TOPIC: INTEGRATED MANAGEMENT OF THE WATER RESOURCES OF THE VOLTA LAKE IN GHANA – THE VRA EXPERIENCE

Emmanuel M. K. Amekor
Principal Environmental Officer
Volta River Authority, (E&SD Department)
P. O. Box 77, Akosombo – Ghana
Email:eamekor@yahoo.com, Cellphone: 233244779983

INTRODUCTION

The Volta River Authority (VRA) in Ghana was established under the Volta River Development Act 1961 (Act 46) with the primary function of generating electric power, first by the development of the hydroelectric potential of the Volta River for the supply of electrical energy for industrial, commercial and domestic use in Ghana. The Akosombo Dam/Hydroelectric Plant was therefore constructed and commissioned in 1965 to fulfil this legal mandate by generating power utilizing the water resources of the resultant Volta Lake. The initial installed capacity was 588MW. Two additional generation units of 324 MW capacity, were commissioned to bring Akosombo total installed capacity to 912 MW in 1972. The completion of the Akosombo Generating Station retrofit in 2005 added 108MW to increase the plant's total capacity to the current level of 1,020MW.

The Volta Lake which is known to be the biggest man-made lake in the world, has a surface area of about 8500 km2, an average depth of 18.8m and a shoreline of about 5,500 km. The total volume of the reservoir at full supply level of about 84.73 m is approximately 150 billion m3.

Integrated Management of the Water Resources of the Volta Lake

1 Power Generation

To ensure optimum and sustainable use of the outflow/waste water from the Akosombo Hydroelectric Plant, the Kpong Hydroelectric Plant (160MW) was constructed and commissioned in 1982 downstream to enable the capture and reuse of water that would have flowed into the sea. It is a run-of-river plant with storage adequate only for regulation of daily peaking outflows from Akosombo.

The VRA now operates a total installed hydroelectricity capacity of 1,180MW from the two hydroelectric power plants made up of 1,020MW and 160MW hydro from the Akosombo and Kpong Generating Stations, respectively. The two plants are capable of providing firm energy of approximately 4,800 GWh/year and long-term average energy of 6,100 GWh/year

2. Lake Transport

Due to the general north/south orientation, the Volta Lake serves as waterway for both large and small vessels. The Volta Lake Transport Company Limited was set up in 1970 to operate as a public carrier

on the lake. In 1996, the VLTC was operating 13 vessels of dry and wet cargo barges with a total capacity of 4000tons. The navigable length on the Volta Lake is 415 km (Akosombo to Buipe) and the volume of cargo on this route ranges between 50,000 to 80,000 metric tonnes annually.

The VLTC transport system on the lake comprises:

- A multipurpose, break-bulk cargo system for transport of all commodities (except for mineral oil products) and a small number of passengers
- A specialized bulk-cargo system for contract transport of mineral oil products; and
- Passenger transport system

VLTC also provides cross-lake ferry services at few landing points including, Adawso, Dambai, Kete-Krachi, Kpando and Yeji.

The lake transport service provides a convenient and cheaper means of moving industrial and constructional materials as well as petroleum products. The alternative means for transporting these goods is by road which is estimated to be 60 per cent more expensive than lake transport. North-bound cargos are mainly constructional materials and petroleum products while South-bound cargos are largely agricultural, foodstuffs and livestock.

The two major port facilities at Buipe and Akosombo for the North – South water transportation have created the infrastructure for development of large bulk storage facilities for fuel, fertilizers and cement for onward re-distribution to Northern Ghana as well as Burkina Faso, which uses Ghana as its gateway for importation of goods. The two major port facilities at Buipe and Akosombo for the North – South water transportation have created the infrastructure for development of large bulk storage facilities for fuel, fertilizers and cement for onward re-distribution to Northern Ghana as well as Burkina Faso, which uses Ghana as its gateway for importation of goods.

Table: Major Cargoes Transported on the North/South Route (as at December 31, 2004)

Category of Cargo	Budgeted Tonnage for the Year	Actual Tonnage Transported for the Year	% Performance for the Year
LIQUID CARGO	50,252.5	44,290	88.1
CEMENT	28,640.1	20,246.4	70.7
FOODSTUFFS	10,168.9	8,787.7	86.4
OTHER CARGO	11,677.8	11,850.9	101.5
TOTAL	**100,739.3**	**85,175.0**	**85**
PASSENGERS (NOS.)	28,000	23,815	85.1

Source: Volta Lake Transport Company, Akosombo

Fuel Transportation

Another major area of operation is the transportation of fuel (diesel, petrol, and kerosene) on the lake to the North of the country. It is estimated that VLTC can carry 135,000m3/annum of petroleum products. This is expected to increase at 3-5% per annum for the next 10 years. Presently, VLTC transports an average of about 75,000 m3 of fuel annually. The long-term objective is to take charge of transporting all fuel requirements to the North including those bound for Burkina Faso.

