

COOPERATIVE AGREEMENT ON SETTLEMENT AND RESOURCE SYSTEMS ANALYSIS

AN ANALYSIS OF THE VOLTA RIVER BASIN AND
DEVELOPMENT IN GHANA AS ADMINISTERED BY
THE VOLTA RIVER AUTHORITY

by

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SUMMARY
OF
THE VOLTA RIVER AND LAKE BASIN

National Development in an International Drainage Basin

The Volta River and Lake Basin extends over a large land area, draining 398,000 square kilometers shared by six West African countries: Burkina Faso, Ghana, Togo, Benin, Mali, and the Ivory Coast. The Volta and its main tributaries therefore constitute an international river and drainage system. Burkina Faso and Ghana occupy 84.5 percent of this total drainage area that divides most of the basin into roughly equally proportioned upper and lower sub-basins. The Volta Lake and Ghana occupy the southern half and Burkina Faso the northern half. Ghana is the most favorably positioned basin member state by nature of the Volta's stream flow regime and related physical features, such as its topography, that make the lower basin more suitable for developing hydroelectricity. It has successfully exploited its comparative advantage by harnessing some of the prime dam sites in the basin and creating the large (8730 km²) Lake Volta for the development of hydropower projects.

As early as 1915 the colonial administration of the Gold Coast, and later independent Ghana, actively supported the possibility of diverting the Volta's water resources. Colonial surveys accurately identified the Akosombo gorge site for constructing a high dam. After independence in 1957, Ghana's government continued to be committed to exploiting the Volta River, emphasizing its hydropower potential as the primary resource in the country to spur the economic and rapid industrial growth that Ghana seemed poised to embark on as British Africa's first independent nation. Historically, "The Volta Project" refers specifically to Ghana's designs for development in close association

with the international interests supporting them that sought to benefit from controlling the Volta River.

Despite Ghana's lead and achievements, its plans to continue to build projects involving the Volta must take into consideration the international scope of the basin. Ghana has from the beginning tacitly recognized generally accepted international principles governing the rights of riparian countries over the use of such river waters. One of Ghana's ablest river basin administrators, A.B. Futa, points out that the history of the development of the Volta has so far been an effort of a single nation because "the means of livelihood of the other countries sharing the Volta River have not been tied to the river as a resource to the degree that has prevailed in some other international river basins in Africa" (Futa 1981: 331). The same author indicates that there have not been any serious disputes among the Volta Basins's co-riparian states.

Example of The Single Purpose Approach

The institutional aspects of river basin development analyzed in this report focus on Ghana's efforts in the Volta Basin. Characteristic of the single purpose approach, development has been carried out almost entirely by a highly centralized and semi-autonomous Volta River Authority (VRA) that represents the government of Ghana. The production of hydroelectricity is Ghana's predominate objective in utilizing the Volta's water resources and the major objective which has persistently attracted international financial support. Hydropower production generated by a 768 MW dam at Akosombo and 140 MW at Kpong, both operated by the VRA, is aimed at serving large industrial blocks of consumers such as the alumina processing plant, VALCO, located at Tema, the country's recently planned port city and industrial complex. Mining developments and the city of Accra represent other major consumers in Ghana.

Presently, hydroelectricity from Ghana's Akosombo and Kpong dams is exported to Togo and Benin with plans to serve Burkina Faso and supplement the needs of Nigeria and the Ivory Coast in the future.

The World Bank has historically set the pattern for all the major donors involved through its allocation of funds and approval of the hydropower project's technical and financial feasibility. It continues to support substantial expansion of the hydroelectric grid and largely insist that economic returns be the prevailing criteria by which the VRA and Ghana invest in and manage the scheme.

Nonpower Development Goals

A number of nonpower development goals and related problems, locally and regionally defined, in addition to specific national and international energy-related benefits were considered in the earliest Volta plans of the 1950s initiated under the colonial administration. Ghana's first independent government under the leadership of Kwame Nkrumah recognized the potential to include multiple objectives in the project coupled with development of the country's hydropower. These nonpower objectives included: irrigation and agriculture, a lake transport system, fisheries, a planned town and industrial park at the Akosombo Dam, and the need to deal with resettlement and health problems. All of the nonpower objectives are discussed individually in the report. Another nonpower initiative resulted in the creation of the Volta Lake research and monitoring program supported by UNDP, WHO and FAO.

These diverse objectives reflected the recognition of some of Ghana's civil servants and advisers during the colonial period that the Volta should provide a cheap source of hydropower for the country and eventually West Africa, but also that the hydroproject and the VRA provided the means to

maximize the potential of the Volta river and lake region's resources to benefit the resettled and migrant peoples located in the basin itself. It was implied, by identifying nonpower goals, that other institutions under the VRA's initial coordination would later become involved in implementing various non-power programs.

The Limitations of "Handing Over" Nonpower Programs

The policy of Ghana and the Volta River Authority for implementing non-power programs was to treat them on a temporary basis and hand over the management responsibilities to the appropriate line ministry or local branch of government. In this way, the VRA managed the earliest phases of programs and projects targeted to promote such areas as draw-down agriculture, fisheries, and a host of problems related to the resettlement of tribal groups. Working directly with other government departments or the University of Ghana at Legon and Kumasi, the VRA centered nonpower activities in its special duties office and coordinated seed monies to start projects that were planned in preparation for their transfer to the appropriate branch of government in an administrative "turnkey" process.

Placing nonpower programs in a special duties office of the VRA indicated that the River Authority was content with its role of starting up activities but also eager to relinquish operation and long-range planning of all other sectors besides energy. "Handing over" in effect complemented the notion held by some of the managers in the VRA that the authority would be more effective if it divested itself of the direct responsibility for a comprehensive or multiple-sector form of development, and hence in a better position to concentrate more of its efforts on producing hydropower.

In practice, handing over functioned most effectively at the start of the process when the VRA had a predominate role. Little attention was focused on the receiving end or on those institutions taking over. The importance of transferring funds and other means of support in order to build-up and effectively prepare institutions to receive new sets of responsibilities and management of projects and programs was largely neglected throughout "handing over." The effects of failing to build up receiving institutions were immediately apparent in the difficulties of taking over projects and explain some of the problems of nonpower programs today.

Institutions required to take over were operating beyond their limits due to the needs of their own nationwide constituencies and the demands placed on them outside the Volta Basin. When it came time to proceed with transferring functions, it also became obvious that in many cases, receiving institutions were not adequately prepared to take on the full responsibility of maintaining projects. Even more so, they were severely limited to plan and execute new multiple objective programs designed specifically for the Volta Basin. They often appeared unable or unwilling to be fully committed to the idea implicit in taking on Volta projects that they would have to balance their own national purposes with the special interests and problems associated with the Volta River and Lake Basin. Ultimately, under the conditions of handing over in Ghana, nonpower programs were treated in piecemeal fashion and carved up as individual sectors to be managed by the respective line department.

The Absence of Integrated Planning

In essence, handing over functions avoided the formalization of a system of integrated planning on a comprehensive basin-wide level. There was no new legislation or governmental action requiring the creation of a permanent body

of inter-departmental Volta Basin coordination as part of the process. A regional basin planning agency specifically directed to coordinate such a process and separate from the VRA has never been an official project in Ghana's Volta Basin planning. A similar strategy in favor of a system of integrated coordination and planning was never formally articulated by the many international donors which supported chiefly Ghana's Volta project schemes.

For these reasons, the VRA experienced only partial success in transferring nonpower programs. One of the earliest and most complex efforts involved evacuation and resettlement of people in the area of the Akosombo Dam. The resettlement aspects are discussed in the report, including the widespread criticism and unsatisfactory results of the first program. A second resettlement effort following the construction of Kpong Dam in 1981 applied the knowledge gained from earlier mistakes and resulted in a significantly improved program compared with the Akosombo experience in the 1960s.

The Role of Research

In areas such as draw-down agriculture and fisheries, the VRA and participating government units plus the target beneficiaries -- farmers and fishermen -- benefitted substantially from the information and scientific research provided by the multidisciplinary Volta Lake Research Program. The research program coordinated by the VRA and involving nine other institutions was able to carry out numerous studies and monitoring programs through the support from international donors. Investigations of the natural and socioeconomic changes brought on by the creation of a large man-made lake served to inform the various special interests concerned with the Volta how to best proceed with design of sectoral projects. It also raised awareness, in general, of the interrelationships between the factors of changing ecosystems, changes in the

resettlement of people and their needs which depended on the Volta River and Lake resources, and the connection of such factors with planning in each of the areas of hydropower, irrigation, water supply, resettlement, rainfed agriculture, fisheries, lake transport, and health.

As a result of the research effort, systematic data gathering was instituted and a monitoring program for the Volta Lake and Lakeside populations was initiated. Because the funding of such a multidisciplinary research activity, including placement of international scientists, was largely derived from international sources for a specific time frame, the research project itself was expected to be incorporated into diverse governmental and university departments. With the termination of international funding, this research effort has not been maintained by national departments as anticipated in a "handing over" type of transfer. Multi-disciplinary data collection on the Volta Lake has gradually ceased. Under the present situation where the program is being disbanded because of the lack of funds, similar research will be unavailable to river basin planning and project design in the future.

The Examples of Projects in Draw-down Agriculture and Fisheries

The two areas of draw-down agriculture and fisheries development illustrate some of the problems in handing over programs without investing in the preparation of institutions on the receiving end.

In order to establish the feasibility of draw-down agriculture, the VRA, through its support of the Volta Lake Research Project, conducted experiments and implanted small-scale pilot draw-down projects at two resettlement villages. To date, the transfer process of sustaining even the first pilot schemes has been difficult, and what was intended to be a model for a much more comprehensive program under the auspices of the Agricultural Ministry's

Irrigation Authority has not been implemented. The earlier experiments are still valid in pointing the way to the potential for draw-down agriculture to benefit most of the Volta's numerous resettlement villages and farming population. The present structure of the Irrigation Authority is incapable of promoting and managing draw-down projects on a large-scale encompassing many new sites and varied locations around the lake. The Irrigation Authority has been limited to managing a relatively small project of 100 hectares at Kpandu Tor'ko.

The most successful drawn-down pilot project initiated by the VRA is currently managed by a local village farm cooperative (Ampaem Village). Its only source of assistance since the VRA phased out its support of draw-down agriculture has been a nongovernmental organization (NGO) -- The Catholic Relief Services. NGOs however, generally have not played an active role in assuming responsibility for the support of local projects in the Volta Basin. Just as a central, comprehensive regional planning body was omitted from the handing over process, nongovernmental organizations that could effectively link regional-level programs with village-level action groups have not been included in promoting comprehensive projects.

The studies monitoring the rising quantity of the Volta Lake's fish stock generated considerable interest to improve access by lakeside fishermen to use this resource. Projects were planned to: improve gear and equipment, start a fishing school, activate fishermen's cooperatives and provide credit, build marketing outlets and roads, and to select lakeside locations suitable for the construction of landing, processing, and market facilities. The most important fishing project resulted in the marketing complex at Kpandu Tor'ko. In this case, even the VRA has been reluctant to disengage completely from managing the fishing school and cooperative located there. The project has been handed over to the Fisheries Department and local town to continue operation, but there is

a sense of reality on the part of all those involved that without the more powerful and experienced VRA in situ to assist in managing Kpandu Torko, earlier achievements could be compromised and subject to breakdown and poor management. The reality is that the Fisheries Department is vastly undermanned and lacks the resources to ensure the long-term maintenance of the complex. The department has accepted the responsibility for promoting other inland complexes like Kpandu Torko. Operating alone, however, the institution is severely limited to plan for and implement additional projects at new locations around the lake.

The Influence of the World Bank

In carrying out nonpower activities and promoting water and other resources for projects not involving energy, the VRA has been greatly influenced by its experience in receiving funds from the World Bank. The VRA's Chief Executive (E.L. Quartey) points out the World Bank was apprehensive over the direct involvement of the Volta River Authority in nonpower developments that would need to draw on the revenues generated from the sale of hydroelectricity. Therefore, the Bank discouraged the VRA from considering the allocation of power revenue in order to finance other projects. The present management of the VRA is also hesitant to invest outside the hydropower function in light of Ghana's current economic crisis whereby new development ventures are effectively constrained or extremely suspect.

The question of financial return has not prevented the VRA from effectively carrying out the responsibility for public health programs related to the Volta Lake and its inhabitants. The VRA operates its own lakeshore health team and hospital in Akosombo. The VRA is chiefly concerned with monitoring and reducing the effects of schistosomiasis on the lakeside population.

The Future

The future of nonpower goals for the Volta River and Lake Basin are linked with the initiatives sparked by the people living and obtaining a livelihood in the basin region. Local initiatives will depend more on using resources from local and regional institutions which heretofore have received less attention or were largely absent from the previous planning and institutional process. It is unlikely that the VRA, which is the most powerful parastatal organization in Ghana, will deviate from a successful strategy of expanding hydropower production. If local initiatives such as the small-scale rice farmers near Kpong Dam are to be encouraged and their success to serve as a model for farmers in other parts of the Volta Lake region, a system of local institutions must be organized to achieve the fullest potential of water and other resource use.

Conclusions

A summary of the most important conclusions are identified as follows:

1. The seemingly narrow focus and rigid management style of the VRA has had a negative effect on the development of nonhydropower goals and the needs of the local population.
 - a. The single-purpose approach separates the energy production goal from the needs for nonpower development, national planning and international funding priorities for the Volta River Basin are skewed towards continued support of the power infrastructure, while less interest is given to nonpower objectives.
 - b. Ghana's commitment to concentrate on power generation, coupled with channeling international aid only towards this goal is especially significant since the Volta is the country's only major river basin; therefore, an alternative, multiobjective approach can only take place by changing the direction and uneven balance of power versus nonpower funding and programs in the Volta Basin itself.
 - c. Changing the direction to include nonpower objectives and the ability to respond favorably to local initiatives will depend on new institutions becoming involved beyond the Volta River Authority. Resources must be made available to build up existing institutions or to create new ones, specifically responsible

for taking over multiple river basin objectives. Such a process termed "handing over" was envisioned in the Volta Basin and was largely unsuccessful due to the failure of building up those entities slated to carry on nonpower programs.

2. The involvement of other institutions should be considered an integral part of any river basin project at the beginning and in consecutive development stages. International donors should also assume some responsibility for funding and building up the capacity of new institutions expected to be handed functions and to sustain management and operation of new programs over the long term. The idea of new institutions includes the responsibility to create an effective system for coordination of progress in handing over programs. Such a system of coordination among new institutions should also monitor the need for additional funding in order to treat basin development planning in a comprehensive manner.
3. The area of resettlement of any portion of the population affected by the power project and projects which follow after the settling-in period has been resolved should be treated as an integral part of any single-purpose project. The total costs of resettlement, or a substantial part of it, should be incorporated into the main project. Without considering resettlement, the true costs-benefits of power projects are distorted. The planning and execution of resettlement programs require intensive monitoring of and participation with the people involved.
4. Industrial growth which benefited from the power supply side of development should be more directly tapped to contribute a fair proportion of the current and repayment costs, as well as contributing to nonpower programs.
5. The VRA's private management, electric utility style, and its operational criteria have allowed it to be very successful at supplying electricity, accumulating foreign exchange, dealing with and obtaining funding from donors, expanding the grid, and negotiating new and more favorable tariff rates. It is unlikely that a different and more comprehensive, regionally-oriented river basin authority would have achieved the same effective financial and technical position to serve the country's energy needs.
6. Ghana's dire economic conditions and the national government's dependence on selling hydroelectricity contributed to strengthening the single purpose approach identified with the VRA. The current phase of internationalizing the VRA's hydroelectric service is similar to the rationale applied in the earliest Akosombo Dam construction phase involving Ghana and Kaisers in the 1950's and 1960's. With the support of the World Bank, Ghana's government managers and those in the Volta River Authority equate the production and sales of hydroelectricity with one of few options open to the nation to gain foreign exchange and to achieve any kind of economic recovery.
7. The experiences of working with resettlement problems and the multidisciplinary Volta Lake Research and Development Project during the

1970s stimulated more interest in developing multi-purpose projects than in any other period of the Volta's development. However, the COG exemplified by such institutions as the University of Ghana did not have the resources to continue the application of multidisciplinary studies after international funding for such efforts was terminated. Under such conditions, much of the earlier research findings, the experience of national staff, the experimental nature of pilot projects, and general knowledge about the physical and biological systems of Volta Lake and environs is lost as the program folds due to lack of funds and noninterest by the GOC and international aid groups.

8. The local populations, their community and informal institutions, and traditional systems are the first to adapt to changes due to basin projects. This institutional level reflects both the problems of adjustment and the ability to take advantage of new economic opportunities. This is a process which takes place locally with little or no direct support by large-scale government institutions.
9. As the VRA begins to internationalize its electric utility function by seeking new international markets for selling hydroelectricity, it would place Ghana's only river basin authority under the Ministry of Energy. This strategy does not deny the need for multiple use development in the Volta Basin, but the direction clearly indicates a preference of single purpose river basin development managers that these developments should be separate and distinct from power generation activities and should be separately financed and managed.

INTRODUCTION

The report is divided into three main parts and two appendices. The first section focuses on the physical setting and the historical context that have shaped the evolution of the Volta River development project. A second part reviews the institutionalization of the Volta River development emphasizing the Volta River Authority. A third section analyzes the implementation and management process, based on the role of the Volta River Authority in the division of river basin development into power production and nonpower activities. The nonpower aspects are organized under the following areas of development: (1) the Volta Lake Research and Development Project; (2) Lake transportation; (3) fisheries; (4) resettlement; (5) health; (6) general agriculture; (7) irrigation development, and agriculture in the draw-down areas. This section also assesses nonpower development from the standpoint of the VRA's "handing over" responsibilities in which the management and expansion of these sectors gain greater prominence by involving other local and regional level institutions and actors.

Appendix I consists of four tables that identify most of the major actors and institutions involved over four distinctive time periods or phases of institutional development in the Volta River Basin. Institutions and actors were selected because of their importance in decision-making with regard to plans, projects and development activities in general. All of these organizations and groups of people share a common interest in considering the use of resources, particularly water, from the Volta and tributary rivers and the Volta Lake. They all exercise power to determine resource uses but this action is highly differentiated in terms of access to resources like economic funding, political support and technology use. The first three time periods and

corresponding tables 1, 2, and 3 indicate a highly centralized development process where national and international organizations control all the initial stages of formulating goals and plans and determine the patterns of funding and the ultimate design and management of the Volta's projects. These stages represent the formal or official "Volta Project Scheme" made up of large-scale hydropower dam and reservoir projects and programs to deal with ancillary considerations such as the "problem" of resettlement.

By the fourth stage this formal and highly centralized institutional development continues but broadens, to a great extent, as a relatively new set of local developments organized on much more informal basis takes place. Table 4 depicts this informal aspect where the examples of farmers and cropping patterns involving rice and small-scale irrigation and the activities of local fishermen characterize much of the current development activity in addition to large-scale energy production.

Appendix II presents a separate report, entitled, "The Volta River Project" by E.L. Quartey. Mr. Quartey, Ghana's first Executive Director for the Volta River Authority, now retired, acted as a consultant to the SARSA river basin planning II analysis. Considering the relevance of Quartey's "inside" look at institutional developments related to the VRA, it was judged appropriate to include his entire report as an Appendix.

PHYSICAL ASPECTS IN THE VOLTA BASIN

The extensive water flow and network of primary and secondary rivers that drain most parts of the basin have drawn the attention, primarily of outsiders, to the economic benefits of developing the Volta's water resources. Historically, the small population densities within the basin, for example, local agriculturalists and Volta River fishermen did not influence to any extent the development goals set by planners, engineers, economists, bankers, and politicians. Another factor which historically constrained larger developments, especially agriculture in the immediate Volta River region, was the high incidence of onchocerciasis or river blindness disease endemic along the fast-flowing water such as existed in the rapids in the area above the dam. Physical aspects such as the streamflow at the lower reaches of the Volta Basin, soil properties, topography, and geology in the same area all contributed to hastening technological decisions that determined appropriate sites where the water control technology and dam construction of the day (1950s) would best function. The technology did prove to be adequate for the chosen location at Akosombo, where a high dam was constructed in record time under a joint venture involving Ghana, Kaiser Engineering, and Italian construction firms. It was only in the 1980s that streamflow was severely altered and reduced to jeopardize the full use of the technological capacity implanted at Akosombo's dam.

Extensive River and Lake System

The physical characteristics of the Volta River are well-documented [see C. Bouvais, The Volta: An International River Basin. Rome: Food and Agriculture Organization of the United Nations (FAO)]. Briefly, the river drains an

area approximately 398,600 square kilometers (154,000 square miles) encompassing territories of six countries: Benin, Burkina Faso, Ghana, the Ivory Coast, Mali, and Togo. By far, the most important territorial expanse is shared by two basin members, Ghana and Burkina Faso, covering almost 85 percent of all the Volta Basin. The land distribution of the basin among the six countries, including the subbasins of the main tributaries originating outside of Ghana are depicted in Table 1.

All of these river systems flow into the Volta Lake. This is the largest man-made lake in Africa, covering a surface area of 8,730 km², registering 402 km at its farthest extremes lengthwise, having a maximum depth of 905 meters, and providing a total shoreline area of more than 6,400 km. Given the physical importance of the Volta Lake's water mass on the stream flow regime in general, and to the entire Volta ecology and its large spatial dimensions, it is more accurate to identify the basin's physical properties, especially the boundaries of hydrological continuity, in terms of the Volta River and Lake Basin.

The lake is spatially critical to transporting goods and locating population centers in Ghana as a whole, owing to its long rectangular north-south shape and size and occupying over two-thirds of Ghana's land mass. Linking the northern and southern halves of the country, Obeng (1973) comments that the Volta Lake is the focal point for most of Ghana's extensive river systems and "is literally in touch with almost all parts of the country" (p. 37), including some of the main population centers.

Location of Dam Sites

About half of Ghana's land mass has an elevation of less than 150 meters above sea level and much of the Volta Basin is low-lying, principally below 650' within Ghana, with some small valley areas to the northwest rising to

TABLE 1

Percentages of Land Distribution for Volta Basin and Principal Subbasins

Volta River Basin (Total drainage area, 398,860 km² (154,000 sq. miles))

<u>Country</u>	<u>Percentage</u>
Burkina Faso	43.0
Ghana	41.5
Togo	6.5
Benin	3.5
Mali	3.0
Ivory Coast	2.5

Principal Tributaries in Subbasins Originating Outside of Ghana

Subbasin

I. Black Volta - total drainage area, 149,016 km² (57,535 sq, miles)

Burkina Faso	62.0
Ghana	24.0
Mali	8.0
Ivory Coast	6.0

II. Red Volta - total drainage area 17,138 km² (6,617 sq. miles)

Burkina Faso	96.0
Ghana	4.0

III. White Volta - total drainage area 104,753 km² (40,445 sq. miles)

Burkina Faso	55.7
Ghana	44.3

IV. Oti River - total drainage area, 72,779 km² (28,100 sq. miles)

Togo	30.0
Burkina Faso	29.0
Ghana	22.0
Benin	19.0

Source: A.B. Futa. 1983. The Structure of the Volta River Authority, pp. 330-331.

around 1500'. The most noticeable feature of relief is a limited series of hilly ranges with isolated peaks in the southeastern corner of the country and less than 100 miles from the coast. This relief feature consists of the Kwahu scarp or Voltaian escarpment (Obeng, 1973), which originates near the town of Wenchi in the midwestern part of Ghana, crosses the country toward the southeast, and passes through the Ashanti-Mampong area and the town of Mpraeso to the south joining the Akwapim-Togo range where it forms the southernmost boundary of the Volta River Basin. The Akwapim-Togo ranges are transversed by the Volta River forming a series of gorges about 70 miles inland from where the river empties into the Atlantic Ocean.

The only possibility for a major dam site is in this gorge area (Kaiser Reassessment Report, 1959). During the period of active studies and dam construction from 1949 to 1955, several dam sites in the lower river gorge cutting across the Akwapim Range were considered by various interested parties. At least seven sites were identified with various modifications during this period. All the potential sites for dams were located in the ten-mile river length between the Mim Rapids and Volta River Bridge and within a 100-mile distance from Accra. According to the criteria applied for purposes of generating hydroelectricity, data registered for the 25-year period before 1954 on water flows through the gorge area of the river was adequate to meet the technical requirements for building a dam and producing a reservoir. The Akosombo site, selected for actual dam construction, offered a combination of the right geological base and rock foundation, adequate width requirements between canyon sides of the river for a short dam and the presence of four small rocky islets near midstream which offered a reasonable opportunity to construct a diversionary coffer-dam.

