) and individual Partner States should develop investment and action programs to reverse the decline of Lake Victoria water levels and mitigate its impacts. The programs should be included in LVEMPII and mid-term expenditure frameworks of individual Partner States. These should include the following.

1. Partner States should make deliberate efforts to reduce dependency on hydropower by developing alternative sources of energy like geothermal, wind, solar, thermal and natural gas within 5 years.

2. The Republic of Uganda should within 5 years construct a power station downstream of Nalubaale/Kiira power facilities. EAC and the other partner States should assist Uganda in this endeavour.

3. The Republic of Uganda should start reducing water releases at Jinja and move towards the Agreed Curve release policy.

4. The EAC should within one year initiate a process to formulate and implement a new adaptive lake regulation policy, based on a modification of the Agreed Curve.

5. Partner States and the EAC should expedite the implementation of the East African Power Master Plan.

6. Partner States should within 5 years formulate and implement watershed management program to reverse the decline in lake levels, restore its ecological integrity and enhance sustainability of associated ecosystems and landscapes. Such program should include afforestation, wetland management and appropriate agricultural practices.

7. This means that there should be continuous and increased monitoring of the lakes hydrologic processes in order to address the management challenges of the lake basin.

8. Partner States should establish/strengthen hydro-informatics centres to monitor and provide information and data on various parameters including meteorology,
hydrology, hydraulic channels, land use/cover, water quality, ecosystem and socio-economic factors and EAC should promote sharing of the information and data within one year.

9. The EAC Secretariat should within six months carry out a rapid assessment of the impact of changes in the water levels on different water uses including fisheries, water extraction, water transport, hydropower production, agriculture and tourism.

10. Partner States should within one year assess trends of water levels in other lakes in the East African region to understand the extent of the problem and their potential causes including possible impacts of climate variability and change.

11. The EAC Secretariat should within five years conduct a follow-up study to extend the Lake Victoria Decision Support System (LVDSS) for the implementation of an integrated regional energy and water resources planning and management, and extend the Lake Victoria Decision Tool being used in Uganda to other Partner States.

12. Partner States should within 5 years make deliberate efforts to build capacity to effectively support integrated energy and water resources planning and management.

Overall, the management of water resources of Lake Victoria should be one of the priority programmes under the Lake Victoria Basin Commission, and the Commission should seek funds to implement it.

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