Private Commercial Lake Transport

In addition to the VLTC, thousands of boats owned by private companies, cooperatives, and individuals carry out brisk commercial transport of goods and people to and from various markets along the lake.

A random study at 12 market centres around the lake indicates that about 402 boats landed at these points with each boat carrying an average of 59 passengers, giving a total of 23, 718 passengers per market day working to an average of 2000 passengers transported by these privately owned boats per market day.

3 Utilisation of Lake Water Resources for Agricultural Production

Commercial Irrigation

The Volta reservoir has brought about possibilities of commercial irrigation. Examples include the Kpong Farms limited established by VRA as a subsidiary company to promote leadership in modern agricultural systems, irrigation practices and food processing technologies.

The project utilized water from the Kpong headpond by a gravity-irrigated scheme covering an area of approximately 100 hectares.

Other private commercial farms are now being established along the Volta basin. Notable among these is a banana plantation, established by the Volta River Estates Limited on the Kpong headpond to cultivate banana mainly for export. The company is utilizing a large-scale irrigation system with water from the basin.

As at Year 2002, the irrigation capacity of the Volta Lake was 565 Million m3. Area irrigated was 75.39 km2 with 1,802.5 m3 potential for further irrigation.

Discussions are ongoing with other private companies for purposes of extracting water from the Kpong headpond for irrigation.

Along some of the tributaries of the Volta, impoundments have been created to provide water for irrigation and urban water supply. Among such impoundments are the Vea and Tono reservoirs.

A number of Government and privately owned irrigation projects have resulted in the construction of small dams or excavated depressions (dugouts) to trap and impound rain fed streams within the Volta basin as a source of water for irrigation and /or livestock

Table : Existing public irrigation schemes within the Volta basin

Region	Location	Area (Ha)
Upper East	Tono, Vea	2,900
Northern	Botanga	450
Eastern	Amate, Dedeso, Kpong	3179
Volta	Aveyime, Afife, Kpando - Torkor	980
Total	10	**7539**

Source: Irrigation Development Authority Report, 2000

Fishery

The Volta Lake constitutes an important resource for fish production. Current figures indicate that 87,500 metric tones, representing about 17% of national fish production is from inland fresh water sources as indicated in the table below. The bulk of this (98%) is from the Volta Lake (Braimah 2001)

Overall, one hundred and twenty-eight (128) species, sixty-three (63) genera and twenty-six (26) families have been recorded from the Volta basin. Species that are important in the fisheries include *Tilapia, Synodontis, Chrysichthys, Hepsetus, Alestes, Distichodius, Hydrocynus, Clarias* and *Lates.* In 1995, an estimated 52,000 metric tonnes of fish was produced from the Volta Lake alone out of an estimated total national consumption of about 375,000 metric tonnes. The fisheries of the Volta river system, therefore, play a vital role in the socio-economy of the nation, especially, the rural community. In 1996, the abundant fish resources of the lake have attracted over 100,000 fishermen and the industry contributed over 140billion cedis to the National Economy.

Table: Annual fish production ('000 metric tones) by source, 1996-2000

Source	1993	1994	1995	1996	1997	1998	1999	2000
Domestic Marine	319	287	337	378	396	376	386	383
Volta Lake	40	42	52	60	62	62	63	65
Other Inland	12	12	13	14	14	14	15	17
Imports	37	19	2	1	0	17	19	17
Total	**408**	**360**	**404**	**453**	**472**	**469**	**483**	**482**

Source: Ministry of Food and Agriculture, Accra

4 Utilisation of Lake Water Resources for Tourism

The Volta Lake provides tremendous opportunities for the development of tourism. The approach taken by VRA is to demonstrate the viability of tourist related ventures to attract private capital for the full development of facilities available on the lake and its islands.

In the utilisation of the lake resources for rendering tourism services, the Akosombo Hotels Limited (a VRA subsidiary) operates an international 3-Star luxury 50-room hotel, the Volta Hotel, at Akosombo. The hotel provides quality hospitality services and promotes tourist activities in and around the Akosombo dam and on the Volta Lake. Conference tourism for example has increased as the main source of revenue accounting for approximately 70% of the business of the hotel in 2003 with an average occupancy of 55% as compared to 41% in 2002. Total revenue for 2003 was ¢7.9billion compared to 5.2billion in 2002. A modest profit of ¢80milliom was realised compared to a loss of ¢740million the previous year.