The Rainfall Pattern and Shortages in Stored Water

The rainfall pattern, especially its marked seasonality, is a critical physical aspect which limits how water resources can be managed in the basin.

Ghana's wet and dry periods of the year are determined by the moist monsoon and dry/hot harmattan air masses which approach the country from opposite sides of the equator flowing towards each other. Alternating between dry and rainy periods and varying from year to year, the harmattan is the predominate influence in the north of Ghana and much of the Volta Basin, while the monsoon takes precedence in affecting climate and rainfall in the south. Basin rainfall follows the general pattern of Ghana with a marked southwest to northwest decrease in the amount of rain received annually. The periods of onset and termination are not well-defined over the annual rainfall cycle. The upper portion of the drainage area is characterized by a rainy season between March and October. In the southern portion there may be two rainy seasons reaching maxima in May-June and October with an intermediate drier period from July to September. Such seasonality and yearly variation can produce unanticipated precipitation shortfalls, particularly in relation to a delayed beginning or premature end to the rains, and bring about conditions of drought.

The effects of the conditions caused by drought which prevail unevenly over much of West Africa as a larger region have different physical and social impacts, depending on the local system for resource use and extraction. As Sanford points out (1979 in Endre-Nygeres, 1986: 322), drought is a relative phenomenon that depends on the demand for and expectation of water; it is "a rainfall induced shortage of some economic good brought about by inadequate or badly timed rainfall." As in any hydro-power scheme, the energy produced through the Volta River during any one period is contingent upon the volume of water stored in the Volta Lake reservoir, measured by its elevation. The

amount of power available for subsequent years relies on replenishment by the annual river inflow for each year. Because of the size of the Volta Lake, a year of rainfall deficit has no serious limits on power production.

For the period of 1981 to 1983, the amount of rainfall deficit and delays in the beginning of the rainy season constituted the worst drought condition or water shortage observed in the 48 years of recorded data pertaining to the Volta River flows as a consequence of this deficit. The VRA's hydropower operation was faced with the risk of depleting the stored water supply below a minimal level to meet the normal demand for electric energy. Table 2 indicates the magnitude of change in the water regime and its effects on power production. The table compares figures for reservoir and turbine inflow and energy produced for the years 1972 to 1984.

Beginning in 1980, the Volta reservoir experienced progressively diminishing inflows, however, turbine inflow and the energy produced actually increased during 1980 and 1981. The annual reservoir inflows for 1980, 1981, 1982, and 1983 were 29.5 million acre feet (MAF), 18.6 MAF, 10.8 MAF and 6.2 MAF respectively. They indicate a sharp decline, well below the average inflow figure of 30.5 MAF for the previous 48 years. By the end of flood season for 1982, the level of the Volta Lake fell to the 249 foot mark, diminishing further to a critical low level of 240.1 feet at the end of the 1983 flood season. The situation in terms of hydroelectric service became critical and a key issue in 1984 was an emergency program to maintain essential power services in Ghana and to consumers outside the country. This prompted a significant power curtailment program, reducing daily power production to 3.0 GWH/day in 1984 down from 14.6 GWH/day figure for 1981 which was close to its designed capacity. Such curtailment of power production enabled operations to continue through the severest drought seasons of 1981 to 1984, and by 1985, due to

TABLE 2

AKOSOMBO RESERVOIR: ANNUAL HYDROLOGICAL AND ENERGY DATA

Reservoir Year	Inflow (MAF)	Turbine Flow (MAF)	Energy Produced from Akosombo (GWH/DAY)
1972	16.2	17.66	3321 (9.07)
1973	21.7	20.62	3872 (10.61)
1974	33.0	22.00	4078 (11.17)
1975	22.7	21.19	3928 (10.82)
1976	15.9	21.98	4174 (11.40)
1977	15.2	23.80	4394 (12.04)
1978	17.1	20.78	3721 (10.19)
1979	42.5	25.53	4631 (12.69)
1980	29.5	28.68	5276 (14.42)
1981	18.6	28.71	5341 (14.63)
1982	10.5	23.86	4941 (13.53)
1983	6.2	12.66	2078 (5.69)
1984	--	5.21	831 (3.42)

Source: Ghana's Volta River Development and Its Contribution to Economic Cooperation and Integration in Africa. 1986. L. Casely-Hayford, A.B. Futa, and V. Adu-Aryu, p. 12.

increased river inflow, the level of the Volta Lake had risen to over 259 feet, allowing resumption of normal power production operations.

The magnitude of the drought conditions directed more attention to the potential conflict between Ghana's Volta River management primarily for hydropower and the possibility of developing other uses for diverting the Volta's water. Most important was the issue of future irrigation projects. The possibility of developing irrigation was seriously considered in the upper basin area by Burkina Faso.

Until the reduction in water supply, the Akosombo hydropower project managed by Ghana had benefited from almost complete regulation of the Volta's total water flow. The Volta River Authority, referring to plans developed at the time of the drought in the upper catchment area, especially those for irrigation, estimated that within the next 50 years, if such irrigation plans became a reality, a reduction of 20 to 30 percent would occur in the total water supply available for purposes of generating hydropower (Casely-Hayford, 1986: 13). Such a projection raises the issue of potential conflicts between riparian rights and uses and the existing institutional arrangements that hitherto have focused on national development rather than international cooperation for exploitation of the Volta River Basin.

HISTORICAL BACKGROUND OF THE VOLTA RIVER DEVELOPMENT

The Formation of the Volta River Project During the Colonial Period

The origin of the idea for dam construction on the Volta River was initiated under the colonial government of the Gold Coast. The key people who were influential in developing the idea represented either the interests of the colonial government or its metropolis, the United Kingdom, or the financial interests of private corporations willing to invest in the project as an economic venture.

Sir Albert Kitson, the Director of the Gold Coast Geological Survey, was the first person to raise the issue of the feasibility of a dam consequent to the discovery of bauxite in 1915 and his determination of the Volta River's strong potential for hydroelectricity. He then proposed a scheme for a 15 m high dam at Akosombo to create a reservoir that would enable the transport of bauxite near Mpraeso to the dam site for the purpose of aluminum processing. Almost immediately this proposal caught the attention of engineers interested in its technical feasibility and multinational bodies interested in its economic aspects. A South African engineer, Duncan Rose, went ahead to form the African Aluminum Syndicate and he proposed a 40 m high dam for 2.5 - 3.5 million. Another South African engineer, St. John Bird joined Rose in this venture, and after additional investigations of the scheme's feasibility, they won the interest of governments and business circles. Together with Rose, he created the West African Aluminum Limited (Wafal) in 1945 in Kpong.

Bauxite was considered a highly regarded resource by the British during World War II so that its availability and exploitation clearly acted as a major incentive to undertaking serious negotiations with Wafal. The United Africa Company, a subsidiary of Unilever, was the first to express their financial

interest in Wafal at such time. Bird's cost estimate for a dam and power station at 11 million then attracted the interest of Aluminum Limited of Canada (Alcan) in 1949 as well as the British Aluminum Company Limited (Baco). Early in 1950 representatives of Alcan and Baco visited Ghana to investigate the technical and economic aspects of a project for the Volta River. They agreed it was more suitable than Borneo for aluminum processing in light of its bauxite reserves and a greater potential for hydroelectric power.

Ghana's potential involvement in producing aluminum became a major issue in the publicity and investigations regarding the practical considerations of building a dam and power station. The government first publicly expressed its interest in such a scheme in a report published in 1948 in which it foresaw the possibility for not only creating a new industry, but for irrigation and electricity. Hence, A. Creech Jones, the Secretary of State for the Colonies suggested a survey be made of the Volta Basin to assess its maximum potential contribution to the economy. A group of consulting engineers, Sir William Halcrow & Partners carried out this survey to recommend schemes for (1) hydroelectric development at Ajena or Bui, (2) irrigation in the basin, (3) navigation on the river below Ajena and on the lake, and (4) provision of port facilities (Hart 1980, 16). They produced a report in August 1951 with the following specifications: a dam with a height of 80 metres and an estimated cost of a dam and power house at 40 million.

The pre-independence Legislative Assembly in Ghana responded positively with its approval of the motion to start negotiations that culminated in a "White Paper" entitled "The Volta River Aluminum Scheme" in November 1952. The White Paper assumed realization of the project in so far as it discussed how negotiations were to proceed, outlined the general phases for implementation, proposed a model act creating the Volta River Authority and recommended

a Master Agreement with agreed upon timetables and cost estimates. The document was essentially intended to set the guidelines for the work of the future Preparatory Commission to be established at independence.

The Preparatory Commission

Sir Robert Jackson, one of Nkrumah's main economic advisers, was named Special Commissioner responsible for organizing the Preparatory Commission report. Sir Jackson shared the thinking of others who advocated that Ghana would develop by relying on an industrialization process with the assistance of foreign capital. The three-volume report, completed in 1956, was the first Volta River plan and coincided with Ghana's attainment of internal self-government until full self-government was achieved the following year. This event only served to intensify efforts to "get the project off the ground" (Adu-Aryee 1985, 23). The report was based upon very exhaustive investigations. Originally, the Preparatory Commission was expected to analyze the scheme as set forth in the colonial era White Paper, however, ". . . the commission went beyond these original terms of reference and virtually carried out a detailed investigation of the whole scheme" (Birmingham et al, 1966, 391). The report examined the technical, economic and social sides to the project. In addition to the dam project, the following components for the total Volta Project were established by the Preparatory Commission report:

- (1) creation of a partnership between the Ghana government, the British government, Alcan and Baco;
- (2) the development and operation of new bauxite mines in the Aya-Yenahin area;
- (3) development of a 130 km railway to transport the bauxite and ingot;
- (4) the construction of a large dam and power station at Ajena and creation of a 9,100 km² lake;

- (5) the development and operation of an alumina plant and smelter at Kpong requiring 90 percent of the dam's electric power and producing 210,000 tonnes of aluminum;
- (6) a new port for imports and exports at Tema; and
- (7) new townships at the site of the bauxite mines, the dam and the smelter.

The costs were higher than the 1952 figures, namely a total of 231 1/4 million compared to 144 million.

The Commission's report went beyond the scope of the White Paper if measured not just by the level of detail but its inclusion of proposals for compensation and resettlement for the population to be moved. Of the choice of options to resettle, the incentive approach was accepted whereby the people would be given housing materials and construction assistance (Adu-Aryee 1985, 22). The report's consideration of human, social and environmental factors was necessarily included for its pertinence to the goal of generating hydropower largely to support aluminum production. Initially the plan envisioned the resettlement process not as an obstacle but as an opportunity to modernize agricultural development. However, this possibility waned when the reality of removing larger numbers of basin population became paramount over considering the future state of resettlement villages and agriculture after the lake was created. Little else in the report had changed in comparison to the White Paper except for costs and scale of operation.

Newly Independent Ghana

Ultimately the estimated costs of the project proved to be too onerous to the aluminum companies and British government, yet this factor alone was not the only reason the companies withdrew from the project; between 1952 and 1956 world production of aluminum had risen 60 percent, and the dollar shortage in

Britain had eased (Birmingham et al 1966, 392). The investment climate was also not favorably perceived, owing to Nkrumah's socialist rhetoric mixed with his assurances of cooperation for investment purposes, and his extreme popularity on the eve of the country's independence.

It is worth noting that British withdrawal from the Ghanaian economy in the wake of independence, apart from the fact that the British economy itself was ailing, was greater than envisioned. The unwillingness of the British to play a more active role was not wholly anticipated. This lack of support created a real hiatus upon independence. In addition, Ghana did not acquire the control over an integrated regional market for electricity consumption as it had envisioned. If anything, Ghana acquired a number of missing components, one of which was how to finance the Volta River Project. In order to facilitate the project's survival, the nature of its overall feasibility based on the dominant single purpose of generating hydroelectricity had to be reinforced.

Nkrumah would not submit to total abandonment of the idea for such a project. Upon independence on March 6, 1957, Nkrumah initiated contact with the United States Government and President Eisenhower in relation to eventual support for the Volta River Project. President Eisenhower recognized the role the United States could play in the first African country to become independent and expressed willingness to examine any of its proposals on the use of power from the scheme. To initiate the process of influencing development in Africa, the U.S. Government depended on the capital and expertise of private enterprise. Nkrumah was introduced to Henry J. Kaiser, head of the Kaiser Aluminum Corporation. This company agreed to do a reassessment of the Preparatory Commission's report with special regard to costs.

The Kaiser Reassessment Report

The report was released in February 1959 and produced the following modifications of the plans:

- (1) cost estimates were lowered and the initial capital commitment of the companies would be lower because the development of the bauxite mines, construction of the alumina plants and townsites would be deferred and alumina imported;
- (2) the site of the dam was changed from Ajena to Akosombo which would provide a larger power capacity, making it more attractive to aluminum producers;
- (3) a power station was suggested for Kpong and a smaller hydroelectric scheme at Bui;
- (4) public utilities would be financed by public funds and not the aluminum companies, which would only be possible with outside assistance (Birmingham et al. 1966, 392); and
- (5) an extensive electricity grid covering most of Southern Ghana would be installed and electricity distributed to domestic and industrial users and power supplied to the larger mines (Govt. of Ghana 1961, 9).

In November 1959, the Volta Aluminum Company Ltd (Valco) of Ghana was formed with the participation of five companies - Kaiser Aluminum and Chemical Corp., Alcan, Alcoa (of America), Olin Mathieson and Reynolds Metals - were begun. In 1960, Kaiser, Valco and the Ghanaian government agreed that: (1) the hydroelectric project was not to be very profitable for the first 30 years, selling cheaply to the smelter at little more than cost price; and (2) the Ghanaian government would not expropriate, nationalize or intervene in Valco for a period of 30 years (Hart 1980, 27 and Getfield 1985, 26). By 1961 Valco was left with a 90 percent interest on the part of Kaiser and a 10 percent interest on the part of Reynolds; the others had withdrawn.

The technical specifications of the Project recommended by the Reassessment Report are highlighted:

- (1) the lake would have a surface area of 3,275 sq mi;
- (2) the capacities of the hydropower dams and generating plants were as follows:

a. Akosombo Dam - full development	768,000 kw
b. Kpong Dam	<u>140,000 kw</u>
c. Akosombo and Kpong dams together	854,000 kw
d. Bui Dam	<u>190,000 kw</u>

Total (c + d) 1,044,000 kw

- (3) four of the six proposed units for the Akosombo Dam would be installed initially at a rated continuous capacity of 512,000 kw, with 15 percent continuous overload if required. The fifth and sixth units would be added as load demand grew (Govt. of Ghana 1961, 8); and
- (4) the smelter would require annual increases of 158,000 kw of power and by 1972 would require 300,000 kw (Hart 1980, 27).

This package of predominately single-purpose dam schemes would constitute the Volta River Project.

The nontechnical changes in the plans for the Volta River Project since the White Paper can be summed up as follows: (1) the idea of constructing an integrated aluminum industry in Ghana was temporarily dropped through the deferment of the construction of the alumina plant; (2) Ghana acquired more financial responsibility for the project; and (3) the institutions and some of the actors were succeeded by new ones.

No review was expected to be made by the Kaiser Company on new town sites, lake resettlement, health and sanitation programs, new ports, roads or other public works (Kaiser 1959). The Kaiser Report was to be more limited in scope, as a major distinction between the Preparatory Commission Report and the Kaiser Report was the greater comprehensiveness of the former. The change in the planning effected by the different standpoint of the Kaiser Company was perceptible in the more narrow focus, the single-purpose focus which then shaped the management and operational style of the river basin authority. The VRA adopted a single-purpose (large dam construction) river basin development strategy not uncharacteristic of the earliest forms of river basin development. The proponents of this strategy point to the advantage of facilitating more

efficient control of resources, management, and technology to accomplish the primary goal.

Generally, the application of the single-purpose strategy requires an administrative system in the form of a single large-scale institution that can assume and combine all phases of the strategy - setting the goals, planning, financing, implementation, and management. Single-purpose managers tend to apply criteria for economic feasibility carefully within certain limits. However, once a system or procedure for measuring economic values is agreed upon, single-purpose institutions are often resistant to the idea of introducing new criteria or measurements of worth to identify economic or social values.

**THE INSTITUTIONALIZATION OF THE VOLTA RIVER DEVELOPMENT PROCESS
CREATION OF THE VOLTA RIVER AUTHORITY**

The Volta River Authority as part of the Government of Ghana largely inherited the goals, financial arrangements, and general plan to implement the Volta River Project. The project's objectives, criteria for design, and funding arrangements had already been meticulously set down before independence. Based on these plans the Government of Ghana had proceeded to convince private financial backers (most important was Kaisers) and international lenders such as the World Bank to support the same project. In light of the magnitude and complexity of the project and funds involved, all the parties, international and national, were eager to establish an appropriate institution to implement and manage the Volta River scheme. Formation of the Volta River Authority attempted to combine several different interests and ideas about developing the Volta Basin which influenced the planning and management system adopted by the institution.

Although the form of their input or commitment was different, the individual parties committed to the development scheme agreed on the overall single-purpose hydropower strategy. For the Government of Ghana led by Nkrumah, the Volta's resources were perceived as a huge untapped storehouse, a national endowment which could be put to use to accelerate the country's development through a rapid industrialization policy. The Volta River's power potential was required to spark the country's industrial growth. The Kaiser Corporation, in its turn, had specific aims to achieve an advantageous site in order to produce and sell aluminum for the world market. They needed a secure and large, low-cost supply of electrical energy and within Ghana, only the Akosombo project would, according to the company's economic terms, meet these criteria. As part of this security, their own Kaiser Engineering firm acted as primary

engineering consultants for the project working with the Volta River Authority. The interests of the two key parties, the multinational firms and the Government of Ghana predominated and converged to formulate the Volta River Project and to make basin development the equivalent of focusing primarily on producing hydropower.

The primary single objective continued to be articulated in structuring the Volta River Authority. Because of the urgency to demonstrate to international lenders their capability to technically and financially manage such an undertaking, the government relied on an institutional model which had already been designed in the 1956 Preparatory Commission Report. The 1956 proposal was detailed in terms of the objectives, organization, staffing, and financing for the new institution. It was presented as a model piece of legislation - The Volta River Authority Bill - to be adopted only after Ghana became an independent nation. Pre-independence colonial planners, together with emerging Ghanaian interests had established the idea that control and management of the Volta hydropower project should be left completely within the new government. The government machinery for this control was to be the Volta River Authority.

Ghana's independent Parliament passed the Volta River Development Act (46) in 1961, creating the Volta River Authority. The same year the United States announced loans amounting to 47 million for the power project and Kaiser's smelter plant (Moxon 1969, 114). The World Bank and United Kingdom committed loans to finance the rest of the total Akosombo project costs. The project was started and the new authority was immediately and directly involved with managing project construction and planning for its role to operate the generating plant.

Institutional Structure and Functions

The Volta River Authority was structured so as to achieve its primary mission - the responsibility of planning, executing and managing the development of the Volta River. The development constituted the hydropower projects as identified and judged financially feasible in the Kaiser report. It was organized as a uniquely autonomous government agency with extraordinary legal and financial powers, intended to operate outside and be fiscally independent from the normal government civil service bureaucracy. The Authority combined many of the generalist functions of cabinet level ministries with the technical, legal, and finance staffing necessary to operate a large-scale hydroelectric dam and stored power system. In essence, it acquired and exercised all the powers normally delegated to Ghana's highest levels of public administration with the responsibilities, financial control and expertise associated with large privately-managed electric utilities.

Influenced by the model forwarded by pre-independence plans and the requirements dictated by the Kaiser engineering report, Act 46 prioritized in a straightforward manner the functions to implement the strategy. The Authority was charged with primarily:

1. The generation of electricity for general and industrial consumption including the operation of an aluminum industry, especially the smelter operation (VALCO) which initially accounted for over one-half of the consumption from projected power output. Such power production could be by any available means however the first option to be implemented was construction and operation of a dam and power station at Akosombo.
2. The construction and operation of a transmission system for the distribution of the power so generated.
3. Implementing the policy of the government for negotiating and setting tariffs of the power so generated and responsibility for allocating the supply of such power to designated bulk consumers.
4. The regulation and control of Water Flow. This included restricting the amount of water abstracted from the man-made lake as well as upstream, and licensing withdrawals only for domestic water supplies

and irrigation not to exceed an established limit. Control of water covered all the lake and area up to the 280' feet contour line.

5. The development of the fishery potential of the lake by the provision of landing facilities and assistance.
6. The development of water transportation on the lake and the ownership and operation of vessels of any kind on the lake for the transportation of goods and services.
7. The responsibility for health and safety alongside the lakeside area and in the construction townships. The lakeside area was primarily defined in epidemiological terms by the Preparatory Commission, and corresponded roughly to a one mile protective buffer strip from the 280' contour.
8. The Authority received functions and planning powers equal to that of local government, to plan, build, and manage the construction township, or Akosombo, which surrounds the immediate area of the Akosombo dam and generating plant.

Under the category of additional powers the Authority could be required by direction from the Head of State to perform any function of a Minister of any public authority or government body in relation to the township of Akosombo and the Lakeside area. The intent of this provision was to facilitate or coordinate diverse works related to construction and operation of the dams and power generating facilities. Another secondary function empowered the VRA to engage in research and to assist and facilitate other institutions regarding research of any matter pertaining to the Volta River Authority's own function and to maintain records or publish the results of such research.

Regarding incidental functions the Authority received powers to "carry on any activity which is reasonably requisite or convenient to or in connection with the discharge of its functions," and that in the discharge of these functions, the Authority is authorised to "cooperate fully with all Government departments and agencies and other public authorities."

All of these functional tasks were influenced by economically-oriented management criteria carried over from the master agreements with lenders to

finance the entire project. Codified in the enabling act, the Authority was enjoined "to conduct its affairs on sound commercial lines," and in particular, to carry out its functions so as to ensure that, "taking one year with another, its revenues are greater than its out goings properly chargeable to revenue account." It also had powers to "borrow on such terms and in such currencies as may be agreed between it and any lender, such sums as it may require." The only constraint to the initiative of borrowing was that the "President may from time to time, prescribe the maximum sums which the authority may borrow ...".

The dominance of the power production functions was clearly reflected in the opening statement of the Act.

. . . to provide for the establishment of an authority charged with the duty of generating hydroelectricity by means of water power of the River Volta . . .[and] for charging the Authority with certain incidental responsibilities in relation to health and other matters . . .
(underscoring added) (p. 437).

Nevertheless, the possibility of developing non-power activities was contained in Act 46, relating to lake transportation, fisheries and research. Two other activities are conspicuous by their absence and lack of consideration as direct functions in the statutes of the Authority. These are the responsibility for developing a resettlement policy and program and developing irrigation. Each of these non-power activities are treated separately in a later section.

The project's first resettlement officer captures some of the frustration in relation to the narrow purpose outlined in the legislation empowering the Volta River Authority to carry out the project:

These objectives were not defined in terms of income redistribution or regional economic growth, although surely the creation of the lake was bound to have consequences in these terms. . . [A]lthough the authority has control of the planning of the use of the water in relation to fisheries development and transportation, such planning according to the Volta River Development Act is optional. In the case of irrigation development, there is in fact no specific mention in the act, although a broad interpretation of 'the development of the lakeside area' would and should embrace this activity and other relevant activities (Kalitsi, 1973).

The Role of Local or Regional Institutions

After independence there was no intergovernmental council to review policies and plans during the handing over of power from colonialists to a national government. The Preparatory Commission plans had already been completed before independence and were destined to be adopted, given that Nkrumah was both the political leader of Ghana and Chairman of the VRA.

The Volta River Project was strongly oriented toward development by a large scale, national institution with considerable interaction between the single authority and the international donors and multinational engineering firms. For example, the Italian firm Impreglio was contracted to begin construction of the dam in 1961. Impreglio had just completed construction of the Kariba Dam over the Zambezi River and with its long-standing reputation for building dams, it maintained an excellent engineering/consulting relationship with the Ghanaians. The single-purpose endeavor had to rely heavily on external assistance and engineering/construction consultants to reproduce a modern technology scheme of such proportions under the conditions of an underdeveloped and newly independent country like Ghana. Institutionally, the Government of Ghana did not question the means of river development, inasmuch as the national goal was to control its management and planning, once the scheme was in operation. Hence, their emphasis on a strong, single national river basin authority.

The VRA was the sole national institution responsible for the development of the river and, as a semi-autonomous and self-operating organization, it was free from any political interference or inefficiency. The VRA had direct ties to international lenders and was soliciting its own funding, so it was able to capture the full official interest of the government of Ghana.

There was no regional development body created at the turn of independence. The VRA was the one large-scale organization that represented the promise and aims of the government to bring development to Ghana. Yet its functions were limited to power production, and extended to non-power activities only as required. As an example, the Akosombo resettlement scheme arose as an obstacle to the construction of the dam, or as indirect costs to the project; it was treated as an ancillary project rather than integral part of the project's goals. Some of the staff of the Resettlement Organisation did indeed understand that Ghana would be judged on the way they conducted this massive and politically sensitive operation, especially those who believed the people in the basin were sacrificing their lands and homes for the sake of Ghana as a whole. "...[T]he rather cautious proposals of the Preparatory Commission, tenable perhaps for a colonial government, appeared inappropriate in independent Ghana, where people and politicians expected something better than simple resettlement by self-help with incentives" (Chambers 1970, 21). The Preparatory Commission plans for some, therefore, were desirable of modification.

Town planners and architects, the Ministry of Agriculture, and the Social Welfare Department all shared the view that the resettlement action was an opportunity to improve and modernize the way of life of the people in the basin. Although they made their proposals known in the discussions with the VRA and the Government prior to the beginning of the dam construction, the time constraint in the face of an inexorable deadline for dam-construction was cause for simplifying the plans and accepting an emergency or crisis operation for dealing with the resettlement of the inhabitants.

Ultimately the VRA did attempt to introduce into the resettlement villages mechanized agriculture and improve the social welfare of the resettled popula-

tion. This by no means implied the principle of popular participation or the formation of specifically local institutions. No new institutions were presupposed as a result of the construction of the dam and the resettlement of a large population. The policy of the VRA was to "hand over" specific responsibilities to already existing government departments, ministries, and bodies rather than creating another large-scale institution.

Handing Over Policy of the VRA

Handing over was the officially stated policy of the VRA for all non-power activities to include social welfare, education, resettlement, research, fisheries, and agriculture. This policy is not uncommon to large-scale organizations that seek to decentralize control over activities for which they assumed responsibility in the initial stages. The gradual process of transferring responsibilities presents problems at the receiving end, for the respective agencies often lack the financial resources and the wherewithal to carry them out adequately and over the long-term. The VRA, for example, had laid the infrastructure - the buildings, offices, roads, and so on - for most of these activities which, upon the withdrawal of its authority, became difficult to maintain in terms of costs and the necessary skilled personnel tied to the operations. The smaller local agencies, departments or line ministries did not the same access to funding as did the well-established and larger VRA organization. Moreover, the reliance of these agencies upon the original organization, the VRA in this case, continues over time, as people automatically associate certain projects with the support of the VRA. Scudder (1981) gives a similar report on the Gezira Corporation in Sudan with the result that efforts on the part of local bodies to become more involved are thwarted: "The giant Sudan Gezira Corporation, for example, has never been

able to implement long standing policies of both decentralization and devolution of certain responsibilities. The resulting dependency relationship between project and development area residents then interferes with local initiative and with the development of strong local organizations" (p. 22). In Ghana during the early stages of resettlement there had been an attempt at irrigated development on approximately 20 hectares at Ampaem on the Afram Arm. This undertaking required substantial inputs of labor, materials and advice from the VRA, setting in place a dependency on this subsidized institutional support that made it unclear how farmers would continue to collaborate or manage the scheme after the river basin authority left the project.

Perceived Benefits of the Volta River Project

The case of Ghana's Volta River development indicates that the initial concept for a hydroelectric scheme continues to capture imaginative support from Ghana's government, administered through the Volta River Authority (VRA). The viability of the project's electricity production is well established and expanding despite constraints outside the control of the VRA management. A 1974 report of the Volta River Authority indicated that the total units of power generated stood at 4,077 GWH annually. The power generated peaked in 1981 at over 5,000 GWH annually, and experienced substantial reduction after 1981 as a consequence of the effects of the Sahelian drought. The aluminum smelter is in operation as a result of Volta power, although affected adversely by the recent power shortages. The larger urban centers located in the country's Southern one half receive electricity from the grid. Power is supplied to two neighboring countries of Togo and Benin and plans are being implemented to serve Burkina Faso to the North and establish an integrated, interconnected system to include the Ivory Coast and Nigeria. The original

national hydroelectric scheme is truly becoming international in service and economic importance.

That the Volta River's hydroelectric resources and infrastructure are perceived as absolutely vital to the country's economic and political interests is best represented by Sir Jackson's statement:

Thus the immediate economic justification for the project will have been provided. But, potentially, the V.R.P. has a far deeper significance than aluminium production. With reasonable luck and sound government policies, the Volta scheme could transform Ghana, not only by providing the power for industrialization, but also by activating the 'heartland' of the country (n.d., 14).

Among the specific benefactors which he names are (1) VALCO and industry and in the future pumped irrigation and domestic demand; (2) the agricultural sector, as the rise and fall of the lake would expose a considerable land area suitable for growing food; (3) fisheries; (4) the urban centers, Accra and Tema, which would obtain additional supplies of water; and (5) the tourist industry. Additionally he mentions that the 200-mile long lake will serve as a natural inland waterway along which new ports and lake services would be developed. The lake itself would serve research in health, fisheries, and its physical phenomena. The construction operations at Tema and Akosombo have generated a large number of highly skilled workers. Even the resettlement operation was looked upon as "creating new and exciting possibilities for development" (ibid., 15-16).

Although the proposed dam and lake projects were primarily conceived as a hydroelectric scheme, it raised expectations by some (Obeng, 1977) that in addition to producing electricity, other multiple-purposes should be realized. Dr. Letitia Obeng, a scientist and Project Manager of the Volta Lake Research Project, has spoken out on some of the societal and environmental effects of the dam construction and Volta Lake project. Despite her critical assessment,

she admits to potential benefits to be derived from the dam - the accumulated water available for domestic and industrial use, the potential for irrigated agriculture important to the dry north region of the country, the drawdown area available for cultivation, and electricity production that has already been proven successful. Limited commercial rice production and spontaneous agricultural development by local farmers have begun to tap the potential for irrigated farming particularly in the immediate Kpong dam head pond and downstream area. The opportunities for fishing, recreational activities, and use of the lake as a waterway attest to the enormous benefits that the project has brought. The Volta Lake fishery resource is producing annual catches beyond original estimates, levelling off in 1977 to about 42,000 tons and several times greater than the catch from fisheries which existed on the river. Not least is the destruction of the breeding places of the fly *Simulium damnosum*, the transmitting agent of *Onchocerca volnulus* which causes onchocerciasis, an incurable form of blindness, and once endemic to the Volta River Basin.

Cost-Benefit Analysis Studies

The Volta River Authority did not conduct a cost-benefit analysis in its evaluation of the project's economic efficiency. There have been few cost-benefit analyses of the Volta River Project, and these have been performed by outsiders whose studies are generally critical in nature and incomplete. Professor Tetteh A. Kofi submitted a paper entitled "Economics of Capital Intensive River and Lake Basin Development Projects and Underdevelopment in West Africa" to a UN-IDEP Seminar held in Dakar, Senegal in June 1986. His method of measuring costs and benefits is largely representative of the partial and critical treatment of a large-scale project. He asserts that large scale, capital intensive river basin projects have proven to be technically efficient

but for the most part, economically inefficient. He further contends that river and lake development projects are not an economically efficient strategy to transform African economies dominated by a rural sector. He stresses the debt cycle as being an important issue in Africa that must be incorporated into a mathematical formulation of cost-benefit models because external loans are generally solicited to finance the project. He calls this a debt-led growth strategy of development. In his formulation, Kofi takes account of the opportunity cost of the expenditure for the project, assuming that this project is chosen over others. Other variables considered in the choice of the project are society's willingness to pay for the foregone project, the physical benefit to society, the product price, and the costs of supplying the project. Time is also introduced into the analyses and a discount rate established.

Kofi takes consideration of the debt profile in determining the net benefits to a water resource project over time. Hypothetically, there is an initial period of ten years or longer in which no benefits are accrued. The debt rises during the initial period, then at stage two rises at a diminishing rate as yields to the project increase. At a third stage trade surplus will rise, interest payments and foreign debt fall off.

The major conclusion, inter alia, that Kofi reached is that the marginal efficiency of the VRA investment was low or the internal rate of return was low due to the inability of the Government and the private sector to exploit the full potential of the non-power activities. The secondary projects - agricultural, industrial, and lake transport services - failed with the exception of fisheries, Kofi says, because they were not based on the specified needs of the local population. To assist the profitability of the VRP, these non-power projects should have yielded high short run returns on investment and in sectors requiring little foreign exchange. A second reason for the low rate

of return had to do with the size and cost of the project; they were too big for Ghana to take on by itself and should have involved the participation of the co-basin countries. Otherwise, the pricing of power to the other countries should have reflected that they did not contribute to the financing of the project.

Another author, David Hart in his book The Volta River Project: A Case Study in Politics and Technology (1980) performs a partial cost-benefit analysis on the economic efficiency of the electricity side of the project, projecting returns into the future, from 1977 on. He uses actual data on electricity revenues from 1965 to 1967 and a discount rate favorable to the project set at 5%. The benefit to cost ratio turns out to be 1.04. He concludes that even with a discount rate and electricity growth rate favorable to the project, the cost-benefit ratio is very unsatisfactory. From a cost-benefit point of view then, Hart arrives at a similar conclusion as the others.

IMPLEMENTATION AND MANAGEMENT

Power Production and the Possibility of Promoting Non-Power Activities

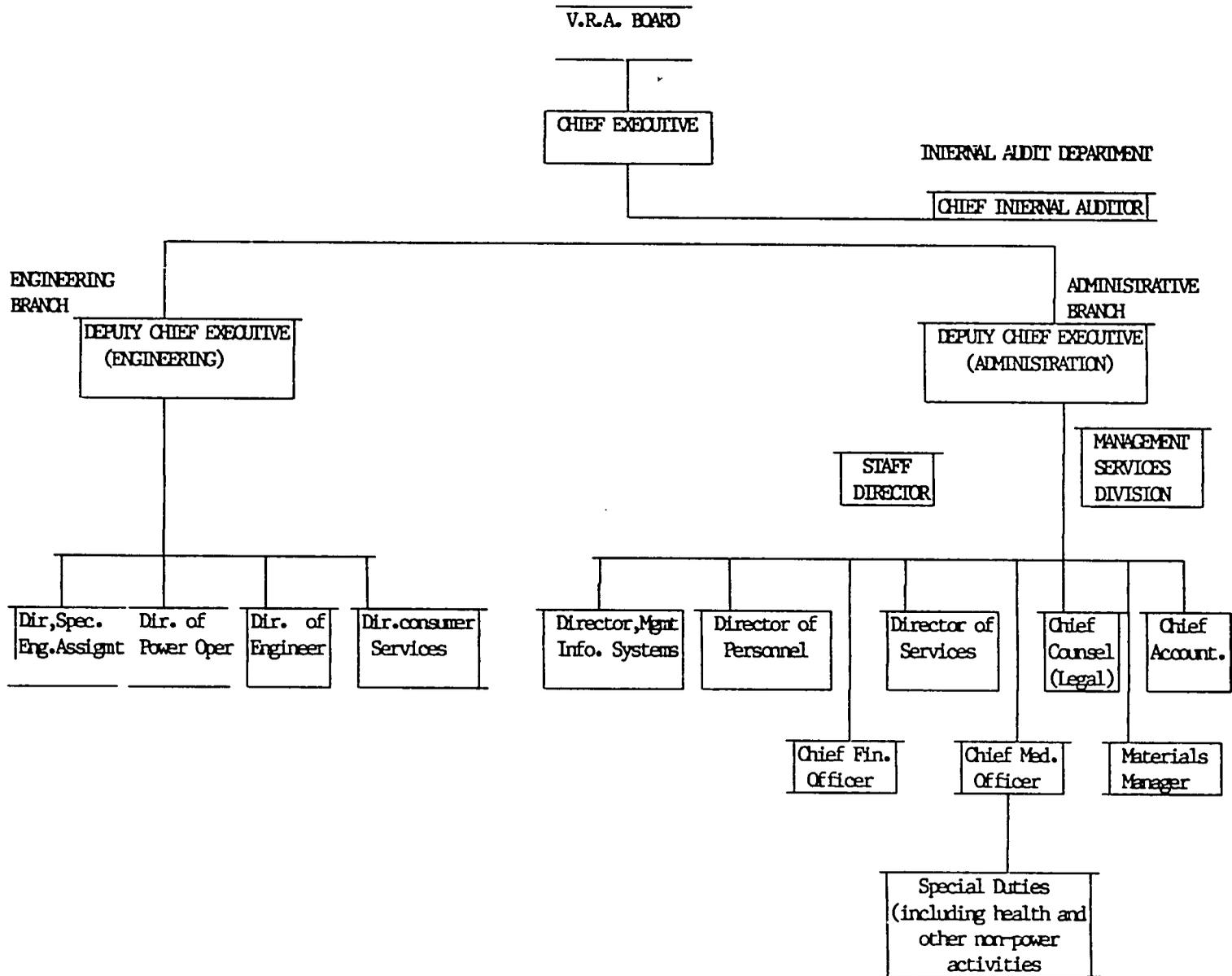
The most immediate objective of the VRA was the production of power and transmission of electricity. It is beyond the scope of this report to go into detail in a discussion of the Authority's main function and the Volta project's most direct outcome. The primary interest is in how planning and managing power-related operations have affected development of non-power initiatives. The purpose is to demonstrate that while the power-oriented development strategy can accommodate multiple problems involving other sectors, it sets its course and limits its involvement in order to maintain the original intent of supplying electricity as efficiently as possible.

The very nature of decision-making and criteria to promote a large-scale hydroelectric system tends to restrict the interest and resources of the single-purpose institution from accepting the uncertainty and costs of directly promoting multi-sector projects which embrace the basin regions and its population beyond servicing national energy needs.

The weight of power production within the Volta River Authority is represented in the present organizational chart of the VRA depicted in Table 3. The Authority's emphasis on the engineering branch is a direct response to marshalling resources so as to promote the growth of energy production. Organizationally, the resources for non-power activities are much less prominent and treated under the category of special duties, coordinated by the Authority's Chief Medical Officer.

TABLE 3

VOLTA RIVER AUTHORITY ORGANIZATION CHART



Power Planning

Because of the emphasis on hydropower generation within Ghana's national development goals, surveys had already determined the optional location of potential dams and reservoirs and, technically sound engineering studies were used to select final designs for the hydro-power scheme. Therefore, the actual project implementation phase was the point of departure for the Volta Authority planning process. With project location and design completed the Authority was more a project management institution than a development planning agency.

To secure investment in the project and fulfill their own management responsibility, the Authority emphasized the economic analysis of forecasting expected net return. Planning and managing the system was influenced by a strategy to achieve a favourable tariff position with the VALCO smelter operation and, more importantly, increasing that portion of market revenues from non-aluminum bulk consumers of electricity. Under such a strategy, planning for the expansion of the transmission grid to service long-range markets is more important than considering alternative means of promoting local development. The costs of non-power activities such as health, resettlement, and research were treated as indirect costs in the original economic justification of the project. As a consequence, nonpower programs were neither expected to generate significant economic returns nor intended to be funded from the earnings generated by hydroelectricity.

According to Act 46, the Volta River Authority was responsible for the conditions under which power was to be supplied to VALCO and the terms or tariff on power purchased by the smelter operation. The repayment of the loans for the Akosombo dam was to be exclusively from the earnings derived from VALCO. The financial benefit for Ghana's own development needs was expected to be generated by expanding the system and selling power to new bulk markets

outside the aluminum industry.

The primary consumers benefited by stored power from Akosombo and Kpong dams as administrated through the VRA are:

- (1) Volta Aluminum Company (VALCO);
- (2) The Electricity Corporation of Ghana which services selected Ghanaian domestic and industrial consumption;
- (3) The Mining Operations and;
- (4) The Communaute Electrique du Benin which supplies Togo and Benin.

There is also a power interconnection between the Electricite du Cote d'Ivoire (EECI) and the VRA. Additionally, smaller-scale consumption is directly linked to the Akosombo township and textile industry located there. Table 4 indicates the annual energy consumed for the years 1966-84 according to the aforementioned category of consumers.

The pattern of consumption depicted in Table 4 demonstrates that the Volta River Authority has been successful in increasing the consumption of electricity to consumers outside the aluminum industry. The direction of this increase is due to servicing Ghana's other industrial and domestic demands and expanding service to supply power to other West African countries such as Togo and Benin. As part of this trend the VRA has engaged in a series of negotiations leading to a new and more favorable tariff arrangement with VALCO. On the basis of these negotiations which took place in 1983 and 1984, the VRA increased by 3.4 times the VALCO power tariff with an adjustment formula to take into account the world average price of aluminum and the amount of energy supplied each year with a minimum below which the rate is not allowed to fall. The conditions of supplying VALCO were also reassessed so that under normal conditions, the VRA was permitted to reduce the power supply to the smelter operation. Planning should first consider the long-term forecast and immediate needs of Ghana's own

TABLE 4

Annual Energy Consumed Per Category of Customer1966-1984

Totals	E.C.G.	The Mines	Akosombo Textiles	Akosombo Township	Valco	C.E.B.	Totals
	(GWH)	(GWH)	(GWH)	(GWH)	(GWH)	(GWH)	(GWH)
1966	300.90	127.20	-	2.70	13.90	-	444.70
1967	360.30	164.10	-	6.30	923.20	-	1,453.90
1968	420.10	177.40	2.00	6.80	1,865.90	-	2,472.20
1969	502.80	185.50	6.30	6.80	1,872.20	-	2,673.60
1970	564.80	206.80	14.85	7.20	2,012.40	-	2,806.05
1971	659.25	226.50	20.82	8.81	1,919.00	-	2,834.37
1972	699.45	242.64	20.94	9.01	2,263.81	1.26	3,237.10
1973	768.12	243.07	21.98	12.54	2,625.99	99.72	3,771.41
1974	893.46	257.02	19.27	11.06	2,734.77	127.78	4,043.33
1975	893.17	271.02	22.57	11.50	2,518.24	136.70	3,853.20
1976	980.01	278.28	22.98	9.68	2,644.89	153.34	4,091.17
1977	1,034.70	260.27	24.31	11.00	2,783.61	178.81	4,292.70
1978	1,062.84	250.25	24.15	11.33	2,086.38	216.63	3,651.57
1979	1,027.76	259.34	17.60	13.01	2,907.53	299.25	4,524.49
1980	1,074.71	271.85	11.53	13.14	3,318.68	439.77	5,129.68
1981	1,115.33	273.99	6.56	9.53	3,303.24	472.19	5,180.83
1982	1,000.29	257.78	1.93	8.77	3,008.71	521.46	3,798.92
1983	948.04	232.49	2.97	8.09	752.93	490.78	2,453.33
1984	799.05	218.83	4.22	7.44	13.18	316.89	1,359.60
Totals	5,105.06	4,404.29	244.96	174.68	39,668.60	3,456.57	63,054.14

Source: VRA Annual Report and Accounts, 1980, 1981, 1982, 1983, 1984.
Culled from Rod Sims and L. Casely-Hayford.

industrial and domestic demands and those of other countries in the West African region.

The significance of these terms was especially acute during the period of the Sahelian drought from 1980 to 1984 which depleted the storage capacity of Volta Lake below the minimal level anticipated in the hydro-power design. The Akosombo Dam is designed as a hydroelectric project to use a regulated outflow through the power units of 1,160 cumecs, which represents the ability to draw on almost complete regulation of total river flows. By 1983, the storage capacity became so low, that VRA was forced to reduce the total amount of electrical energy it could supply. The area of major curtailment was the VALCO aluminum smelter which shut down three of its five potlines reducing its rate of consumption from 3,008.71 GWH in 1982 to 13.18 GWH by 1984 as indicated in Table 3.

In addition to re-allocating the distribution of power production, the effects of the drought and negotiations with VALCO also reinforced the narrow direction of the single-purpose strategy. The view was strengthened that the VRA should concentrate on expanding the existing hydro-power capacity by increasing distribution to new energy markets within and outside the country. And, to sustain this expansion, greater care in the future should be taken to reduce the risk of fluctuations in storage capacity. Any non-power activities which would significantly draw on the system's stored water, especially irrigation, were perceived as a constraint to pursuing the single-purpose of hydroelectric production.

The Role of International Donors

Financial aid has been crucial throughout the life of the project, and it is useful to identify the key donors and reassess the nature of their more

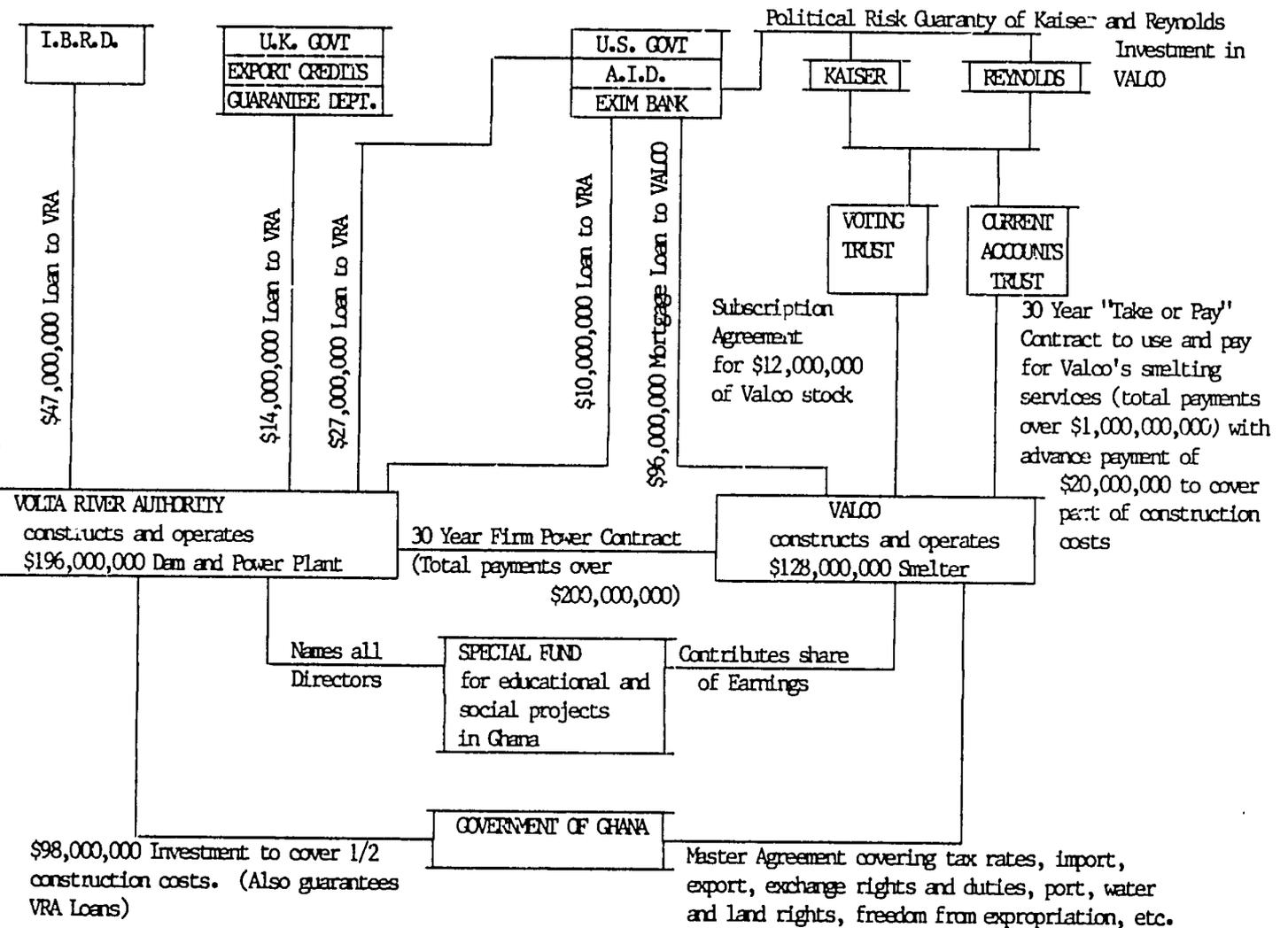
recent involvement.

The major involvement of lenders like the World Bank, and other sources of loans has focused on the energy sector - power generation and distribution being carried out by the Electricity Corporation of Ghana (ECG) and the VRA. The World Bank assisted in financing the Akosombo Project with a loan in 1961 (see Table 5). A second loan in 1968 helped to finance the Volta Expansion Project, and a third in 1977 to finance the Kpong Hydro Project. Three projects related to the ECG's distribution system were financed by three credits from the International Development Association (IDA) and one IBRD loan. The third project was not successful because of Ghana's dire economic situation after 1981 and also the ECG's poor project administration and management of its operations. The World Bank recognizes the ECG's problems - its non-accessibility to foreign exchange to procure the material and equipment necessary for its operations, and also its lower status among the parastatal enterprises and lower salaries. Because the Bank has not been successful in improving the ECG's reliability and reducing costs, it has consequently been channeling its loans into the more efficient and well-managed institution, the VRA which will also be assuming responsibility over the electricity grids and transmission facilities in some regions formally assigned to the ECG to ensure a more reliable supply. The implementation of a power system rehabilitation project by the World Bank in 1985 illustrates the perceived importance of supplying public service electricity for Ghana's economic recovery through the extension of the grid with increased dependence of the mining, smelting and export-oriented industries.