The hotel also runs a regular weekend cruise with a vessel to the Dodi Island, which is about 26 kilometres from the Akosombo port. The patronage of such cruises is a real indication that investment such tourist activities are worthwhile. The Table below shows the passenger capacity trend from 1998 to 2004 for the pleasure boat MV Dodi Princess operated by the VRA.

Table: Passenger trend for MV Dodi Princess

Year	No. of Trips	No of Passengers
1998	45	4,999
1999	61	7,615
2000	44	6,156
2001	37	5,322
2002	53	9,814
2003	55	9,536
2004 (as at September)	42	7,708

Source: VRA, Maritime Services Unit of ESD

Currently, private hotels and resort centres are being built along the Volta Lake. Services provided by these centres include water-sporting activities, rental of chalets etc. It is noted that such tourist centres, if not properly monitored, could cause pollution of the waters by their activities. The VRA has therefore set up a multi-agency team including the Ghana Environmental Protection Agency and other related institutions to regulate and monitor the activities of all operators along the lake.

The Akosombo dam itself serves as attraction for tourists both local and foreign all through the year. The VRA encourages visit to the dam by school and church groups as well as social clubs. The table below indicates the number of visitors to the Akosombo dam from 1999 to 2004

Table : Annual Records of Visitors to the Akosombo Dam

	1999	2000	2001	2002	2003	2004
JAN	1556	1005	1308	1431	824	1742
FEB	2297	1678	1273	1241	1493	1482
MAR	2597	2763	3207	3560	2724	3670
APR	3433	1867	2364	3130	1479	2402
MAY	3204	2484	1601	3156	1317	1879
JUN	3016	1557	1930	2380	2000	2125
JUL	9254	3747	3396	4824	4618	6000
AUG	5373	3264	3726	3369	5028	4228
SEP	2976	2724	1278	1329	1830	1248
OCT	2018	1756	1400	903	1035	1463
NOV	1751	2178	2097	2933	2201	1776
DEC	2844	2109	2746	2296	3339	1382
TOTAL	**40,319**	**27,132**	**26,326**	**30,552**	**27,888**	**29,397**

Source: VRA, Public Affairs Department.

5 Utilisation of Lake Water Resources for Rural Health Delivery (Mobile Hospital Ship)

An innovation in the utilisation of the water resources of the Volta Lake is the delivery of health services to communities not easily accessible by normal health care teams. To this end, the VRA operates a mobile hospital ship on the lake that offers health services/care to communities in the lakeside area. With the emergence of the explosive growth of aquatic weeds and the attendant bilharzias disease, the medical staff on the hospital ship has been treating cases of bilharzias in addition to other medical problems such as malaria and intestinal worms among others. Sometimes minor surgeries are carried out on the hospital ship. Major surgeries are however referred to the VRA hospital at Akosombo. Data gathered from the Akosombo Health Services Department show and increasing patronage of the services of the hospital ship year by year.

6 Utilisation of Lake Water Resources for Rural/Urban Drinking Water Supply

Apart from the Akosombo Township which is supplied with drinking water from the Volta Lake by the VRA authorities, the lake water resources also serve as the main source of drinking water supply to the Ghanaian capital city Accra as well as other urban and rural communities in the country. The volumes extracted by the Ghana Water Company vary according to the population levels of the cities and towns being served.

Rural domestic water demand

- 1990 = 48.6 million m3 , 2000 = 74.5 million m3 , 2005 = 88.7 million m3
- 2010 = 100 million m3 , 2015 = 105.6 million m3 , 2020 = 150.2 million m3 (Projected)

Urban Water Supply

Kpong = approx 200,000m3/day, Tamale = 15,900 m3/day, Sogakope-Ada-Anloga = 8,712 m3/day, Kpeve/Ho = 18,200 m3/day.

LESSONS/CONCLUSION

1. The Volta River Authority has demonstrated the multiple and integrated uses that the water resources of the Volta Lake could be put to.

2. The success of these VRA investments has catalysed private sector investment in the tourism, agriculture, fisheries, and other areas.

3. The potential for optimisation of the use of the water resources exists and when developed, could serve as a major foreign exchange earning sector to propel national economic growth.

4. The introduction of appropriate technology and innovative administrative measures could further enhance this potential.

Akosombo Hydro Generating Plant

MAP OF THE VOLTA BASIN SHOWING POLITICAL BOUNDARIES