Ghana as a whole receives aid from both bilateral and multilateral donors. According to a World Bank report, Ghana received 42 per cent from bilateral sources and 58 per cent from multilateral sources in 1985 with the largest

TABLE 5

SCHMATIC DIAGRAM OF PRINCIPAL FINANCIAL AGREEMENTS
AT THE INITIATION OF THE VOLTA RIVER PROJECT



Source: Jackson 1964, 7.

proportion of aid allocated to projects. Other types of assistance are program/sector, food/commodity, technical, and debt relief. The share of bilateral aid has been increasing and individual countries are shifting their assistance from planned projects to program/sectors.

The Kpong Hydroelectric Project is a good example of a large project or sub-project of the Volta River Project which receives substantial support from international donors. The World Bank assisted the VRA since the inception of the Kpong Hydro Plant in 1973 and the Canadian International Development Agency (CIDA) carried out the feasibility study. The Bank put together a financing package consisting of financial commitments from multiple lenders: CIDA, the Arab Bank for Economic Development in Africa (ABEDA), the European Development Fund (EDF), the European Investment Bank (EIB), the Kuwait Fund, the Saudi Fund and the IBRD. These donors as well as other funds from the the U.K. Government, the U.S. Agency for International Development, the Export-Import Bank of Washington, and the Opec Special Fund are all currently contributing long term loans to the V.R.A. for the production of power and electricity. Donors contributing to non-power activities linked to the Volta River development are (1) Japan which signed an agreement in 1983 with the Government of Ghana for a grant-aid to the Volta Lake fishery development program (V.R.A. 1983, 24); (2) USAID and UNICEF to family planning and school health service; and (3) the German Agency for Technical Cooperation (GTZ) to the Volta Lake Transport System, specifically for the Ferries Rehabilitation Programme.

What this illustrates is that large-scale aid from international donors promotes the development of major projects undertaken by the government or large-scale institutions sponsored by the government that contribute to the macro-level efficiency of the economy. In this respect, the World Bank lending strategy sets a pattern for the nature of financial assistance offered by large

international lenders in general. Presently, it is concerned to rehabilitate the capacity utilization of Ghana's existing productive assets and to improve the country's essential infrastructure including transport, water, petroleum, and power in order to facilitate increased production. International aid is not geared towards small-scale or local projects initiated by a segment of the population, many of which were spurred by or could have arisen out of the implementation of the Volta River Project. One of the difficulties with supporting this type of project is that these development efforts often involve several local agencies pooling their services and resources. The fragmented nature of the entire operation of a project makes the distribution of funds a complicated process. Hence, international aid strengthens the institutions and large-scale projects that are already well-equipped materially, administratively, managerially, and operationally to perform with an adequate degree of success, for which one of the criteria is the long-term capacity to abide by its repayment schedule. Those institutions, like the V.R.A., generally have easy access to foreign exchange. The single-purpose character of the Volta River development then is reinforced by the nature of international aid.

Management of Non-Power Activities

A. B. Futa, (United Nations, 1981) a former Director of Lake Transport, in the Volta River Authority, has raised the possibility that multiple-uses from the project should have figured more directly in the responsibilities of the Volta River Authority. He observes that some of the Ghanaian interests involved during the formation of the institution shared a more comprehensive perspective as expressed by Nkrumah himself:

...He believed that such a scheme apart from creating a new industry, would enable large tracts of land to become fertile by irrigation and also generate other forms of development. We find that during his term of

office great efforts were being made to extend the activities of the Authority beyond that required by an ordinary power utility agency. . . .He looked at the Authority in much the same way as Roosevelt and his New Deal Planners looked at the TVA in relation to the development of the southern region of the United States. (United Nations, 1981, 340).

It is true that Nkrumah had authorized at substantial costs studies on the development of the Volta Lake for transportation and irrigation. For instance, irrigation was not one of the VRA's direct statutory functions, however, using the discretionary powers of Act 46, the Authority commissioned the Kaiser Engineering Firm to carry out a detailed study of irrigation potential in selected areas. Completed in 1963, the study did not influence the final design or operation of the Akosombo project, since the dam structure did not provide for any outlets and other irrigation engineering works to facilitate projects for irrigated water directly dependent on the main hydro-power infrastructure. Further, another Kaiser study in 1981/82 assessing irrigation potential concluded that the economic and financial feasibility of such projects made implementation and management difficult and recommended that a new management structure, outside the VRA, be established to promote irrigation projects.

In practice other non-power activities like fisheries and transportation were conceived as secondary functions, but were only temporarily coordinated as programs within the Authority itself. Often, these ancillary initiatives did not fulfill the VRA's economic criteria of being economically self-supporting and the Authority's interest was ultimately in handing over such efforts to the appropriate line ministry or government department.

Other secondary issues like resettlement were intended to be temporary activities, which could require extensive resources in staffing and funding during execution of the VRA's responsibility for such a program. This temporary experience developed with a high degree of interaction between the Volta

Authority and other national departments and international institutions. The intensity, complexity, and degree of coordination required are captured by the organization chart of the Kpong Dam resettlement effort from approximately 1977 to 1981 (Table 6). The whole program was instituted under the permanent VRA special duties office, activated to meet the needs to effectively resettle those people displaced by the dam, then phased out as the infrastructure, services and housing for resettlement villages and towns were completed.

The appropriate line ministry or branch such as water works, education, social services, and agriculture were expected to incorporate the resettled area into the conventional, on-going national service or program. In some cases, for example education, this transfer process worked smoothly. More often, however, line departments were ill-prepared and much less endowed with resources than the VRA to take over and further manage the solution to a non-power development problem. Under the circumstances, it was difficult to perceive such a takeover process other than as an additional burden, and even less likely would a new agency in the process contemplate the resettlement area and lakeside region as a viable platform to develop new initiatives. There was no new development agency created that was regionally comprehensive in scope, to effectively promote or coordinate new opportunities or resolve older problems in the lakeside region.

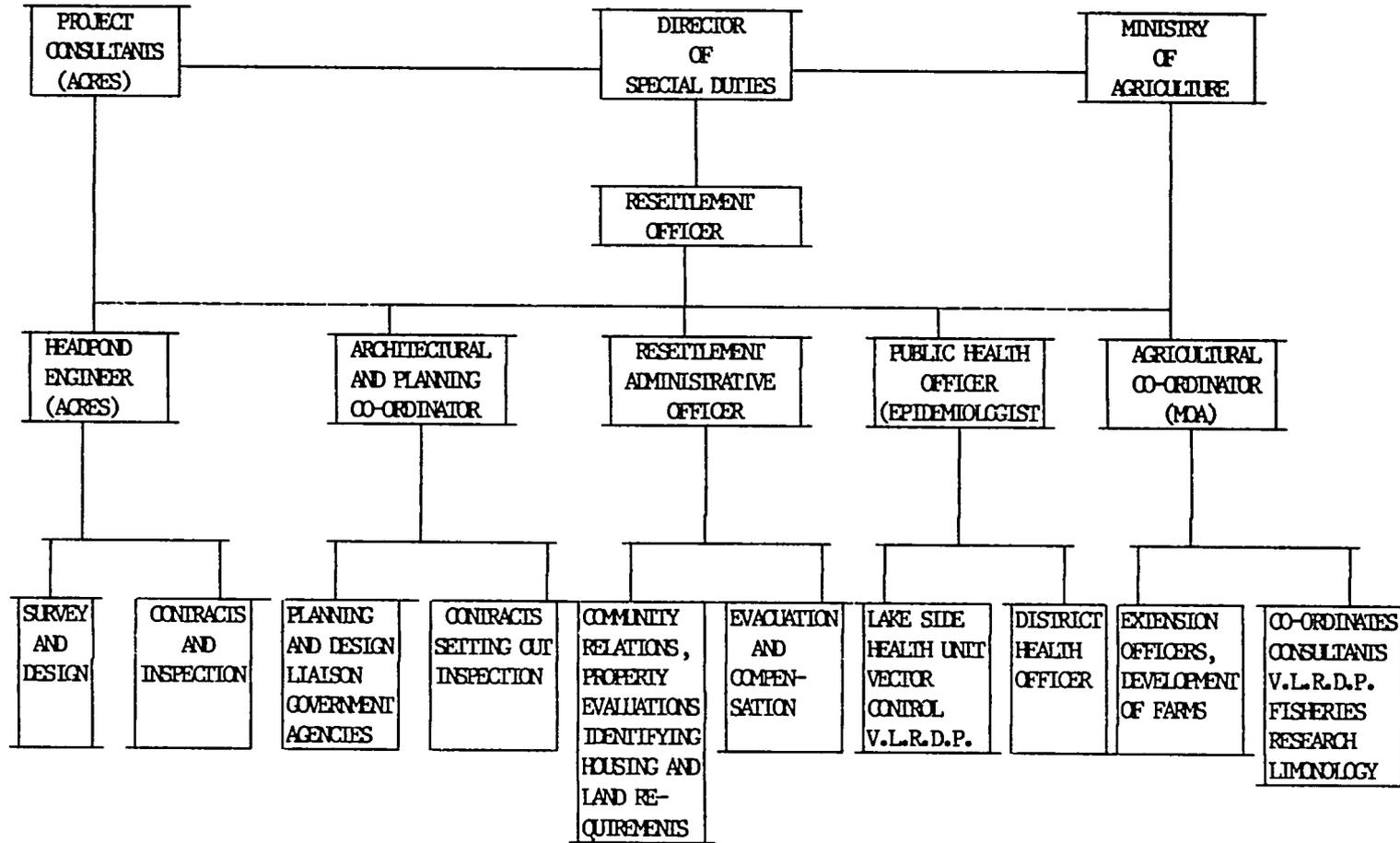
Lake Transportation

The creation of such a large man-made body of water (3,275 sq mi) can effectively link or separate the southern and northern halves of the country. Ghana has a well-established road network and railway system serving the south of the country. There are 9,200 miles of tarmac road and 11,000 miles of dirt road passable to vehicles, together with 800 miles of railway connecting Accra,

TABLE 6

VOLTA RIVER AUTHORITY
 Kpong HYDROELECTRIC POWER PROJECT
 RESETTLEMENT PROGRAMME

ORGANIZATION CHART
 JUNE 1977



Kumasi and Takoradi. The northern reaches of Ghana including the Upper Volta River Basin region is much less developed in terms of transportation and subject to disruptions due to weather conditions. The possibility of using the lake to transport passengers and cargo would serve to increase opportunities for linking the north with the south of Ghana.

The possibility to greatly improve north-south transportation was identified in the earliest proposals for the Volta project, and recognition of the potential tended to promote a vision of large-scale projects requiring high capital investment. Some of the economic criteria associated with managing the hydro-power generating plants have influenced planning the kind of commercial transportation proposed for the Volta Lake.

The Volta Lake provides a 250 mile navigable channel from the Akosombo Dam site in the south to Buipe, a ferry port on the northern reaches of the Black Volta. Akosombo is well connected to the main seaport of Tema and Accra by an all-weather highway; road extensions radiate from the northern port of Buipe to all parts of the northern region and to Burkina Faso. Both Akosombo and Buipe are the sites of extensive development plans to create a multi-market and port complex for marketing and transporting commercial cargo, and handling passenger traffic. The project at Akosombo is in the construction phase and the port is already serving passengers and transshipments of cargo.

The Volta River Authority was authorized to fulfill the expected benefits from lake transportation and commissioned several major studies attempting to justify a commercial lake transportation system linking north-south traffic. The procedure was similar to that of the Akosombo project; foreign consultant firms were primarily requested to conduct an economic analysis of the north-south transportation system utilizing economic forecasts to estimate expected cargo and passenger traffic. One such study (Ostenfeld & Jonson, 1969) esti-

mated a demand of 150,000 tons by 1975, 260,000 tons by 1980, and 426,000 tons by 1985. The development of the system was initiated by the VRA which operated a small-scale project on pilot basis. In 1970, when the pilot scheme proved to be financially possible, a wholly owned subsidiary company, the Volta Lake Transport Company, was created to manage and operate a lake transportation system. The volume of cargo transported began to decrease after 1973, declining from approximately 28,000 tons of transported cargo that same year to a little over 3,000 tons by 1979 (Thomi, 1982). These figures were all substantially lower than earlier forecasts. One reason for the decline in traffic was the unreliability of the single, large vessel due to a lack of spare parts and equipment to service existing craft and the low water level in the lake which interrupted some services and restricted carrying capacities on others (Hart, 1980).

Under such conditions the original commercial and large-scale system envisioned could only be implemented with support by international donors. In 1974, the government of Ghana obtained aid loans and technical assistance from the German Government and Development Bank, KfW. KfW is presently financing a significant improvement in the necessary port infrastructure at Akosombo and Buipe and for construction of additional lake ferry craft including a transport suitable to carry petroleum.

The Volta Lake Transport Company is a privately oriented management and capital entity which must secure a large transportation market in order to repay investment in the company. Design and planning of the main North-South system is anticipated to capture an increasing share of aggregate traffic demand including servicing a substantial portion of Burkina Faso's cargo requirements. The company's objectives are by its organization, sectoral in scope, and much of its success and estimated traffic flow will depend on

development particularly in the Upper Volta Basin.

This type of transportation scheme tends to neglect the needs of local lake travel and moving of goods between the lakes region's market centers. The demand for circuitous lake transportation is currently being served by private operators using large numbers of 2 to 3 ton transport boats powered by inboard and outboard motors and capable of making shoreline landings where the lake is shallow or no landing structures exist.

Additionally, the ferry service at five points around the lake has contributed to local and micro-regional development. All these ferry stations and towns have grown to be important market centers not only for travelers' food-stuffs but also for marketing fish, agricultural products and personal consumer goods depending on their access with the immediate region they serve (Thomi, 1982).

Fisheries

The development of the lake fishing activity seems to have achieved a significant amount of positive benefits. By 1975, it was estimated that lake fisheries supported the livelihoods of approximately 87,000 people, occupying 1,479 villages around the lake (Coppola and Agadzi, 1979). The natural changes caused by the Volta Lake increased the fish stock even beyond original estimates (18,000 tons of catch per year estimated by the Preparatory Commission, 1956) to a high level of 60,000 tons in 1969 and finally to the current annual catch of approximately 40,000 tons. This annual catch can be compared with the estimated figure of 10,000 tons obtained from fishing in the Volta River Basin before the Akosombo Dam was constructed. Previously there had been only 2,000 fishermen depending on the river as a source from which to catch fish.

The size of fish catch is also significant to Ghana's national economy. The Lake's annual fishing production accounts for approximately 15 to 20 percent of Ghana's total fish consumption. In 1977, the value of total lake fish production of 38,719 million cedis surmounted the earnings of the Volta River Authority from selling electricity for the same year (33,474 million cedis).

Fishing is a traditional activity in Ghana and the vast majority of lake fishermen migrated from the banks of the lower Volta River to the newly formed Volta Lake in order to take advantage of a unique opportunity for selling and marketing fish while relying on an older livelihood - fishing. According to a survey in 1970, only 3 percent of the households in the fishing villages were participants in the official resettlement program, and an additional 1.6 percent of the households were classified as "gone elsewhere" or chose a self-resettlement form of compensation. The migrant fishermen occupy shoreline areas which can have access through resettlement villages. In such a situation the fishing village occupies land controlled by resettlement communities by means of a lease-type arrangement.

The development of fishing is the most integrated example of involving various local, regional and national institutions together with the VRA to achieve locally and regionally oriented development projects. The program was first proposed by the Volta Lake Research and Development Project and emphasized improving local fishing in all three phases of: 1) the catch; 2) landing and processing the raw fish (typically by smoking); and 3) marketing fish to the consumer. From the beginning, it was conducted so as to include the participating government agencies, and designed programs and projects with the objective of operating these in the future through the appropriate line department or local authority. The Volta Lake research unit based their proposals on adequate surveys and monitoring of social, economic factors as

well as physical and biological studies pertaining to lake fishing. Research and monitoring was frequently updated and produced results using observations taken in the field involving fishermen and other local actors. As new problems and institutional developments evolved, the coordination of the project was able to adjust or abandon some older components of the scheme and allow for new ones to produce a more effective outcome.

The major objectives of the program included:

- (1) construction of improvements of the landing and marketing facilities at the Kpandu-Torkor beachhead-roadhead market in order to make marketing commercially attractive, technically easier and safer in terms of environmental and public health hazards;
- (2) assistance and education of potential fishermen (youth) in modern fishing gear techniques, boat building and fish processing. Provide a consumer supply house for the sale of fishing inputs. These were intended to gradually increase fish production and;
- (3) promotion of better fish processing methods, by installing improved smoking sheds and an ice plant.

The Kpandu-Torkor complex was intended to serve as a demonstration project and model for similar projects at other fishing/market centers along the lake.

Most of these objectives were achieved with the exception of the ice plant. The specially designed boats were not adequate to lake fishing conditions and have since been abandoned, while fishermen increasingly use boats following a traditional canoe design. The management responsibility for the projects was complex and some of the difficulty underscores how much of a gap exists between the resources and organization of the Volta River Authority and other government institutions. No new institutions were formed and the existing fisheries department which is to run the scheme is grossly understaffed to effectively take over the operations and management of the complex.

The limitations of other institutions to actively absorb future management has delayed the planned withdrawal of the Volta River Authority's direct

involvement. In terms of reproducing similar projects, much of the progress of creating new shoreline fishing markets is a result of spontaneous initiatives involving local fishermen and Ghana's traditional "market mammies", women who constitute the labor force for marketing and processing fish. The agricultural development office for the Volta Region, (VORADEP) has recognized this trend and local development effort. VORADEP is financing a road project to serve such a beachhead market center at Dzemini.

Resettlement

Resettlement schemes as part of any large-scale projects constitute a separable issue that has provoked a substantial amount of criticism and a number of investigative studies. The resettlement issue unveils the importance of the consideration of the social and environmental impacts of a project. The Volta River Project's resettlement scheme is exemplary of the types of problems that arise when large groups of people are forced to leave a region and relocate voluntarily on land allocated to them by the government. The factors of time, money and the authorities responsible for executing the plans have proven to be crucial to the outcome of the scheme linked to the Volta River Project. There are, nonetheless, conditions specific to this case that would explain why these factors acted as constraints. The V.R.A. and Government of Ghana carried out a major resettlement scheme in conjunction with the construction of the Akosombo Dam, but a second resettlement scheme of a much smaller scale associated with the more recent construction of the Kpong Dam was able to benefit from some of the lessons learned from the first. A comparison enables us to distinguish between the mistakes that can be avoided and the problems that tend to persist or for which no solutions have yet been found.

Construction of the Akosombo Dam was begun in January 1962 immediately

upon the signing of the final agreement. The area of inundation that it created required the resettlement of 80,000 persons from 740 villages and nine different ethnic groups. The people had to be moved before filling in of the area began in May 1964, allowing just two years for a massive mobilization effort. Construction of the dam was initiated even before attempts were made to resettle the inhabitants. The end result was a "crash programme" whereby the VRA succeeded in "evacuating" 80,000 people and providing them with a basic shelter.

Originally the scheme was to be implemented over the course of four years, however, it was delayed to allow more time for the redesign of the dam, the construction of the Akosombo Township, and unsettled negotiations for the smelter and loans (Boyle and Kuhns, 1964, 7). Although no well-defined plan for implementation had previously been drawn up, the Preparatory Commission had devoted two entire volumes of its report (1952) to the resettlement question. Its treatment of the issue was tantamount to a very detailed survey of the area to be inundated and cleared for the inhabitants and their economic activities rather than a step-by-step plan of action for their resettlement. The furthest the Commission went to devising a strategy was to present three possible approaches to resettlement. The "self-help approach," whereby the inhabitants would resettle of their own volition and be provided the necessary technical advice and material aid, was considered the most viable. The two other approaches were: (1) to pay for what was legally due for the disturbance of the inhabitants with no further commitments, or (2) consult with the people concerned and then set up a central organization which would re-establish the communities on the designated sites as part of a single operation (Adu-Aryee, 1985, 21). The last approach is the one adopted by the Kpong resettlement scheme.

Five years elapsed between publication of the report and the signing of the final agreement in 1956 and six more years of negotiations passed before implementation could begin. Original emphasis on self-help, communal initiatives and cash compensations was replaced by the urgency of evacuating the people in a shortened amount of time. Ultimately, the government had to revert to the option of a monetary compensation for loss of property. Everyone involved was more concerned with the costs of this operation, like any other that was dictated by the Volta River Project, except that this operation was only peripheral, albeit necessary, to the construction of the dam. The VRA alone was not officially mandated to cover the expenditures for resettlement. The other organizations among which responsibilities and costs were distributed were: (1) the Ministry of Agriculture that initiated clearing of the land, (2) the Ministry of Social Welfare that assigned people to villages, (3) the Department of Town Planning responsible for village outlays, (4) the Department of Water Supply, (5) the Housing Section of Ministry of Communications and Works, and (6) the Land Division of the Ministry of Justice (Boyle and Kuhns, 1964, 8). The VRA was active in constructing the core houses (partially built) and houses for the administrative staff, installation of latrines, the clearing of land, and construction of access roads.

Twenty per cent of the people concerned opted for cash settlement and preferred to go elsewhere while the remainder were moved by the government into 52 new villages. The Government of Ghana spent \$41 million on the implementation of the program and after the first few years of resettlement, 59 per cent of the settlers had vacated the villages. Living conditions were felt to be unsuitable; too much emphasis was placed on modern looking communities that did not conform to the cultural style of the specific ethnic groups. The settlers were left to create their own economic basis for earning a living

which was virtually impossible under the circumstances, combined with the fact that compensation was not paid out satisfactorily and not enough land had been cleared for agriculture (Hart, 1980, 83). Incomes were also lacking because the Food Marketing Boards delayed payments of five to six months.

The newly settled villages were regarded by the government as part of the plan to industrialize the country, hence, the importation of mechanical equipment, creation of large-scale farms and formation of cooperatives, all contributing to the replacement of the traditional patterns of farming. Resettlement was treated as "an aspect of social change rather than rehabilitation with gradual improvements" (Hart 1980, 84).

The situation of the settlers was further aggravated by other factors. The creation of the lake brought on a high incidence of diseases - bilharzia, onchocerciasis and malaria. The lake transport scheme that was to reconnect communities divided by the lake failed. In 1966 the VRA surrendered, as planned, its responsibilities for water supplies, roads, and welfare services with the assumption that the towns would have developed into viable socio-economic units. The government funds for allocation to these purposes were deficient. According to a 1979/1980 survey (Thomi n.d., 11), none of the townships developed into an economic growth pole or cell of change which could activate the rural population over the 15-year period. From 1970 on, some movement into the townships did occur owing to the local demand for cheap housing, but the size of the settlements still greatly exceeded the demand. Basically a shortage of time, lack of money and poor planning characterized this attempt to carry out a resettlement scheme.

The Kpong Hydroelectric Project, 25 km downstream of Akosombo, was initiated in February 1977 to provide water for hydropower irrigation and domestic water supply. Not only was the plan for this project enlightened by

the first resettlement scheme, but in 1968 the Volta Lake Research and Development Project was set up with the aim of conducting research in resettlement, fisheries, hydrobiology, and public health. Extensive environmental impact studies were made prior to the dam construction. Moreover, the resettlement programme was in this case consolidated with the hydropower construction works and treated as a component of "a single indivisible programme" (Futa 1983, 99). The lenders agreed to include the construction of four of the six resettlement sites into the main contract for the dam and power house.

Responsibilities for the resettlement of the 7,000 people were better distributed; the VRA would coordinate the entire programme but would be assigned a more active role in the initial years in developing the land and maintaining the services. The Ministry of Agriculture would intervene in the post-resettlement phase with an emphasis on effective agricultural extension services. The whole tone of the planning effort with regard to resettlement had changed:

The objective of the Kpong Agricultural Resettlement Programme was to provide sufficient land for the resettled communities to continue their traditional methods of cultivation and offer them the means for developing them by their own effort (Derban 1985, 7).

Large-scale mechanized farming was not intended as part of this scheme. There was an overall sensitivity on the part of the authorities to the types of agricultural practices suited to the ethnic groups as well as to their integration into the host community, the appropriate village size, housing, sanitation facilities and the array of services needed to achieve the development of a resettled population. A great deal of attention was also to be given to health care and the involvement of the people in the control of disease, particularly bilharzia.

The differences of the Kpong resettlement scheme compared to the Akosombo

scheme are striking, but they stem from more than just "lessons learned." The Kpong scheme had the advantage of being smaller in scale and involving shorter distances. The displaced farmers numbered 7,000 and were merely being moved to outlying areas away from the headpond. Moreover, the resettlement villages had closer links to urban centers which meant infrastructure and services were already available.

The construction of the villages began in 1977 and was completed in 1981. At that time six resettlement villages were ready for people to inhabit. Although no outside assessment of the project has as of yet been made, it is significant that the implementation of this project is being guided by a set of principles that seeks to correct the mistakes and problems identified in the first attempt.

Health

Public health is an issue that has attracted considerable attention in Ghana, not just in relation to the social impacts of the hydroelectric projects, but in general. The Chief Medical Officer to the Volta River Authority, Dr. L.K.A. Derban asserts:

It is generally agreed that rational industrialization can help to accelerate socioeconomic development in a country and that every sector of the economy has a health component of such importance that it cannot be disregarded in any major development programme (Derban 1975, 49).

This statement is largely representative of the thinking of the VRA and government of Ghana on the subject of public health in the period of the country's transition to an independent state. The concern over health was integrated very early on in the plans, dating as far back as the White Paper. The Preparatory Commission itself predicted the health problems that might accompany the creation of the lake, and for the purpose of dealing with them, a

Health and Safety Section of the VRA would be established.

A survey on the prevalence of diseases among the population concerned was carried out before and after the Akosombo Dam, i.e. 1960 and 1964. It was found, for example, that urinary schistosomiasis or bilharzia, a snail-borne infection, was present in 5 per cent of the school children before the formation of the lake and 90 per cent of them in the post-construction period. On the positive side, the incidence of onchocerciasis or river blindness carried by a small black fly that breeds in well oxygenated, rapidly flowing streams and rivers was substantially reduced by the creation of the lake. Trypanosomiasis or African sleeping sickness carried by the tsetse fly that breeds in the light forest fringing the edge of the lake became less prevalent as the formation of the lake drowned their harboring grounds and as the vegetation pattern around the lake has been changing.

The 1964-67 survey identified another set of causes for health problems in the settlement villages. Problems of gastrointestinal and parasitic infections were attributable to limited resources to maintain health services and a gradual breakdown of water supply and sewage disposal. Spare parts and fuel were not available for hand and diesel pumps, and communal latrines of the aqua-privy type ceased to function. These problems further increased the spread of water-borne diseases. What this experience with health problems demonstrates is the strong interdependence of environmental, cultural, and human factors and their interplay under a project that directly intervenes in these conditions. The failure to maintain health services can in this case be considered part of the overall failure of the settlement scheme, or the ill-preparedness of the authorities to implement plans effectively.

The Volta Lake Research Project in 1968 engaged the Ministry of Health, the Medical School, the Institute of Aquatic Biology and other agencies along

with the VRA to formulate a lake-side health programme and in 1971 it collaborated with the UNDP and WHO on a disease control programme. Extensive health measures were applied to the settlements in the Kpong area by the Lakeside Health Unit of the VRA. These measures included surveillance and mass treatment of bilharzia which was quite successful in reducing the prevalence rate to a considerable degree (Adu-Aryee 1985, 122). Above all, an active health education campaign was launched for the first time with the aim of soliciting the participation of the people in the control programme on a self-help voluntary basis. A community health program is receiving financial support and supplies from the Valco Trust Fund, a benevolent trust set up by the Volta Aluminum Company in Ghana (ibid., 122).

Equally important was the emphasis placed on the need for environmental sanitation in these settlements. To prevent the use of streams for washing, bathing and cooking, the villages were supplied with potable piped water originating from the Kpong Water Works. Other precautions taken were the provision of communal latrines, deep water boat landing points to prevent wading in the headpond, and the demarcation of a peripheral area around the lake restricting any sort of developing or building.

The danger of the spread of bilharzia caused the VRA to suspend expansion of the Kpong irrigation project. Health authorities emphasized that rural farmers were not in a position to manage the system properly without continuous technical assistance which would minimize the risk of the disease. Fish ponds were also not pursued for the same basic reason. The rigorous health programme now being carried out among the villages affected by the spread of disease is representative of the responsiveness and progress on the part of the agencies involved in the health issue. Unlike the other non-power production sectors, the VRA was committed to long-term investments in the health sector.

The Volta Lake Research And Development Project

The damming of the Volta River was bound to cause enormous physical and ecological changes. The Volta Lake Research Project (VLRP) affiliated with the University of Ghana was created prior to closure of the dam in 1964 to deal specifically with the anticipated consequences. This initiative eventually led to the signing of a Plan of Operations in January 1968 by the Government of Ghana, the United Nations Development Project (UNDP) and the Food and Agricultural Organization (FAO) as the executing agency of the UNDP. The VLRP, one of the VRA's non-power activities, was also treated as such. The Volta Lake Research & Development Project (VLR&DP) as it was called then became a more rigorous and shared effort to confront the disturbance problems resulting from the creation of the lake in order to deal with them effectively. The project was intended to be of limited duration, expected to terminate in June 1971, but was extended until October 1977.

In the first phase until 1971 its designated aim was to conduct research in fisheries, hydrobiology, public health and resettlement with an emphasis on fish stock and public health problems of water-borne diseases (Adu-Aryee 1985, 37). Additionally, the project was to develop new systems of agriculture and incentives for resettled people through research and demonstration. The agricultural potentialities in the lake basin would be realized in irrigation and utilization of residual moisture in the drawdown area of the lake.

The second phase from October 1973 to October 1977 was necessary to strengthen the selected research programs for the development of the Lake's resources and, moreover, to implement recommendations made in the first phase. As an indication of the breadth of research accomplished by the VLR&DP, the quantity of its publications produced between 1968 and 1982 is worth quoting:

51 in fisheries, 28 in agriculture, 15 in public health and related activities, 14 in hydrobiology, 31 in socio-economic and development planning, 13 general and miscellaneous reports, and 4 technical reports.

Throughout the two phases a number of other government ministries, departments and national agencies also participated and the VRA set up a Coordinating Committee of all interested parties to integrate their efforts (Lawson 1970, 95). The specific institutions and departments involved were the Ministry of Health, the Fisheries Department, the Irrigation Department, the Department of Game and Wildlife, the Medical School at the University of Ghana, the Volta Basin Research Project affiliated with the University of Ghana, the Forest Products Research Institute, and the Institute of Aquatic Biology of the Council of Scientific and Industrial Research.

The scientific nature of the committee members would explain the strong emphasis on the biogeochemical cycles rather than on the human or socio-cultural aspect, except for the health issue which can be derived directly from the assumption of man as part of or affected by the cycles. In other words, the project was not only meant to be short-lived with enough time to carry out the research necessitated by the damming of the river, but was not designed with the long-term goal in mind of developing the lake area and managing and monitoring its development. Originally, the U.N. Special Fund contributed \$ U.S.\$ 1,336,000 to the project for a period of three years and this amount was matched by an equivalent contribution by the government of Ghana (Obeng 1973, 80).

When the UN withdrew in 1977 no funds were available to continue the work begun or implement on a broad scale the proposals derived from the completed research. The role of executing agency was assigned to the VRA after 1977 for the purpose of reassigning responsibilities and personnel and redistributing

the remaining assets to the different agencies or bodies. At the same time the Government of Ghana was burdened by the financial responsibilities. This had a quite visible impact on the continued implementation of the program until it became clear that in the absence of funding and the administrative and infrastructural support of the VRA, the program would be phased out. The fishing vessels belonging to the project fell into disrepair and many of its canoes had to be sold. Indeed, by 1981 "the administration of the Project continued to be hampered by the lack of vehicles, research equipment and Government financial contribution" (Republic of Ghana 1981, 21).

According to the VRA's 1983 Annual Report, the research programs were being scaled down considerably, and the Committee set itself the task of redefining its direction in light of the many constraints cited. Its new objectives were to develop limited agricultural and fishery programs on a commercial basis and concentrate on relevant research in the environmental impact of hydroelectric development, particularly with regard to aquatic weeds, bilharzia and fish stocks (1983, 24). To recoup the losses in inputs to the fishing projects, the government solicited grant aid from Japan which would include the importation of fishing inputs such as nets, outboard motors and mending twine. In agriculture, five demonstration farms around the lake ceased operation in 1984 and attention was limited to the Anyaase Farms Project to be run commercially. It was expected that this Project would be self-financing after two years.

The interdisciplinary nature of the VLR&DP and the temporary status and multinational composition of the research staff presented another problem at the end of the second phase; it made it all the more difficult for the research project as a whole to be handed over to others. The diversity of studies being carried out required a maximum of coordination. Staff were

borrowed from the nine research institutes of the Council for Scientific and Industrial Research, studying the country's soils, crops, cocoa, forests, inland water system, food, buildings and roads, industries and animals (Obeng 1973, 89). The national staff cooperated with a group of non-Ghanaians from five different continents. Facilities for the research project were not concentrated around the headquarters at Akosombo, partly because it was so isolated, but at the respective universities and institutes.

In the overall research program of the lake much more emphasis was placed on assessing stock, preserving, and processing, and much less so on exploitation of resources. Thus, for example, their concern was to maintain the needed concentration of nutrient material at the lower levels of the food chain to ensure the proper working of the food cycle. This was considered a better strategy than resolving how to restock the lake with new fish when yields fell. In what concerns the actual application side of the research program, problems of handing over responsibilities also stemmed from the organizational and operational structure of the program.

The handing over policy was intended to promote the principle of self-reliance or self-help for which in the end conditions proved not to be propitious. The actual degree to which the research was oriented towards application is illustrated in the pilot project approach. This facilitated the validation of the research and its viability with only a minimum of inputs and costs, given the short-term duration of its commitment, and minimal investment of resources (human and physical) to the improvement of social and economic conditions in an area. The pilot projects only engaged a limited number of local participants in the activities necessary for testing their findings. It was exceptional that a project or an initiative taken by the VLR&DP acted as an impulse to an area's development, and as previously mentioned, no allocation of

funds were specifically designated for the prolongation and expansion of the project. The short-term and minimal commitment of the VLR&DP typifies the general VRA strategy made possible by its narrowly defined functions that then absolve the organization from further responsibilities in terms of management, supervision, provision of materials, finances, or otherwise. The VRA in the case of the VLR&DP pilot projects was able to claim success, for example, because its obligation ended with the results of the research experimentation.

The constraints notwithstanding, the potential for the elaboration of a particular research finding and its conversion into benefits for an area did exist. To give an example of how a research finding might and did in fact translate into a development type of project, the development of the concept of a fishery scheme arose from a project study in 1969 which showed that with the formation of the lake the feeding and breeding potential for fish was enhanced and the fish population did indeed increase steadily. Fishermen were increasingly attracted to the area, so the VLRDP drew up a proposal which was submitted to the Central Government for a scheme to develop the Volta Lake Fishery. The proposal called for landing and marketing facilities, a fishing school for training young school leavers, and general infrastructure and services required. The scheme was ultimately approved and accepted.

It was unusual, however, for the research project to act on the basis of a given demand. Their normal procedure was to experiment and introduce new ideas. For example, to develop new systems of agriculture, it set up a Model/Mechanisation Services Programme. However, the model farms and demonstrations have hardly affected the population in the drawdown area (200 to 400 sq mi) for which the potential for crop development is very high.

Agriculture and Irrigation Development

Irrigation was not specifically designated as a function of the Volta River Authority in the Volta River Development Act. The design of the Akosombo dam project did not provide for the inclusion for multiple consumptive purposes such as irrigation development. The power-oriented management of the Volta River Authority also recognized the potential conflict of depleting water storage capacity because of possible diversion for other uses. The most significant quantity lost to other uses would be from large-scale irrigation development. The threat of the lakeside area's most serious health problem, bilharzia, also casts doubts on actively promoting irrigation schemes, since developing canals could significantly increase the spread of the disease. Further, Ghana's experience with large-scale plantation or contract farming for producing sugar cane for export has not been successful and similar scale farm projects which would require large amounts of irrigation and other inputs are not attractive to nor actively pursued by the present government. The most recent statement of Agricultural Development Policy, 1986 - 1988, affirms in relation to irrigation projects that "prior to conclusion of the national irrigation study, there is a moratorium on all new irrigation schemes unless a detailed feasibility study has been taken and shows attractive returns" (Republic of Ghana 1986, 16).

Despite the constraints associated with the lack of successful agricultural development projects in the past, national policy makers and international advisors agree that the "scope for efficient agriculture is vast since Ghana is endowed with an immense agricultural resource base," (Republic of Ghana 1986, 1). The development of agriculture has also suffered as a result of a general decline in Ghana's economy. The Government of Ghana is particularly anxious to apply appropriate policies and means to develop agriculture

as part of the country's general economic recovery program. The very potential of the Volta Lake's system for supplying irrigated water should figure in the country's agricultural development planning. The volume of water that the VRA statutes allocate for irrigation purposes would irrigate 14.5 percent of Ghana's total cultivated land (Futa, Appendix F 1986, 3). One FAO advisor points out that there is enough water in the lake to irrigate 50 million hectares at 3,000 cubic meter per hectare, yearly (Jama, Appendix F in Futa 1986, 3). In addition, the large population resettled because of inundation of the area covered by the lake should receive and will need much in the way of improvements in the lakeside region's agricultural development. Irrigated agriculture would also benefit the potential for agricultural production in the dry northern region of the country.

The most significant area of irrigation development related to the Volta Project is the headpond and area immediately downstream of the Kpong Dam and hydroelectric plant. This area forms part of the Accra Plains which had previously been considered a priority area for irrigation and the subject of several feasibility studies. As part of the Kpong hydroelectric power development, an assessment of irrigation potential was conducted for the Volta River Authority, which used its discretionary powers to authorize such an agricultural study. The assessment indicated that a total area of 7831 ha located on both sides of the Volta River below the Kpong Dam was suitable for irrigation. Irrigation outlets were subsequently incorporated into the final design and construction of Kpong which was completed in 1981. The average annual withdrawal of water from the headpond reservoir from the irrigation outlets was limited to $2.43 \text{ m}^3/\text{s}$ representing only 0.2 percent of the total regulated flow. The University research station and farm located in the same area also benefited and operates its own diversion canal from the Kpong headpond.

The actual development of this irrigated farming potential was assigned to the Ministry of Agriculture's Irrigation Development Authority (IDA). The IDA recognizes this opportunity, however, the agency has limited resources and is developing a small scheme with FAO support near the former sugar plant at Asustare. Because of the financial gains possible with irrigation, the VRA has also invested in a pilot commercial project designated the Kpong Farms Ltd. It was formed in 1982 as a private company with limited liability and is a wholly owned subsidiary of the VRA, whose Chief Executive serves as chairman of the Kpong Farms Board of Directors.

The Kpong Farms is located adjacent to the dam structure itself and abuts the shoreline where the major irrigation outlets of the headpond reservoir are located. This strategic location permitted closer control by the VRA and facilitated its potential to act as a demonstration effect for similar farming schemes. The initial objective was to operate a large-scale farm for producing food crops for the Volta Authority employees and the immediate regional market. After reviewing the performance of the food crop orientation, the VRA decided to operate it as a purely commercial venture including the possibility of exporting products. Abandoning the food crop concept was based on: (1) the high rate of subsidy provided by the VRA and, (2) the concentration on food crops, mainly vegetables whose preservation, storage and marketing proved uneconomical to operate. These involved risks and losses were unacceptable to the Volta River Authority management. In justifying the reorientation, management referred to the economic criteria in the authority statutes "to conduct its affairs on sound commercial lines. . . as to ensure that taking one year with another, its revenues are greater than its outgoing properly chargeable to revenue account" (Futa, 1986).

The Kpong Farms presently operates as a commercial enterprise depending

solely on its revenue. The production and profitability of rice suited this commercial goal best, and by cultivating primarily irrigated rice the Farm has started to show a profit margin. The Farm depends on modern intensive techniques with a high level of expensive, imported inputs which are not characteristic of agriculture in Ghana. Because of this commercial and mechanized type of operation the demonstration aspect of such a model is limited under present conditions. It does demonstrate the marketability and profit for growing rice when produced under the right organization, inputs and proper management.

Small farmers in the Kpong area and some residing in resettlement villages are actively discovering the cash rewards for cultivating small plots of paddy rice. These farmers are exposed to the experience of the Kpong Farms and a significant number has worked with irrigated rice cultivation at the nearby University Agricultural Research Station. Applying their own techniques, local farmers are diverting headpond water into small paddy areas around the immediate Kpong Dam shoreline. Relying on the natural rise and fall of the lake to irrigate, little equipment is required for such small plots. The potential for small-scale rice farming is being demonstrated and so far diffusion of such activity is largely spontaneous and uncoordinated by any direct government agency.

Agricultural Development in the Drawdown Area of the Volta Lake

A second area of agricultural initiatives as a consequence of changes produced by the Volta project is very different than the motivation and large-scale commercial methods applied to the Kpong Farms experiment. The land area immediately covered by the Volta Lake (845,000 ha) was used to produce locally consumed crops such as maize, cassava, water yams, yams, groundnuts, cowpeas,

tomatoes, hot peppers, and many other less important crops which were lost as a farming resource to an estimated 94 percent of the former farming population who lived there. A new rainfed agricultural system for resettlement areas was planned and implemented away from the lake shore. Rainfed agriculture has proven to be more difficult than expected, and adversely affected by dry weather conditions, during the 1970's and first five years of the 1980's.

The percentage of the resettled population engaged in crop production has declined partly as a result of the difficult conditions of the settlers and limitations due to the isolation of resettlement villages; also crop yields have been lower than before inundation. Agricultural production connected with resettlement was out of necessity oriented to local consumption. It is dependent entirely on rainfall during the major (April/August) and minor (September/November) growing seasons and on residual moisture which becomes available in the drawdown area as lake water recedes between November and June each year.

The advantage of utilizing residual moisture for farming can only be realized in the lakeshore drawdown area. During the months of November and July - the dry season - the Volta Lake recedes and exposes an estimated land area, termed the drawdown, of over 300,000 acres. The drawdown area has a very high potential for crop production and is immediately accessible in most cases to small farmers from the resettlement villages situated along the lakeshore as well as for use by host and migrant farmers in the same lakeshore region. It is capable through residual moisture of sustaining crops between 40 to 60 days depending on the type of soils and slope of the land. Longer maturing crops can also be grown by applying a supplementary system of irrigated water during the later stage of the natural residual moisture utilization.

The importance of drawdown agriculture was especially apparent during the

drought impact which affected the country and greatly increased the amount of land normally exposed as the actual water level fell much below normal variations. In the course of the drought, the drawdown area could sustain the growth of food crops like maize, rice, cassava, sweet potatoes and vegetables. The driest portions of the upper basin could benefit significantly since over 200,000 acres of the drawdown agricultural zone is located in the northern region of the lake basin. The remaining 100,000 acres is distributed in the southern region and Afram arm of the lake basin. Because of its unique potential and importance to agriculture, especially to improve farming for resettlers, the Volta Lake Research and Development Project initiated a drawdown research program.

The research emphasized a survey of the lake basin to identify the areas of highest agricultural potential. In selected areas, crop production trials were carried out on experimental farms, and indicated that tomatoes, pepper, garden eggs, sorghum, okra, and rice were the crops most suitable for local farm utilization of the drawdown area. A pilot project was targeted for one village, Ampaem, to introduce simple techniques of utilizing residual moisture to produce food crops and vegetables in the dry season. The Ampaem project also demonstrated that supplementary irrigation was needed in combination with the drawdown natural moisture retention. Applying simple irrigation methods in the drawdown area, tomato cultivation has provided the best results and profit. By 1982, over 2,000 small farmers in Ampaem and surrounding villages in the basin's south Afram region were cultivating tomatoes in the drawdown during the dry season as their only source of income. Farmer's average annual income increased from ₵ (Ghana) 2,500 to ₵ (Ghana) 27,500 for 1982.

The potential and successes achieved by farmers in the lake drawdown area seem to highlight some of the frustration and inability of the single-purpose

framework to sustain ancillary projects. After 1982, the Volta Lake Research program for drawdown agriculture gradually terminated as external funding (UNDP & FAO) ended. The research effort had established the viability of utilizing the drawdown in one pilot village project, however, there was no adequate Ministry of Agriculture structure to continue assisting the project nor extend the results effectively to other resettlement and host villages along the lake shore region. The Irrigation Development Authority is presently supporting a small scheme near the Kpandu-Torkor fishing market. It appears however, that extension of the advantages and understanding of the practices of drawdown agriculture will largely be the result of local and village directed initiatives. The original pilot project at Ampaem has been successful in attracting support from a private voluntary organization, Catholic Relief Services (CRS) in Ghana. CRS has funded the Ampaem agricultural cooperative to support the acquisition and maintenance of irrigation equipment in order to continue village cultivation of tomatoes in the drawdown.

Drawdown agriculture could benefit most of the farmers in the lakeshore region. It does require some level of initial assistance from government or private extensionists. Supplementary irrigation will also require that farmers have the access and skills to apply even simple irrigated techniques. Although the Volta Lake Research unit was instrumental in establishing the initial viability of the drawdown area, its continued development will require the assistance and coordination of institutions like the Irrigation Development Authority or Catholic Relief Services.

OTHER INSTITUTIONS

Introduction

The role of institutions or special interest groups beyond those directly related to some aspect of the VRA's administration is difficult to assess since the formal Volta River development and project planning process did not recognize a need to establish new agencies or coordinating bodies linking local or regional organizations with national programs. Private or parastatal organizations such as producers' cooperatives or marketing boards have also not figured importantly in implementing national plans dealing primarily with the energy sector. The need for any continuous coordinating functions was also limited. Once initial plans involving sectors such as fishing or problem areas like resettlement villages reached a stage where basic physical infrastructures were in place, the possibility or need for interagency coordination was not formally promoted. Rather the policy of handing over, as previously discussed, discouraged establishing a permanent coordinating framework among the different agencies and interests involved.

Continuity of non-power activities was tied directly to the capability and budgets of existing line departments. This created little or no incentive to propose new projects or respond energetically to unanticipated problems per changes involving the population in the Volta Lake region. To a large extent, the growth and direction of local initiatives was dependent on how local authorities perceived new opportunities and were able to financially support them and how capable they were to sustain long-run management of local projects. In this respect, Ghana is no different than most other African nations where the management and financial resources of local institutions is already overextended. This includes local field offices of national government ministries which are not in a position to absorb new responsibilities and

costs. Therefore, the actual success of handing over functions and integrating them into the existing government structure was not only an issue of the VRA's apparent rigid management style and narrow set of hydropower goals, rather the possibility of sustaining local initiatives was dependent on other institutions.

Although non-power problems were identified in the earliest Volta River plans, the need to build up other institutions and insure that they could effectively manage or contribute their share to non-power projects was not provided for in the same official planning process. The experience of institutional arrangements like the Volta Lake Research and Development Project seems to offer an unfulfilled promise for evolving into a permanent interagency framework through which multidisciplinary research could be coordinated and applied to local project planning. This is a complex issue, and some of the reasons involving the research focus and the lack of international funding for continuous support have been touched on in an early section of this report. However, it is important to point out that such a project-oriented Volta Lake Research & Development institution was not articulated in the Volta's national planning exercise or agreements with international donors. And, like other sectoral units of the government, those participating institutions in the VLR&DP were treated under the general strategy of the handing over policy. That is, the Government of Ghana was intended to redistribute the functions of the project within the various departments involved. These functions and, in some cases, programs, then had to compete with all programming and funding for the entire country (Mensah, personal interview, 1986).

Instead of acting as a transition process for transferring non-power efforts at developing the basin to a more decentralized level of local and regional authorities, the future of handing over functions in Ghana is clouded

and lacks general support. The VRA's commitment to the process is waning, primarily because the central government has not responded in a timely and adequate fashion to maintain even existing projects. In order for such a handing over process to work, the government of Ghana would have to become more directly involved in the future of non-power development efforts related to such examples as: fishing, marketing, transportation systems, and agricultural development. Perhaps a first step would require the formation of some form of interministerial Volta Basin Committee including, but not overshadowed by, a powerful parastatal like the VRA. Such a forum would ideally have the power to draw on the multi-sectoral expertise of the various ministries and constitute a decision-making process that pulled together individual interests to focus on the region as a whole. This would include a coordinating function and the ability to monitor plan-making and projects targeted for the Volta Basin.

This type of interministerial framework representing the highest levels of government should attract the interest and support of international donors, and channel aid or loans to the relevant executing branch of government. An interministerial commission or committee only points out the further need for intermediary institutions, both governmental and non-governmental, which would effectively link the interests and initiatives of local groups with the resources and expertise of national programs. This intermediary role does not appear to be appropriate for the Volta River Authority. The tendency of the VRA is to expand their power production management and service role to include energy consumer markets outside the country, further drawing their official attention and resources away from local, non-power issues.

Other institutions seem more likely candidates to energize efforts to reach the local level and perform a coordinating function in terms of allocating and handing over responsibilities to individual groups or specialized

agencies. Some of these institutions are identified here only briefly.

Regional Government

Ghana is divided administratively into nine regions, each containing a regional capitol or urban center where a regional governor and office presides. Using the Volta Region as an example, this regional system intends to be a structure that would decentralize national government. One of the most important steps in this direction would be a change in the present system where regional governments would be more directly responsible for developing a regional budget and allocating funds in relation to a regional development planning function. If such a budgeting/planning system was implemented, a regional government administration with linkages to decreasing scales of government at zonal and smaller district levels could logically act as a clearinghouse for multiple-purpose programs and projects targeted for the Volta Basin. Such a regionalized budgeting and programming system is not currently practiced, making the role of such regional governments more speculative rather than in real terms. It should also be noted that administrative regions are presently delineated without considering the natural continuity of watersheds such as river basins. The Volta River Basin itself contains no less than five administrative regions. The Volta Region which is recognized for purposes of the Government of Ghana corresponds to the eastern portion of the Basin or that area located between the Volta Lake and the frontier with Togo and includes less than one-third of the total area of the Volta River Basin within Ghana.

Volta Region Agricultural Development Project - VORADEP

Another important regional entity is also headquartered in Ho, the Volta Region administrative center and is largely the result of a five-year agricul-

tural recovery program for the region which is funded by the World Bank. According to the expatriate director of the project, VORADEP represents primarily a regionally-located center of Ghana's Ministry of Agriculture with direct access to loans and credit provided by the World Bank which also involves FAO. Each of the Ministry of Agriculture's departments: livestock, extension, marketing infrastructure, fisheries, irrigation, and rainfed agriculture, are housed under the VORADEP management and funding umbrella. A similar experiment is planned for Ghana's northern region called NORADEP.

VORADEP at the beginning of its five-year program established a region-wide agricultural development plan which underwent a review and changes by 1984. Major programs which were highlighted by the VORADEP director include:

1. an emphasis on rainfed agriculture over irrigation projects which was more important in the beginning;
2. introduction of new crop varieties involving cereals and legumes;
3. construction of shallow wells in villages instead of a few deep wells envisioned in the first plan; and
4. rehabilitation of roads rather than construction of new roadways.

More than one-half of the VRA resettlement villages and most of the Volta Lake's eastern shoreline are located in the jurisdictional area of VORADEP. However, the agency has not singled out resettlement, Volta lakeside farming and marketing, and lake fishing as a distinctive set of problems and needs. The history of large-scale dam projects and creation of the Volta Lake impacting on the region does not appear to have influenced VORADEP planning. For example, the basic research and pilot projects for developing drawdown agriculture established in earlier efforts by the VLR&DP do not seem to influence project design or priorities for VORADEP's agriculture programs. The lakeside micro-region and its people are not considered separately for development

purposes any more so than the larger administrative region and population of which they are a part.

One exception to the pattern of general neglect that the Volta Lake receives from VORADEP is a result of recent growth of fishing and marketing along the lakeside. VORADEP is presently funding the construction of road serving a new fishing and market at Danyasi similar to the volume of activity characteristic of the Kpandu-Torkor market to the north. Interest in pursuing some of the development responsibility for fisheries is also due to VORADEP staffing since the head and members of the VORADEP fishing program are former key participants in VLR&DP projects involving the Kpandu-Torkor project. As a consequence, the World Bank through VORADEP is supporting a road project linking a new lakeside fish market area at Danyasi to the established highway network and larger market centers in the Volta Region and Accra. This coincidental staffing element does not carry over for other VORADEP departments.

Non-Governmental Organizations

The VRA or the Volta Lake Research & Development Project did not establish any official links with the numerous NGO's that have programs in Ghana. Three non-governmental organizations were identified during the field survey for this report which perhaps represent similar efforts by private groups being carried out in the Volta Basin. All of these work with projects related to fishing and agriculture. The projects are especially relevant to local initiatives because they deal directly with local groups, specifically village farm or fishing cooperatives. In two cases, contact to gain access to NGO support was initiated within village farm production or fishing cooperatives themselves through religious organizations located in or serving that area of the Volta Basin. These institutions then communicated specific needs or proposals to the

national NGO office. A third project to assist the agricultural cooperative at Asustuare in the lower Volta region below the Akosombo Dam was instigated through contact between the Ministry of Agriculture's Irrigation Development Authority and the NGO Technoserve.

Projects involving Ampaem village drawdown agriculture supported by Catholic Relief Services (CRS) and the Lutheran Synod's support of the Volta Lake Mobile fishing school continues efforts initiated through the VRA and the VLR&DP. And, in both cases, former VLR&DP staffers - the Ampaem Farm Cooperative manager and two fishing school extentionists were able to continue in their positions because of NGO support. The Lutheran project involves funding for vehicles and salaries enabling two extentionists - one a fishing gear specialist, another to aid in marketing and the smoking technique - to periodically assist village cooperatives situated around the eastern side of the Volta Lake.

The CRS-assisted project at Ampaem, a resettlement village on the Afram arm of the Volta Lake continues a pilot irrigation project originated through VRA support in 1978. The project involves 50 to 200 acres in Ampaem's drawdown zone which relies on a sprinkler irrigation system and a CRS truck to produce and deliver tomatoes for the cash market. In terms of yields and profits, the project has been successful and membership in the cooperative has increased accordingly from the original groups of 90 to approximately 200 farmers. Just as important, the success of Ampaem is sparking considerable interests in similar schemes in other resettlement villages. CRS, however, is not placing high priority on such initiatives within their own programming. Therefore, it is unlikely that the NGO would actively take on new projects including additional resettlement villages.

All of these examples of NGO involvement with village producer coopera-

tives rely first on the existence of a well-established, locally-operated organization and, secondly, on the presence of equally established intermediary organs such as the Lutheran and Catholic Churches which are receptive to locally initiated projects and are in a position to respond even on a limited material basis to proposals for resources needed to maintain such projects. It should be recognized that such a linkage is not easily replicated to similar village settings even in the same area of the Volta Basin since the management support from NGO's is limited in scope and they are not intended to develop the region.

Resettlement Village Associations

There has been a long tradition of diverse forms of community and political action on the part of resettled, host, and migrant communities affected by dam construction and loss or changes in title of land affected by the Volta Lake and Kpong reservoirs. Depending on the point of view, this type of community action could be regarded as a legitimate right of advocacy in defense of fundamental social obligations concerning people and land. In the case of the VRA management (see Adu-Aryee 1985: 151-80.), which dealt directly with such expressions of local interests, such protests seemed to merge into an official attitude that settler and host communities tended to develop a dependent and complaining attitude towards government action related to resettlement. Historically, housing and farming land issues from the government's viewpoint seem to build up an experience which Adu-Aryee (1985, 152) calls the dependence syndrome. One interpretation representative of this dependency is illustrated by a passage relating loss of crops by the Fodzoku community resettled under the Kpong Dam resettlement scheme in 1980:

During the construction of the east dyke as part of the main hydroelectric project, some farms belonging to this community were

over-run. This was at a time that the agricultural resettlement programme had not started. An emergency farming programme was therefore mounted to provide, at least temporarily, a means whereby the people of Fodzoku could continue with their farming activities, to offset the possibility of food aid, short of which, there could have been famine as a result of loss of production. The Agricultural Development Company was persuaded to release seventy hectares of prepared land ready for cropping production for the use of the farmers of the Fodzoku community whose farms had been affected. The land which was released shared a common boundary with land the Agricultural Development Company had prepared for planting maize that season. With the assistance of the planning group given in the form of technical advice equipment, the land was seeded with maize.

After the seeds had germinated, as is normal with any farming activity, it became necessary to replant those seeds that had failed to germinate. Accordingly, the Fodzoku farmers were called upon to provide labour for the replanting. But this they refused to do adding that the Volta River Authority should hire a planter from the Agricultural Development Company to do the replanting. This request was naturally turned down. This action was so resented by the Fodzoku farmers that they refused to maintain the farm which eventually had to be taken over and maintained by the resettlement planning group. When the crop was ready for harvest, however, the Fodzoku people came forward to claim the harvest.

There are numerous cases of similar episodes of conflict and expressions of protest often documented in formal letters or petitions addressed from local chiefdoms to the VRA Chief Executive or even the Prime Minister of Ghana. Such community action continues today, more than twenty years after the first resettlement projects. Recently, the low level of the Lake waters, creating a much larger section of the lakeshore suitable for drawdown agriculture to be exposed, has been a point for contention among both resettled and communities located near the Volta Lake.

A letter in May 1986 requesting a meeting with the VRA Chief Executive to resolve an issue over access to the drawdown area is one instrument applied by a group called the Akosombo Resettlement Townships Association which testifies to this type of community action. The letter refers to action taken by host community farmers which under threat of violence are not allowing resettlers access to drawdown farm lands, claiming they never received compensation for lands which are now exposed due to the receding water level.

Spontaneous Development Initiated by the Local Population

Most of the current development activity which takes advantage of new resources such as a large body of stored water for irrigation or stock of fish are the result of spontaneous action by the people themselves with little assistance from formal government programs. This type of local production, combining subsistence and cash generating enterprises, is more characteristic where resettlement communities are integrated with the surrounding settlement pattern and commercial network. The Kpong headpond area appears most representative of this development potential and is located in that portion of the Volta Basin or micro-region along the shore of the Volta Lake and immediately along the Volta River downstream. It is here that population is historically the densest and commercial network intense occupying the southern fringe of the Volta Basin. The resettlement population together with host and migrating populations are more actively involved in new opportunities for economic endeavor, as in fishing and irrigated farming, created by large-scale changes and projects which have transformed the Basin. More so than the other resettlement zones of the Basin, the Kpong area and population have outgrown many of the basic problems and conflicts of resettling and moved on to take advantage of new economic opportunity.

Although the reasons for the growth of local initiatives characteristic in the immediate Kpong headpond are many -- and it is not accurate to attribute such locally-directed development to one kind of factor or influence -- some key elements which appear to contribute to the success of local farming and fishing production can be briefly described.

First, the Kpong dam resettlement program completed in 1984 was much more effective in resolving basic housing, site and services problems than the

earlier Akosombo experience. The program was smaller in scale (six communities), adequately funded through donor support, and more amenable to managing the range of diverse services and physical infrastructure that had to be coordinated and put in place before occupation by the resettled population. Earlier mistakes of Akosombo were corrected by designing housing and the township layout with more flexibility and providing for the needs of expanding settler households. All the sites were situated in order to facilitate continued and new access patterns to nearby roadways, transportation, existing towns and markets. Resettlers have access to land for farming and fishing the headpond which permits alternative production systems to serve the same general population. Because of proximity to established market areas, farmers and fishermen can take advantage of marketing outlets to produce cash products in addition to meeting the needs of the family food supply. All of this is in contrast to Akosombo resettlement towns which although older, remain relatively isolated, far from markets, continue to be served by poor transportation, and because they are removed some distance from the Volta Lake, it is more costly to develop irrigation for agriculture.

The Kpong area also benefitted from quickly becoming reintegrated with the population, towns, services and commercial networks existing before the dam and reservoir were created. There are also some important government agricultural projects functioning in the same region, which appear to have had some demonstration effect on the surrounding farmer population. An agricultural research station managed by the University of Ghana occupies 930 acres immediately adjacent to the Kpong headpond. The station operates pumps for irrigated farming and is primarily experimenting with irrigated rice cultivation. The influence of experimenting with rice production has indirectly affected local farmers employed by the station, who are applying their experience by growing

paddy rice on small, individual plots, some of which are within easy access to resettlement village sites. Relying on the daily rise and fall of the headpond water, farmers using few inputs, divert water for plots around the immediate shoreline, producing rice for the local cash market. The same farming group is active in fishing for local consumption and marketing in the Kpong. Farmers have also witnessed or worked on the Acres Commercial Farm venture which is located next to the University's research station. Both of these institutions, although not officially involved with outreach or extensionist programs, have indirectly stimulated interest among local small farmers to produce irrigated rice. The Acres manager and University research staff estimate that in the last two to three years, hundreds of local farmers have initiated similar rice growing efforts.

The potential benefits from small-scale rice farming and lake fishing have been demonstrated. These examples of local river basin development are a spontaneous form of individual economic initiative and local organization, and have materialized without the direct support of the Volta River Authority.

SUMMARY AND CONCLUSIONS

The formal decision-making process for developing the Volta River, the execution of plans and projects through the administration of the Volta River Authority, fueled by international aid and investment have concentrated on the single purpose of producing hydro-electricity. Many of the local-area efforts to take advantage of new conditions created by damming the Volta River are more spontaneous in nature, the result of individual decisions by farmers and fishermen to exploit resources made available by natural changes and accessible through planned resettlement or voluntary migration to the Volta Lake region. It is not difficult to imagine that establishing a similar narrow aim for river basin development in Africa would produce many of the same results or indirect effects characteristic of the Volta development experience in Ghana. The key official interests, financial support, and institutional planning and management system are the most efficient when pursuing the single-purpose.

In the case of Ghana, the need to improve on and expand the nation's position relative to servicing and profiting from block consumer markets for hydroelectricity has set the boundaries for managing the basin's huge water resource. Under such a strategy, the criteria of economic maximization prevail over considerations to rechannel basin development towards less profitable solutions of socio-economic problems at the local scale. Often ancillary projects beyond the immediate objective of pursuing hydropower production did not offer a secure economic return. When the Volta River Authority assumes such an economically risky project or program on a temporary basis, it accepted the condition by utilizing guidelines of economic efficiency. This seems part of a policy characteristic of single-purpose river authorities to treat ancil-

lary activities as temporary obstacles or necessary diversions, anticipating these will be "handed over" to the appropriate government agency. The policy of handing over secondary benefits such as fishing and drawdown agriculture has been inadequate under present conditions in Ghana. The existing line ministries or departments are too weak institutionally and financially to effectively take over complex projects or programs aiming to exploit new resource conditions in the Lakeside region. Much of the scientific research effort supported internationally as part of the Volta hydropower project for over a decade, has generated much useful information, however, the vacuum created at the research project's end has not been filled by a new institutional arrangement to continue the work and apply the results. Because of this, possibilities to develop local, regional or alternative means of development not directly connected to hydropower go unexplored. In addition, without an effective multi-disciplinary research program in operation, new and potentially adverse changes, can remain undetected and little understood.

To consider whether Ghana's Volta River hydroelectricity potential would be practicable to develop within an institutional framework where the Volta River Authority is absent is difficult to assess. The Authority's rigid single-purpose management style has weathered many difficult political events and natural constraints. Today, the private management techniques have strengthened its position as Africa's most effective electric-power utility organization. The management of Ghana's hydropower resources by the Volta River authority is perceived to be an important and essential component in the country's economic recovery program. It should be expected that a difficult and limited economic position for the nation as a whole strengthens policies to expand the single-aim of power production. A change in the prevailing interests and control over river basin institutions and funding for projects in

Ghana will most likely not take place internally. Local initiatives to develop alternative, non-power projects without assistance from outside the country should continue to be neglected or go underutilized.

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APPENDIX I

Tables on the Institutional Analysis of the
Volta River Project

TABLE 1: VOLTA RIVER BASIN
 KEY INSTITUTIONS DURING PRE-INDEPENDENCE OR COLONIAL PHASE: 1940-1956
 INCLUDING INITIAL START-UP OR PLANNING PHASE: 1956-1960

PHASE	OFFICIAL PLANS	INSTITUTIONS	UNPLANNED EVENTS	SIGNIFICANT DONORS	GOALS
Colonial Phase (Pre-Independence) 1940-1956	The White Paper (1952)	• British Colonial Government			<ul style="list-style-type: none"> • provide energy and means to exploit bauxite • attract investors
	The Preparatory Commission Report (1953)	Convention People's Party (CPP) led by Kwame Nkrumah The Preparatory Commission appointed by Colonial Gov't			<ul style="list-style-type: none"> • development of Volta River • hand over power but maintain advantages through trade agreements • lead Ghana's independence • achieve economic development through industrialization - which highlights Volta power scheme • investigate the technical economic and human aspect of project • make specific proposals
Planning Phase (Independence) 1956-1960	Kaiser Reassessment Report (1959)	Kaiser Aluminum and Engineering Corporation	Reduction in total costs	U.S. UK	<ul style="list-style-type: none"> • modify plans of Preparatory Commission Report to reduce costs
		Int'l Bank for Reconstruction and Development (IBRD)			<ul style="list-style-type: none"> • appraise project of financial, economic and technical soundness • draw up a financial plan
		Volta Aluminum Co. Ltd of Ghana (VALCO)	Withdrawal of Baco, Alcan, Alcoa, and Olin Mathieson; involvement of U.S.	U.S. export-import bank U.K.	<ul style="list-style-type: none"> • operate the smelter and aluminum processing part of project • increase production over time
		Government of Ghana	Falls on development of vertical aluminum industry more dependence on VALCO	World Bank	<ul style="list-style-type: none"> • spur industrialization through Volta River Development • reduce dependence on cocoa revenues and on U.K. • transfer control to Ghanaians • create appropriate national river authority

FUNCTIONS	CRITERIA FOR SUCCESS	OUTCOME OR OUTPUT	RESPONSE TO OUTCOME
<ul style="list-style-type: none"> est. a sound business venture out of idea of dam construction 	<ul style="list-style-type: none"> amount of financial backing acquired demonstrate technical feasibility and economic viability for Akosombo dam 	<ul style="list-style-type: none"> Alcan of Canada and Baco of Great Britain show interest colonial gov't becomes actively involved sets pattern of transnational capital involvement 	<ul style="list-style-type: none"> stirs interest in colonial government to survey dam sites by Wm. Halcrow and Partners and produce White Paper ALCAN acquires controlling interests
<ul style="list-style-type: none"> create administrative process envisioning independent Ghana 	<ul style="list-style-type: none"> Hydropower production and aluminum production representation of Britain's economic interests 	<ul style="list-style-type: none"> survey propose; plans Nkrumah concurs with Plan 	<ul style="list-style-type: none"> accepts responsibility to develop project formation of Preparatory Commission further negotiations
<ul style="list-style-type: none"> represent national interest in the negotiation process and promote Volta scheme for independent Ghana 	<ul style="list-style-type: none"> social and economic development of Ghana and greater inter-regional econ. cooperation long-term economic benefits to Ghana 	<ul style="list-style-type: none"> pursue negotiation process for dam construction 	<ul style="list-style-type: none"> Preparatory Commission Report
<ul style="list-style-type: none"> devise a plan based on White Paper begin to treat non-power aspects-health, resettlement, etc. create appropriate river authority model 	<ul style="list-style-type: none"> show political, social, and economic viability of scale of operations proposed 	<ul style="list-style-type: none"> approval of report by Legislative Assembly reassessment of report by Kaiser Aluminum Corporation 	<ul style="list-style-type: none"> Great Britain withdraws; assistance sought in U.S. (see Kaiser) creation of Volta River Authority model of legislation (see Table 2)
<ul style="list-style-type: none"> act as engineering consultants and business partners 	<ul style="list-style-type: none"> economic viability and technical feasibility of project indicate financial soundness and sufficient econ. returns 	<ul style="list-style-type: none"> more narrow scope - single purpose focus Electric utility manag. style plan attractive and acceptable to international donors and engineering firms 	<ul style="list-style-type: none"> World Bank and other make commitments; Kaisers and Impreglio sign contracts
<ul style="list-style-type: none"> offer financial advice indicate financial soundness to rest of lenders, donors 	<ul style="list-style-type: none"> acceptability of terms by all parties concerned 	<ul style="list-style-type: none"> financial agreement finalized 	<ul style="list-style-type: none"> move to construction of dam
<ul style="list-style-type: none"> take charge of smelter operations 	<ul style="list-style-type: none"> ability to expand production and generate income to Ghana in order to meet repayment schedule on loans negotiated favorable power tariff rate 	<ul style="list-style-type: none"> produce aluminum on competitive basis for world market 	
<ul style="list-style-type: none"> mediate in negotiations on Volta River Project draw outside support 	<ul style="list-style-type: none"> economic independence extension of electrification 	<ul style="list-style-type: none"> successful contracts of international technology for hydro-power dams initiates construction of one of Africa's first large-scale hydro-power projects 	<ul style="list-style-type: none"> must maintain and create new bulk electricity consumer markets to retain econ. solvency of project

TABLE 2: THE DOMINANT INSTITUTIONAL MODEL FOR THE VOLTA RIVER AND LAKE BASIN -
THE VOLTA RIVER AUTHORITY: 1961-1986

PHASE	OFFICIAL PLANS	INSTITUTIONS	UNPLANNED EVENTS	SIGNIFICANT DONORS	GOALS
Institutionalization of Volta River Project 1961-1985	Kaiser Reassessment Report, Volta River Development Act (46) - 1960 No recent major basin-wide plans, master plan, etc.	Volta River Authority (V.R.A.) To some extent the power goals and functions are shared by the Electricity Corporation of Ghana-ECG Both are part of the Ministry of Fuel and Power	Downfall of Nkrumah (1966) does not alter VRA as institution 1981-1983 Drought	IBRD-World Bank US AID Export-Import Bank-U.S. U.K. Kpong Project: Saudi Arabia Kuwait Arab Bank for Development in Africa (BADEA) Canadian International Dev. Agency CIDA - also funds Acres International European Dev. Fund European Investment Bank World Bank African Dev. Bank (ADB)	<ul style="list-style-type: none"> spur Ghana's econ. and industrial development by supplying power reduce dependence on imports for energy to plan, execute and manage the development of the Volta River to divest responsibility for non-power activities to line ministries, departments and existing institutions
				Canada CIDA (ACRES management consultants)	<ul style="list-style-type: none"> establish commercial farm enterprise for irrigation Kpong Farms Ltd.
				World Bank	

FUNCTIONS AND SECONDARY OBJECTIVES	CRITERIA FOR SUCCESS	OUTCOME OR OUTPUT	RESPONSE TO OUTCOME
<ul style="list-style-type: none"> • generate electricity for general and industrial consumption, esp. for smelter operation • operate a transmission system • regulate and control water flow and license withdrawals for domestic water supplies and irrigation 	<ul style="list-style-type: none"> • establish cost effective planning/management system • to operate Volta Power Production-transfer cost efficient to non-power activities whenever possible or appropriate • ability to repay loans and derive profit from sale of electricity • foreign exchange from export electricity • mitigate potential adverse affects on people and health 	<ul style="list-style-type: none"> • construct and operate hydro-power dams • increased consumption of electricity by bulk consumers; increased revenues significant drop after 1981 because of rainfall shortage picks up after 1985 • plans and design for 3rd dam at BUI-no donors 	<ul style="list-style-type: none"> • continued support from donors for expanding grid • much less gain in rural electrification • VRA assumes ECG responsibility by expanding transmission system to North Ghana; World Bank implements a power system rehabilitation project in 1985
<ul style="list-style-type: none"> • provide landing facilities and assistance for developing fishing potential • development of water transportation on lake and operation of vessels on the lake • provide health and safety services along lakeside and in townships • carry out and supervise two resettlement schemes- Akosombo and Kpong • engage in research and assist institutions affiliated with research in order to monitor socio, physical, biological and econ. change 	<ul style="list-style-type: none"> • increase fish production • establish economic viability for Lake Transportation scheme • stem spread of diseases associated with lake creation • relocation of displaced population • promote new livelihood systems 	<ul style="list-style-type: none"> • constructed the Kpandu-Torkor marketing complex; promoted better fish processing methods; installed new smoking sheds; provided new fishing gear and boats • small-scale pilot project • collaboration of VLR and DP with UNDP and WHO on a disease control program • Akosombo resettlement scheme-largely unsuccessful; Kpong Scheme - construction of villages part of project • creation of VLR and DP with temporary duration • establish pilot projects in drawdown agriculture 	<ul style="list-style-type: none"> • transfer of Kpandu-Torkor management of operations to Fisheries Department • creation of Volta Lake Transport Company • continuation of health programs necessary • Need to monitor - due to Schisto Problem • other institutions not well-equipped to carry over responsibilities, GOG does not assume active coordin. • difficulty in handing over functions, in some cases pilot projects abandoned or picked up by NGO's
<ul style="list-style-type: none"> • establish commercial farm enterprise for irrigation Kpong Farms Ltd. 	<ul style="list-style-type: none"> • financial feasibility • does it make profit without subsidy 	<ul style="list-style-type: none"> • cost effective only for exporting rice • good management (expat.) & expensive inputs results in profit. • some subsidy thru import concessions 	<ul style="list-style-type: none"> • can modern intensive methods & high tech management be replicated. <u>No</u> under present conditions
<ul style="list-style-type: none"> • implied potential to expand power system to serve West Africa: Togo, Benin, Burkina Faso, Ivory Coast, Nigeria 	<ul style="list-style-type: none"> • agreements and funding to expand system outside of Ghana 	<ul style="list-style-type: none"> • 1972 - Service to Togo and Benin • 1984 - Interconnection with Ivory Coast 	<ul style="list-style-type: none"> • 1985 - consider direct inter-connection with Nigeria • 1985 - consider service north to Burkina Faso

TABLE 3: NON-POWER IMPLEMENTATION AND MANAGEMENT PHASE 1963-PRESENT
BY MAJOR INSTITUTIONS INVOLVED WITH HANDING OVER PROCESS

PHASE	OFFICIAL PLANS	INSTITUTIONS	UNPLANNED EVENTS	SIGNIFICANT DONORS	GOALS
Implementation and Management Including "Handing Over" Policy	Volta River Development (Act (46)	Volta Lake Transport Company	<ul style="list-style-type: none"> • decline in lake traffic • drop in water level 	German GIZ Netherlands Denmark KFW (West German Dev. Bank)	<ul style="list-style-type: none"> • to create a large-scale, commercial transportation system
		Irrigation Development Authority		FAO African Dev. Bank	<ul style="list-style-type: none"> • contribute to growth of Ghana's agricultural sector through irrigation
		farmers	rainfall shortage increases importance of drawdown area for agriculture	Limited NGOs	<ul style="list-style-type: none"> • to make use of residual moisture in drawdown area • produce food crops for subsistence
		Fisheries Department		Japan-grant-aid to Volta Lake fishery development program (1983)	<ul style="list-style-type: none"> • increase cash incomes • in accordance with Ghana's development policies, to expand fishing sector
		fishermen			<ul style="list-style-type: none"> • depend on fishing for a livelihood, including selling and marketing
		resettlement process Primarily the overall responsibility of VRA but shared and managed by other gov't institutions		AKOSOMBO: UN World Food Program Soviet Union KPONG: Canada (ACRES) Saudi Arabia Kuwait Badea	<ul style="list-style-type: none"> • provide residents in areas to be inundated with construction of the Akosombo and Kpong dams with housing, townsites • modernize their way of life - introducing mechanized agriculture
		Volta Lake Research and Development 9 Ghanaian Gov't and University participating units and inter. experts		UNDP WFD FAO	<ul style="list-style-type: none"> • investigate the social and ecological impacts of the dam construction and lake creation

FUNCTIONS	CRITERIA FOR SUCCESS	OUTCOME OR OUTPUT	RESPONSE TO OUTCOME
<ul style="list-style-type: none"> manage and operate lake transportation system 	<ul style="list-style-type: none"> ability to repay investment increased traffic ability to solicit international funds 	<ul style="list-style-type: none"> low level of traffic cargo and passenger service difficulty in maintaining and management reliance on donors & expatriate to finance and construct infrastructure 	<ul style="list-style-type: none"> increase donor support German Gov't. and Development Bank finance build-up of port infrastructure at Akosombo and Bupe construction of lake ferry transports should increase lake traffic
<ul style="list-style-type: none"> exploit potential for irrigated agriculture without building large schemes to benefit dry northern region, and alongside lakeshore 	<ul style="list-style-type: none"> increase yields, production of Ghana's agricultural sector, particularly in food crops 	<ul style="list-style-type: none"> support a small scheme near Kpandu-Torkor fishing market and other resettlement villages 	<ul style="list-style-type: none"> very low lg. & sm. scale irrigated production in terms of potential
<ul style="list-style-type: none"> household production and communal system 	<ul style="list-style-type: none"> maintain their livelihood and improve standard of living gain support for their initiatives est. cooperatives in some cases where possible 	<ul style="list-style-type: none"> sm. projects like Ampaen limited benefits of pilot projects do not diffuse easily 	<ul style="list-style-type: none"> supplementary irrigation needed to utilize drawdown
<ul style="list-style-type: none"> acquire responsibilities by VLR & DP & VRA developed assist Volta fishermen 	<ul style="list-style-type: none"> assistance to fishermen increase catch and marketing 	<ul style="list-style-type: none"> minimal management of existing scheme at Kpandu-Torko 	<ul style="list-style-type: none"> transition of projects to Fisheries Dept. is unstable lack of manpower, access to donors, some support from VORADEP
<ul style="list-style-type: none"> occupy lakeshore area to exploit fishing 	<ul style="list-style-type: none"> food supply economic gain 	<ul style="list-style-type: none"> migration to Volta Lake made use of own resources 	<ul style="list-style-type: none"> increases in fish stock stimulates increase in number of fishermen, catch, and marketing
<ul style="list-style-type: none"> to evacuate population to make possible the creation of Volta Lake and construction of Kpong Dam 	<ul style="list-style-type: none"> for VRA to provide land, housing townships, farming 	<ul style="list-style-type: none"> resettlement housing & towns failure in intensive mechanized rainfed agriculture stimulates some departure of the resettled pop. 	<ul style="list-style-type: none"> Akosombo-resettlement still treated as problematic enclave Kpong-resettlement loses crisis identity better integrated to surrounding region
<ul style="list-style-type: none"> monitor changes in lake ecology, public health set up demonstration farms and pilot projects to promote development of agriculture irrigation and fisheries hand over responsibilities upon termination of UN funding 	<ul style="list-style-type: none"> extension of research knowledge to implementation of effective programs 	<ul style="list-style-type: none"> creation of pilot projects, programs in fishing, and irrigation facilities at Kpandu-Torkor ending of international support seems to limit ability of Ghanaian participants to continue 	<ul style="list-style-type: none"> ability of nat. agencies also equipment to maintain monitoring is lacking GOG has not provided adequate support to continue VL&RP activities no donor support in sight

TABLE 4: OTHER INSTITUTIONS BEYOND THE VRA
5 REPRESENTATIVE GOVERNMENT AND NON-GOVERNMENT EXAMPLES

PHASE	OFFICIAL PLANS	INSTITUTIONS	UNPLANNED EVENTS	SIGNIFICANT DONORS	GOALS
Contemporary 1980's		Other institutions beyond the VRA 5 Examples			
		1.) Regional Gov't-Admin. Ex. of Volta Region			<ul style="list-style-type: none"> • unclear under Ghana's current revolutionary gov't. intended to decentralize or regionalize central gov't. and decision making
		2.) Volta Region Agricultural and Dev. Project-VORADEP		World Bank FAO African Develop. Bank	<ul style="list-style-type: none"> • energize (short term) agricultural 5yr. development in the region by direct funding • consolidate agriculture departments in one management/planning structure at regional level
		3.) NGO's example of Catholic Relief Services (CRS)		U.S. NGO	<ul style="list-style-type: none"> • traditionally more relief oriented food aid etc. • secondary interest in developing local small-scale projects
		4.) Resettlement township associations			<ul style="list-style-type: none"> • traditional outgrowth of resettlement crisis and response of community action sometimes along ethnic lines
		5.) Small scale rice farmers (largely unorganized more spontaneous in nature)			<ul style="list-style-type: none"> • take advantage of immediate cash earning opportunity • diversify production • utilize access to new water resources

FUNCTIONS	CRITERIA FOR SUCCESS	OUTCOME OR OUTPUT	RESPONSE TO OUTCOME
<p>potentially to perform coordinate regional level budget/planning process</p>	<p>perhaps at this stage the amount of responsibility this institution undertakes which is currently implemented by central gov't</p>	<p>partial consolidation of central gov't. functions into a regional office</p>	<p>appears to be more of an experiment unsure as to future Does not treat the Volta Basin separately or differently from the Volta Administrative Region</p>
<ul style="list-style-type: none"> • appropriate and manage funding for reg. agric. projects • create agric. planning framework • coordinate sectoral programs for agric. 	<ul style="list-style-type: none"> • establish efficiency in budgeting planning and implementing projects • insure completion of 'seed' projects by injecting adequate funding 	<ul style="list-style-type: none"> • development of basic projects in: crop varieties; extension road construction, water supply • experience of multi-sectoral team approach for agricultural development 	<ul style="list-style-type: none"> • whether impulse of direct funding at regional level provides base to expand on later is unclear • question of future institutionally after VORADEP funding and expatriate staff is removed • perhaps because of short term served to create dependency on external resources • no official linkage with VRA or Volta River Development and no recognition of needs and potential of developing Volta Lake micro-region
<ul style="list-style-type: none"> • respond to requests for funding small-scale projects • provide minimal technical asst. • carry out relief food aid programs 	<ul style="list-style-type: none"> • create some level of local self-sufficiency • provide experience for self-help • maintain adequate food production/supply 	<ul style="list-style-type: none"> • successful match-up of resettlement village irrigation project, right funds at right time, coupled with local management ability 	<ul style="list-style-type: none"> • the intermediary action of local parish priest was a key in reviving a VLRDP pilot project in drawdown agric. • how do you repeat the process promote coordinated efforts between VRA and NGO's?
<ul style="list-style-type: none"> • expression of traditional leadership • advocate interests of local groups, community chiefdoms • petition or request action from appropriate gov't. office • develop community image of collective action, self help 	<ul style="list-style-type: none"> • eliciting response from higher authority usually directed to VRA • resolve conflict from community viewpoint • maintain community leadership roles 	<ul style="list-style-type: none"> • mixed results to resolving conflicts • establish legitimacy and necessity from community interests through recognition of gov't agencies which now is anticipated at the beginning of planning process 	<ul style="list-style-type: none"> • such forms of community action particularly petition format is more a legacy of the past resettlement crisis • what is the role of association beyond advocacy issues?
<ul style="list-style-type: none"> • cultivate cash crop for local market • cash farming with least amount of inputs from outside household and village 	<ul style="list-style-type: none"> • rice field • marketing ability coupled with cash reward • amount available to invest in rice cultivation 	<ul style="list-style-type: none"> • increasing number of farmers practicing irrigated rice farming • significant cash rewards • still available resources for rice plots-but this will eventually run out 	<ul style="list-style-type: none"> • spontaneous diffusion effect among farmers themselves • observed by local COG institutions but no interference or support • How long will it last without formal institutional support?

APPENDIX II

The Volta River Project

by

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Retired Chief Executive

The findings and recommendations in this report engage only their author and do not not necessarily represent official positions of the United States Agency for International Development nor of the Government of the Republic of Ghana.

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The Volta River Project

Introduction

This report attempts to review some of the salient features of the Volta River Project twenty-five years after its establishment, and after twenty-one years of commercial operation, as may be of assistance to other African river basin developments.

Any river basin development project has various principal objectives: irrigation, agriculture, fishing, potable water supply, navigation or water transportation, flood control, electric-energy generation, and soil conservation. Some projects combine more than one of these, and in the case of the Volta River Project, almost all of them were combined.

The Volta River Project, as originally visualized, was the integrated development of Ghana's bauxite deposits, the refining of the ore into alumina (aluminum oxide), and the subsequent smelting of the alumina into aluminum, which requires large quantities of electrical power and energy. As it actually developed, however, the first component of this proposed integrated development was initially separated and postponed, chiefly because of limited financial resources for investment.

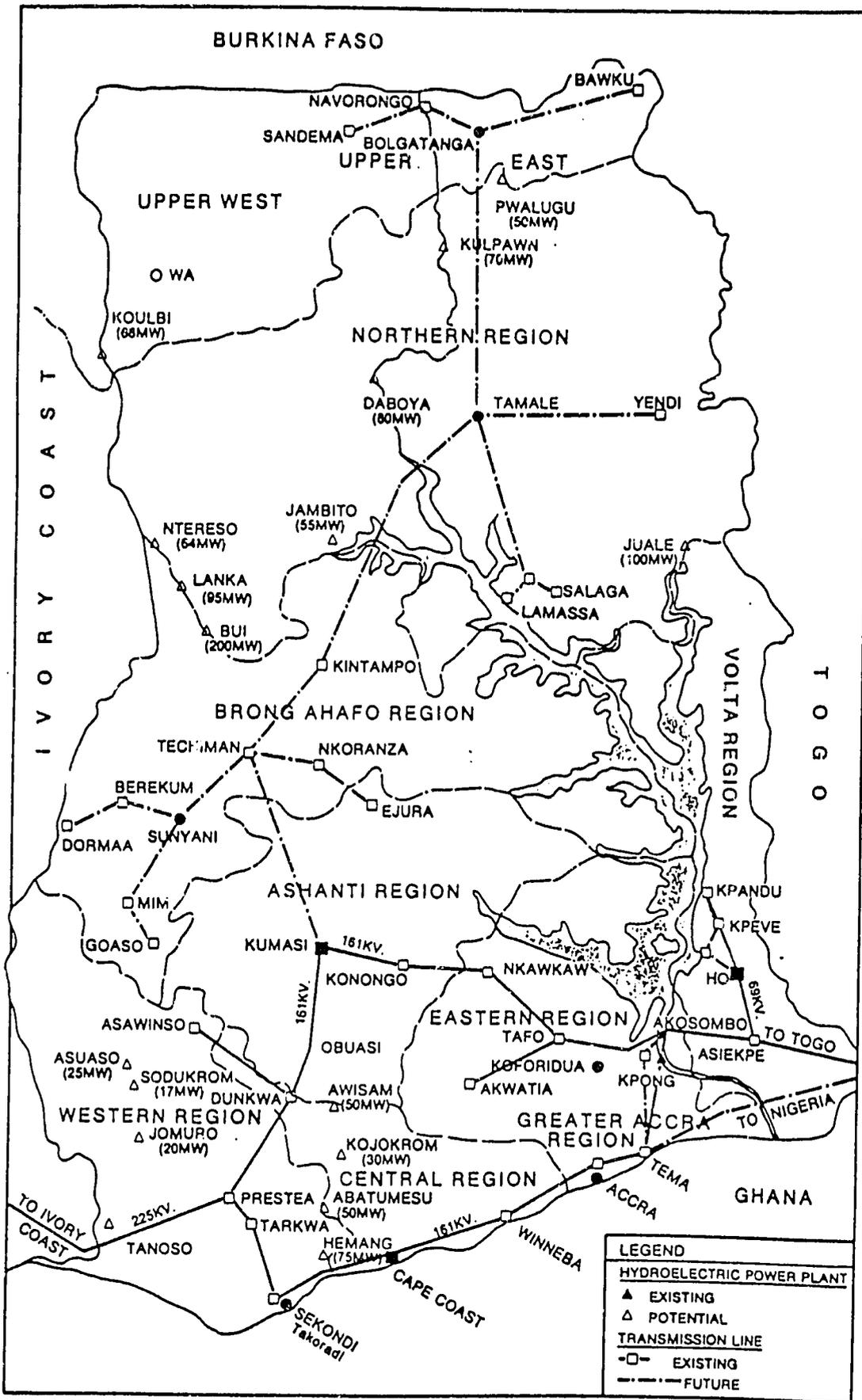
The realization of the Volta River Project was an achievement of sheer political will, determination, and direction by the first President of the Republic of Ghana, Dr. Kwame Nkrumah, and the shrewd business acumen of Mr. Edgar Kaiser, President of Kaiser Aluminium and Chemical Corporation, with the generous support of two successive Presidents of the United States of America, Dwight Eisenhower and John Kennedy, and the Prime Minister of Great Britain, Mr. Harold Macmillan. This combination and the world political and economic situation greatly helped in the success of financial negotiation to

fund the project. It began under the Gold Coast and continued under Ghana when it became independent in March 1957. Since Ghana was the first black African country to become independent, it helped appeal to international financial lending agencies that wanted to be seen doing something to help Africa!

Figure 1 is a map of Ghana, showing its geography, the Volta Lake, the location of the dam and power station, and electrical transmission lines and substations--indicating the major centers of electrical power and energy consumption. Figure 2 shows the resettlement villages. Ghana is in West Africa, and lies roughly between longitudes 1° east and 3° west, and latitudes 5° and 11° north. Most of the country is low plateau and plains. Originally the river and its tributaries were utilized mainly for fishing and intertown and intervillage transportation. In the subsequent Volta River Development Act, therefore, it is not surprising that these features are preserved and emphasized.

At the time of appraising the project, Ghana was not known to have any fossil-fuel deposits of oil, and all electricity production had been by means of imported distillate fuel. Clearly, this would be inadequate and expensive for the generation of electricity for any serious economic development and industrialization. Ghana has a large hydroelectrical potential, however, especially the Volta River. To attempt to develop it on its own would be both expensive and excessive for requirements. Nuclear energy was considered, but because of its attendant operation complications and hazards, it was adjudged not to be viable. It was apparent that large-scale use of electrical energy would be necessary for the financial success of a hydroelectrical project. At the same time, a large aluminum smelter would require the Volta River project for its operation. The two were therefore complementary and interdependent.

Figure 1



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VOLTA RIVER PROJECT
NEW SETTLEMENT TOWNS

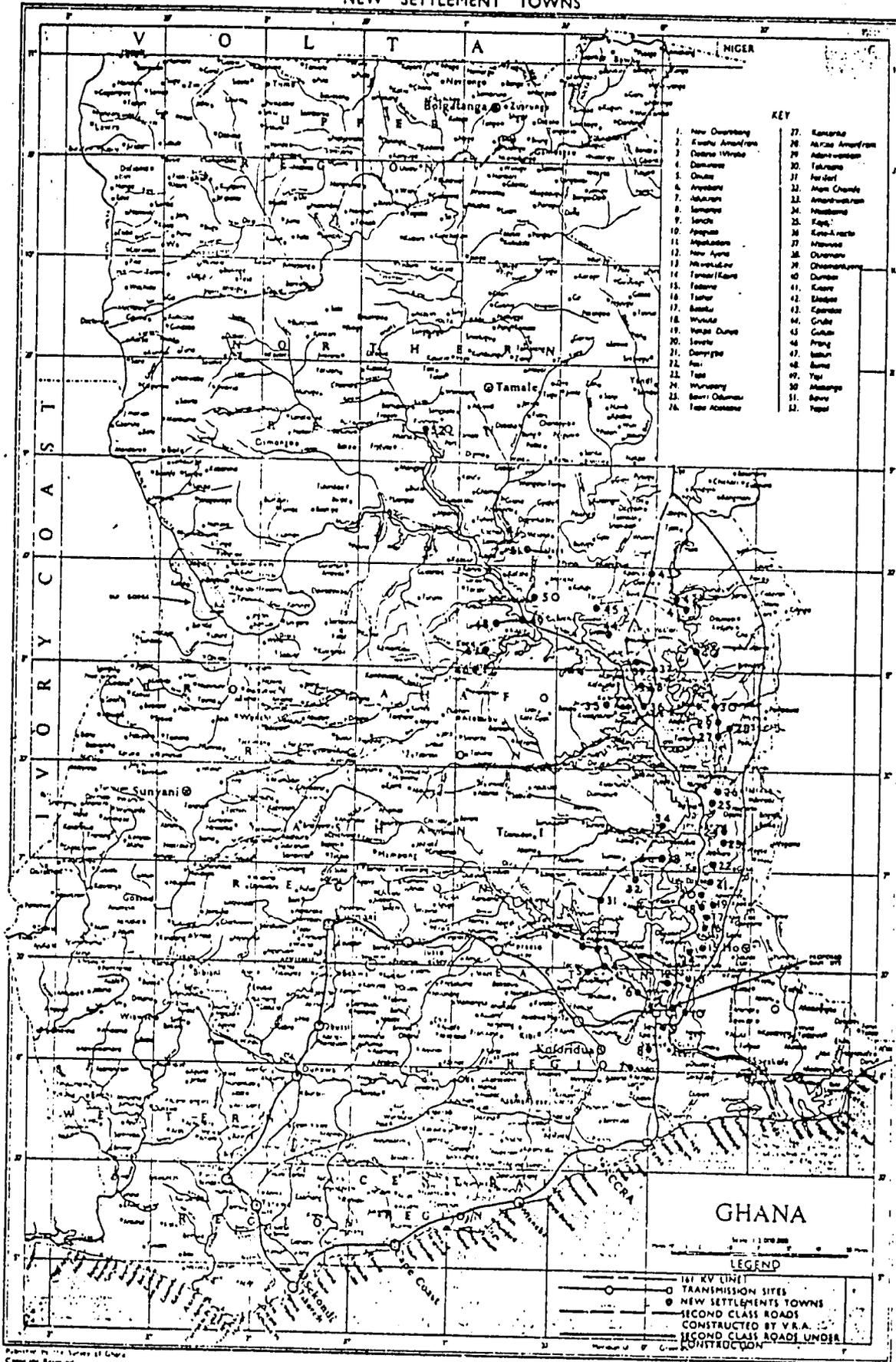


Figure 2

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Moreover, the world-market demand for aluminum in the late 1940s was increasing, further expediting the exploration of new development sources. Additionally, the British government had become increasingly anxious to locate a source in the sterling zone, and so the British Aluminium Company, West Africa Aluminium Ltd., Aluminium Company of Canada, and the British government were very willing to consider the development of the hydroelectric potential of the Volta River with the Gold Coast government. It must be remembered in this connection that the Gold Coast had (and still has) large deposits of bauxite, the primary ore that is chemically refined into alumina (aluminum oxide) before it can be reduced to aluminum--a process requiring large quantities of electrical energy. If the financial viability could be proven, it would be highly beneficial to develop the great electrical energy potential of the Volta River primarily for this purpose. In addition, there would be surplus for other industrial users such as the mines and for domestic consumers, whose annual consumption of electrical energy had increased from 40m kilowatt hours in 1945 to 200m kilowatt hours in 1955. These were the circumstances under which the partnership eventually took place between the Volta River Project and the Volta Aluminium Company (VALCO).

Location and extent of bauxite deposits

There are three main areas of bauxite deposits in the country: Yenahin and Aya in the Ashanti region; Kibi and Kwahu in the eastern region; and Awaso in the western region. The construction of new rail links were contemplated from the Ashanti sites to the existing Kumasi-Koforidua railway and from Koforidua to Kpong, a site proposed for an alumina refinery and an aluminum smelter.

The Volta River

The Volta River has five main tributaries:

- (1) The Black Volta, which emanates in Ivory Coast and constitutes the western portion of the Volta catchment area, flows northward to Burkina Faso (formerly Upper Volta), and then southward into Ghana;
- (2) The White Volta, which rises in Burkina Faso in the east and forms the eastern portion of the Volta catchment;
- (3) The Oti River, which rises in Benin, flows through Togo, and joins the Volta in northeast Ghana some 175 miles from the estuary at Ada in the Gulf of Guinea;
- (4) The Afram River, which lies wholly in Ghana, rises in the Kwahu plateau, and joins the Volta 82 miles from its estuary at Ada; and
- (5) The Red Volta, which rises in the east of Burkina Faso below the White Volta and joins the main river further south.

The catchment area is some 152,000 sq. miles, of which 61,500 sq. miles lie in Ghana. Altogether, the Volta River itself is some 1,000 miles long from the headwaters of the Black Volta. The river showed a flood frequency of 1:1,000 years in 1963 during the construction of the dam and again in 1968.

Development

The concept of generating electricity from the Volta River, preferably in conjunction with the establishment of a large aluminum smelter to assure a good firm base load and enhance viability--and also to process Ghana's vast bauxite ore deposits--had periodically been examined over a long period of time. In 1915 the possibilities were studied by the South African geologist and engineer Duncan Rose. It was not until the early 1950s, however, that a permanent commission--the Volta River Preparatory Commission--was established jointly by the Gold Coast and British governments to further investigate, reexamine, and coordinate the various studies and reports. It was under the chairmanship of Commander Sir Robert J. G. Jackson, and demonstrated the seriousness with which the two governments had come to regard the prospects of realization of the

project. The commission carried out its work with the utmost diligence and objectivity, and its report included a sizable appendix on electrical energy development by the British consulting firm of Sir William Halcrow and Partners. The recommendations included the establishment of a dam and a hydroelectric power plant at Ajena, an alumina refinery and an aluminum smelter at Kpong, a port at Tema, and the construction of railway lines between the port of Tema and the aluminum smelter site at Kpong and from Koforidua to Kpong to transport the bauxite. On completion of its work, the commission was redesignated as the Development Commission, whose principal task was to coordinate all of Ghana's development, especially the Volta River Project, and to ensure the project's continuity.

The estimated costs were considered by potential lenders and the government of the Gold Coast to be too high, however, and a subsequent reappraisal of the project by the American consulting company of Kaiser Engineers and Contractors Incorporated recommended four major modifications, especially for financing purposes:

- (1) The deferment of refining and using Ghana's own bauxite for the aluminum smelter in the early years;
- (2) The location of the dam and power plant at Akosombo (meaning a chain of rocks) instead of at Ajena: this would involve more difficult but quicker construction than at Ajena, and the smelter at Tema;
- (3) the dam to be the clay-core, rock-filled type instead of concrete arch; and
- (4) the cancellation of the planned railway link between Tema and Kpong in view of (2) above, and also because of the excellent new highway between the port of Tema and Kpong, requiring only an extension to reach Akosombo that, like the port of Tema, the government had constructed regardless of the hydroelectric project at Akosombo.

With this new parceling, serious parliamentary and public debate of the project could commence while negotiations for possible financing and other

preparations were underway. Some details of funding of the power project are stated later. For the bauxite refinery and aluminum smelter, British Aluminium Company, West Africa Aluminium, and Aluminium Ltd. of Canada eventually withdrew; but a newcomer to the scene, Kaiser Aluminium and Chemical Corporation of Oakland, California, endeavored to form a consortium. Eventually a new company--Volta Aluminium Company (VALCO), was established with 90 percent shareholding by Kaiser Aluminium and Chemical Corporation, and 10 percent shareholding by Reynolds Metal Company, and had a thirty-year power contract with Ghana, which included a minimum "take or pay" charge. The contract also provided that within ten years it must use alumina produced from Ghana bauxite, or have its tolling charge on imported alumina increased by four percent.

Two early decisions turned out to be fortuitous for the project. Although international financing had by no means been finalized at the time, and although Mr. Kaiser had not yet secured agreement for the new aluminum company, President Nkrumah had tenders called in May 1960 for the construction of the dam and powerhouse installations. Within a year the contract for the main works was awarded to the Italian firm of Impregilo at some £15m, nearly £4m below the engineer's estimates. About eight months later, similar tenders were invited for the supply of turbines and generators and for the construction of transmission lines, and the award of the contracts for these showed a saving of some £4 1/2m from the engineer's estimates. These two acts saved not only money, but also about one year of construction time.

Another element of good fortune to the project was in the selection of the civil contractor for the main works and the assignment of his field staff to the project. When Impregilo was awarded the contract, it had already satisfactorily constructed the Kariba dam in Rhodesia, and was also engaged on the

Roseires in the Sudan. Its chairman, Dr. G. Lodigiani, OBE, was clearly competent and very experienced. For Akosombo, he assigned Mr. Baldasarini as his site-construction manager, a post he previously held on the Kariba, and would hold again at Tarbella in Pakistan. For the Authority, Mr. Frank J. Dobson, on secondment from Ontario Hydro-Electric Company of Canada, had been appointed chief executive. With Kaiser Engineers and Contractors Incorporated as the consulting engineer, it was a strong combination for the project. The government's electricity department performed an advisory function chiefly on the electrical-power aspect of the project.

The President himself continued to be very keen on the project and its side benefits, notably that:

- (1) the whole of the country should be electrified immediately;
- (2) Ghana should share the electricity with neighboring countries for regional cooperation;
- (3) the railways should be electrified to take advantage of the cheaper and cleaner energy;
- (4) agriculture resulting from the project should be mechanized;
- (5) the river should be canalized from the power plant to the estuary at Ada--and possibly also to Tema--for both commerce and recreation; and
- (6) agriculture generally should expand rapidly, by irrigation as necessary.

The Volta River Authority

The Volta River Authority was established in December 1961 by the Volta River Development Act (Act 46), attached hereto as Appendix 1. Technically, it is the Board of the Authority that is termed the Authority, an autonomous body. It has responsibility for the policy control of its administration and is headed by a chief executive who is nominated by the government, approved by the lenders, appointed by the Board, and is also a member of the Board. The chair-

man is nonexecutive, and is also appointed by the government. There are six other members: one of whom must have thorough knowledge of finance, and two of whom represent the two major consumers of electricity--namely, VALCO and the Electricity Corporation of Ghana (ECG). All six are appointed by the government. Its first chairman was the president of the Republic of Ghana, thereby setting a high, prestigious standard for future appointments. The government appears to have selected the board with great care and regard so far. A typical board included Dr. Justice Nii Amaa Ollenu (as chairman), a retired Appeal Court Judge and retired Speaker of the National Assembly; Mr. E. K. Okoh, retired Secretary to the Cabinet and Head of the Civil Service of Ghana, Dr. Amon Nikoi, Governor of the Bank of Ghana, Sir Robert Jackson, Chairman of the former Volta River Preparatory Commission, and Nene Azu Matekole, OBE, KMC, Paramount Chief of Manya Krobo.

Although the Authority was intended to be independent, the government could have substantial influence on it through the appointment process. In their implementation, these arrangements sometimes had difficulties, but on the whole their advantages outweighed their disadvantages. In the context of Ghana, for example, it is not always easy for a chairman, especially as a political appointee, to understand and accept that it is not an executive position. Also, because of Ghana's colonial past, ministries, ministers of government, and civil service administrators found these arrangements very unusual; and some considered the Authority as a "state within a state." Indeed, a later government set up a one-year committee of enquiry into the Authority--partly, perhaps, to emphasize the limits of its autonomy. Regrettably, the report of this committee was never published. With the passage of time, however, the arrangements have apparently become more accepted; although

conflict with the government and the occasional disagreement between the chairman and chief executive have not been entirely eradicated.

Like the Tennessee Valley Authority, the Volta River Authority was conceived and established as a multipurpose development agency, and the enabling Act is appropriately titled the Volta River Development Act (Act 46, 1961). Virtually all the costs and funding of the project, or very sizable portions of them, however, were compared to the electrical-energy development component of the project in assessing its financial viability. In addition, certain of the costs were borne in full or in large measure by Ghana alone. For example, although the total cost of the resettlement program at the completion of the project was £10m, only £3 1/2m was allowed to be charged to the project. The remaining £6 1/2m was paid by Ghana on the grounds that it used the project to provide a better quality of life for the settlers. In addition, the cost of the new port of Tema, some £35m, was entirely the responsibility of Ghana and was independent of the project. The cost of the new modern highway from the port of Tema to the power-project site at Akosombo was also considered to be part of Ghana's improvement to its infrastructure facilities. Ultimately, the Akosombo dam and power station, and associated transmission system were completed ahead of schedule and under the allocated budget. This was altogether a laudable achievement--to the discomfiture of those critics who had predicted overruns and delays. A major contributing factor to this success was the human resources of Ghana.

The Volta Lake

The lake formed behind the dam by the impoundment of the river is vast, some 3,500 sq. miles in area. It measures 18 miles at its widest point, is 200 miles long, and has a shoreline of some 4,500 miles. Indeed, at one time it

was adjudged to be the largest man-made lake in the world. In terms of capacity it ranked fourth after Kariba, Bratsk, and Aswan. It is, clearly, a large portion of Ghana's total land area, which accentuates the importance of the resettlement aspect. Eventually some fifty-two new settlements and townships were required. Furthermore, it aggravated the environmental and ecological problems, particularly the disease schistosomiasis (bilharzia). The lake has also affected the climate, mitigating the dry harmattan season by evaporation, and has increased rainfall over the area; but there have recently been repeated droughts, considerably reducing the seasonal inflow into the lake. Indeed, according to some authorities, the Sahara desert is moving south at the rate of five miles per annum, which will further aggravate this problem. The possibility of tree-planting in the north and along the shoreline has been considered, using eucalyptus and pine, but this has not yet been implemented. The possibility of occasional "seeding rain" has also been considered. Perhaps after these twenty-one years the advisability of restocking the lake with fish should be reexamined, especially with the species presently considered by some as delicacies--the lates and the Nile perch. The Fisheries Department of the Ministry of Agriculture appears to be well suited for this task. In addition to its potential for hydroelectricity, the Volta Lake provides other possibilities for economic development.

The seasonal drawdown area of the lake--the area of land seasonally exposed by the depletion of the lake--provides an excellent opportunity for agriculture. Rice, sugarcane, and cotton appear to be particularly favored; but vegetables and seasonal foodstuffs are also certain to do well. The tardy development of the latter crops appears to be due to the lack of any agency taking responsibility for it. It is generally felt that the Ghana Irrigation

Authority of the Ministry of Agriculture, in conjunction with the extension unit of the same ministry, would be the most appropriate organization. Earlier experiments carried out by the Volta River Authority's agricultural unit at some of the resettlement sites were very successful: for example, tobacco at Mpakadam and pig and poultry raising at Nkwakubio. This upland area requires more than agricultural development. It requires coordinated and integrated total development of resettlement villages and host villages into coherent units, marketing of agricultural and farm products, and suitable local and cottage industries. The lake-transport service will certainly help; but considering that the lake spans at least three regions of the country, it seems that a country-wide authority or body is required for this development. An appropriate description might be the Volta Lake Upland Development Corporation, with activities between the 272 ft. and 280 ft. contours around the lake--land presently vested in the Volta River Authority but not being utilized. The reservoir still provided a good resource for water management and flood control, however, as demonstrated during the flood of 1968. The lake itself flows very slowly, and so far no appreciable amount of silting or sedimentation on the bed has been observed. Time did not permit the area to be cleared of the original trees and vegetation before the land was inundated, which enhanced fish food later.

Resettlement

The resettlement program of the main Volta River Project was not specifically defined as being an integral part of the project; hence, neither the consultant nor the dam civil contractor had any responsibility for it. Initially, it was expected to be carried out by the Department of Social Welfare and Community Development. By the end of 1962, however, little progress had been

made in the matter, and the government assigned the responsibility to the Volta River Authority. Since that time, concern for the human and environmental aspects of hydroelectric schemes has increased so much that, in the case of the subsequent Kpong hydroelectric project, resettlement was actually considered as an integral part of the project. Indeed, some of the lenders stipulated satisfactory arrangements for this as a condition of their loans. Consequently, all of it was included in the work of the consultant, and the construction of four of the six new resettlement villages was included in the contract with the dam's civil contractor--the integrated approach, as it is called. In both cases, the resettlement aspect had to be planned, commenced, and completed before the completion of the main dam construction to ensure timely evacuation of the people and their settlement on higher ground. The resettlement program followed considerable and detailed fieldwork of annotation, crop and property enumeration, identification of ethnic groups, ascertainment of land boundaries, and local population counts--all to facilitate future reidentification, computation of entitlements, and payment of compensation. This exercise considerably facilitated subsequent action; and the data compiled certainly provides an excellent record for future reference and use.

The basic housing was of the sandcrete core-type single-bedroom design with a roofed kitchen space and toilet and bathroom; but with provision for extending the building to five bedrooms by each household. Attempts were made to settle some ethnic groups together to achieve larger village sizes and more economically viable infrastructures, but without losing the village-community character. Additionally, each registered adult of a household was later allotted a three-acre plot of land for subsistence farming; then another ten acres for commercial agriculture. Altogether, some 80,000 people were relo-

cated. The standard of the program was declared to be that no settler should be worse off after resettlement than before, but this goal was rarely achieved. When human beings must tear themselves away from their old roots and from ancestral homes and shrines, the pain can be wrenching. A third party may tell them they are better off--because they are being paid compensation or given better accommodations--and should be happy, but this is a subjective matter. Even with the greatest "persuasion" by a government and cooperation by the settlers, the process can still be traumatic and was! Along with the power project's financial cost, the human aspects of resettlement were also difficult to bear.

Various United Nations agencies assisted in the resettlement program, notably the United Nations Development Programme, the Food and Agriculture Organization, the World Health Organization with the Volta Lake Basin Research Programme, and the World Food Programme to help feed the people until their own farms were fully established and productive. Three features that came to light with these programs were:

- (1) The organization's administration costs were sometimes much higher than the amount actually expended on the project, resulting in the recipient country contributing substantial inputs that it did not anticipate;
- (2) the local "counterpart" personnel required to understudy the foreign "experts" brought in for the programs were sometimes as qualified and experienced as--or more so than--the "experts," and this could cause frustration to the local counterpart personnel; and
- (3) the premature curtailment by UNPD/FAO of financial support to the Volta Lake Basin Research Programme merely emphasized the mechanical nature of some of these aid programs.

Irrigation

The question may well be asked, what provision was made for irrigation? The answer is, regrettably, none from the headpond of the reservoir. However,

a special study of the Accra Plains irrigation scheme was made. The objective was to conserve the potential of the headpond water for electric energy generation, particularly because that high head of 276 feet is not required to make the water flow downstream just for irrigation: only about 47 feet is required. Consequently, it was hoped that this lower head of water could be pumped from the lower tailwater level into storage tanks and then gravity-fed for irrigation, which would conserve the electric-power potential in the headpond. The estimated cost of the scheme at the time was £100m. Because of this high cost, a phased development seemed to be indicated. By contrast, with the Kpong project, irrigation outlets were incorporated in the dam itself, chiefly because the much lower level and smaller electric power potential of the Kpong dam make irrigation more viable, although on a much smaller area of land. Even so, there is really no reason for not applying this "pumped storage" technique in the uplands of the Volta Lake with its rich alluvial deposits and much larger area.

VALCO Fund

An unusual feature of the VALCO contract with the government was the establishment of a VALCO Fund into which that company would pay a proportion of its profits for national educational and charitable purposes. It is administered by an independent board of trustees appointed by the Volta River Authority, with the managing director of VALCO and the chief executive of VRA as advisors.

Financing

The funding of the project was international and involved considerable negotiation with prospective lenders. The Ghana team was under the leadership of Mr. K. A. Gbedemah, Minister of Finance. In the form originally proposed,

the British government was willing to lend the Gold Coast £50m at an interest rate of two percent for a period of 80 years in return for the rights to to purchase 75 percent of any aluminum produced by the project for a period of 30 years. The Gold Coast government, however, felt that this would be politically unacceptable, and might be misconstrued as some veiled attempt at perpetuating colonial economic domination. Eventually, the inputs contributed by various bodies were as follows:

(1) International Bank for Reconstruction and Development	US \$47m
(2) USAID--for American goods and services	US \$27m
(3) Export-Import Bank of America--for American goods and services	US \$10m
(4) United Kingdom Export Credit Guarantee Department	£ 5m
(5) Republic of Ghana	£ 35m

Ghana's contribution was about 50 percent of the total cost. A schematic diagram of these arrangements is shown in Appendix 2, which also indicates VALCO's funding.

These loans all had their peculiar conditions, terms, and schedules of repayment; the Ghana contribution was treated as equity investment on which a target rate of return of six percent had to be earned. At one period of time, however, the total annual debt servicing of the foreign loans was US \$8m, payable semi-annually. Firm arrangements were clearly needed to assure timely, regular debt servicing and loan repayments in foreign currency. It was in this connection that VALCO agreed to pay for the electrical energy consumed at its smelter at Tema in foreign exchange, US dollars, while payments by other Ghanaian consumers would be made in local currency. Certainly, earnings from VALCO were not adequate to service foreign debt in the early days. By 1973, under a 15-year agreement for the sale of electrical energy to the Republics of

Togo and Dahomey, foreign-exchange earnings by the Authority were augmented. Additionally, the VALCO power rate was increased three different times, a tedious process following many reports by different consultants! It is gratifying that the latest round of negotiations with VALCO has resulted in a still higher price for electrical energy. The other consumers of the Authority's electric power are the Electricity Corporation of Ghana--for retail and local distribution--the Obuasi Gold Mines, the Dunkwa Gold Mines, the Prestea Gold Mines, the Akwatia Diamond Mines, the Konongo Gold Mines, Akosombo Textiles Limited, and the Communauté Electrique du Benin (C.E.B.) for Togo and Benin. It is anticipated that the power demand and consumption of ECG will soon be higher than VALCO's. The annual energy consumption of the Authority's customers from 1968 to 1984--as published in the Authority's various annual accounts--is tabulated here as some indication:

Table 1
Annual Energy Consumed Per Class of Customer
1966-1984

Totals	E.C.G.	The Mines	Akosombo Textiles	Akosombo Township	VALCO	C.E.B.	Totals
(GWH)	(GWH)	(GWH)	(GWH)	(GWH)	(GWH)	(GWH)	
1966	300.90	127.90	--	2.70	13.90	--	444.70
1967	60.30	164.10	--	6.30	923.20	--	1,453.90
1968	420.10	177.40	2.00	6.80	1,865.90	--	2,472.20
1969	502.80	85.50	6.30	6.80	1,972.20	--	2,673.60
1970	564.80	206.80	14.85	7.20	2,012.40	--	2,806.05
1971	659.25	226.50	20.82	8.81	1,919.00	--	2,834.37
1972	699.45	242.64	20.94	9.01	2,263.81	1.26	3,237.10
1973	768.12	243.07	21.98	12.54	2,625.99	99.72	3,771.41
1974	893.46	257.02	19.27	11.06	2,734.77	127.78	4,043.33
1975	893.17	271.02	22.57	11.50	2,518.24	136.70	3,853.20
1976	980.01	278.28	22.98	9.68	2,644.89	153.34	4,091.17
1977	1,034.70	260.27	24.31	11.00	2,783.61	178.81	4,292.70

Table 1. continued.

Totals	E.C.G.	The Mines	Akosombo	Akosombo Textiles	VALCO	C.E.B. Township	Totals
1978	1,062.84	250.25	24.15	11.33	2,086.38	216.63	3,651.57
1979	1,027.76	259.34	17.60	13.01	2,907.53	299.25	4,524.49
1980	1,074.71	271.85	11.53	13.14	3,318.68	439.77	5,129.68
1981	1,115.33	273.99	6.56	9.53	3,303.24	472.19	5,180.83
1982	1,000.29	257.78	1.93	8.77	3,008.71	521.46	4,798.92
1983	948.04	232.49	2.97	8.09	752.93	490.78	2,453.33
1984	799.05	218.83	4.22	7.44	13.18	316.89	1,359.60
<hr/>							
Totals	15,105.05	4,405.03	244.98	174.71	39,668.56	3,454.58	63,072.15

Other Functions

Other functions performed by the Authority are resettlement, Volta Lake transport, health, development of fishing in the lake, limnology, and Volta River basin research into waterborne diseases--notably onchocerciasis (river blindness) and schistosomiasis (bilharzia), lakeside experimental resettlement agriculture, local authority administration of Akosombo township, and the development of the lakeside for tourism. These activities, except for Akosombo township administration, are funded by the government and the accounts for them are kept strictly separate, under the heading of "non-power activities," from those for "power activities." Although they have all been progressively well developed over the years, three of them might be singled out for special mention. First, lake transport should be considered. From its humble beginnings with old discarded construction craft, the project had developed sufficiently by 1981 for the Federal Republic of Germany to grant Ghana a very generous combination of loan, grant aid, and technical assistance--amounting to some DM 95m--for further development of a south-north lake-transport service. It began with service from Akosombo to Yapei near Tamale, and later expand to Buipe on the Black Volta, and eventually include the charting of a navigation

channel, improved ferry crossings, and port facilities and workshops. The potential of the lake transport for Ghana's rapid economic development cannot be overemphasized. Apart from supplementing road transport, it can lower the cost of north-south transport to the extent that the price of petroleum in the north could be reduced by 3p per gallon, which, in turn, would lower the cost of foodstuffs and produce from the north to the south. The distance by water is half that of the road journey; moreover, it is accessible during the wet season, just when the general conditions of the roads deteriorate because of the rains. It must be stated that the satisfactory development of lake transport was greatly helped by the Authority forming a partnership with Messrs. Elder Dempster Lines Ltd. of Liverpool, and Messrs. Scanlake of Copenhagen--two commercial ocean companies--after considering various proposals and gaining government approval. Second, a completely new fishing complex and preservation unit has been built at Kpandu Torkor, near Kpandu, with its own shop for supplies, a boat-building yard, and a mechanical workshop for maintenance and repairs--all operated and administered on a revolving-fund basis by a committee of townsmen, officials, and technical advisors. As for Akosombo itself, the town now has modern street lighting, a well-equipped hospital, primary schools, a secondary boarding school, a pipe-borne potable-water supply, a slaughterhouse, a market, a modern sewage system, and several recreational facilities; also a privately owned textile factory, located there chiefly because of the humidity of the local climate. At one stage, the estimated total revenue to the lakeside dwellers from fishing was higher than revenue to the Authority from the sale of electrical energy. On completion of the project, permanent residential accommodations had to be provided for the operation and maintenance staff, which was achieved by converting the temporary wooden construction

housing into cement-block work; in the case of senior staff and management, housing cost £600 each.

Tourism has also been started in the lake on the little island of Dodi, which is also a wild game reserve. The Ghana Tourism Board has been encouraged by the government to seriously promote this development.

The "power activities" have also been changing. From the initial capacity of 588 MW in 1965, the capacity of the generating station was expanded to 883 MW in 1972 by the addition of two units of similar size. Earlier operating experience helped to specify improvements in the design of the new units. Additionally, a new four-unit 160 MW tailwater station was completed and commissioned at Kpong, sixteen miles downstream, in 1981. Also, the transmission system was extended to Togo and Dahomey in 1972, and interconnection with Ivory Coast was completed in 1984--a rather impressive rate of growth and performance. There has always been a need for considerable forward planning and negotiations for financing, because hydroelectric projects--from project identification to commissioning--usually take ten years. The detailed design and specification of the next stage 200 MW development at Bui, on the Black Volta, have already been completed. In addition, a study of the Oti River, the major tributary into the Volta Lake, is contemplated for possible early development. Also, extension of the grid to northern Ghana, and electrification of the Volta region of Ghana from the Volta transmission grid are both presently in progress; and a direct interconnection with Nigeria is being considered. As an example of regional cooperation, the Authority's achievements are outstanding.

In the case of the Kpong project, the foreign-exchange costs were funded--

largely on concessionary terms--as follows, in US dollar equivalents:

Saudi Arabia, Kuwait, and the Arab Bank for Economic Development in Africa,	
Khartoum	\$73m, for civil works
Canadian International Development Agency	35m
European Development Fund	10m
European Investment Bank	10m
World Bank	39m

The status of loans to the Authority as of 31 December 1984 is stated in the VRA 23rd Annual Report and Accounts, Figure 3.

The World Bank's lead role in project appraisals is very important. Because of its expertise and competence, its reports are very thorough and readily accepted by other lending agencies as accurate and suitable for their own purposes, thus saving time and some expense.

The World Bank is very cautious about its investments in the Authority, however, and has sometimes been rather dogmatic. For instance, it was with some difficulty that the Authority persuaded the Bank to undertake its development "non-power" activities, specifically lake transport. Again, in the matter of the development of the Kpong hydroelectric station, the Authority was anxious for a decision, but the Bank insisted for a long time that Ghana's needs could adequately be met by gas turbines, thus postponing the heavier investment required for the Kpong hydroelectric project. Furthermore, the Bank suggested that an interconnection with Nigeria might prove even less expensive, after an additional, detailed study of Nigeria's hydroelectric potential, particularly in the Shororo gorge; and the division of the Authority's operations into power and non-power activities was a resultant compromise. This division had some justification, because at one time some people were apparently beginning to

regard the Authority's income from the sale of electricity as part of the general public revenue, and expected it to be disbursed by the government.

VALCO, for its part, has expanded its plant capacity at Tema from the initial 80 tons per annum in April 1967 first to 120 tons, then to 210 tons.

The Authority is, therefore, not only multipurpose but also multidisciplinary; and the question has sometimes been asked whether the chief executive should always be an engineer. Because the Authority includes so many departments--power operations, finance, accounts, medical and health, resettlement, agriculture, lake transport, Akosombo township administration, and legal--the emphasis should be on good administration and leadership. One of the more spectacular achievements of deliberate policy of the Authority is the way its whole management and staff quickly became all-Ghanaian. Initially, a team of operators was brought in, under contract with Ontario Hydro-Electric Company of Canada, to operate and maintain the power facilities. It included Ghanaian understudies and provided for their further training, both abroad and locally. This was so successful that within two years of the commencement of its power operations, all of its management and staff were Ghanaians of high competence and excellence. This is demonstrated by the records and performance--a matter of great satisfaction and pride to Ghana--and is an inspiration to other African countries. Indeed, the Akosombo Expansion Project in 1971 and 1972 was executed entirely by the Authority's staff, under the supervision of only the consultant's resident engineer.

To further assure success, the Authority has developed cooperation with the government, government agencies, and international agencies to almost an art, without surrendering its autonomy. For example, whenever the Authority is able, it pays an annual dividend of not less than the 1968 equivalent of

Figure 3. Statement of Long Term Loans as at December 31, 1984

	Original loan facilty	Drawings as at 31/12/84	Repay- ment as at 31/12/84	Exchange variation (Note xxiii)	Balance as at 31/12/84
	€'000	€'000	€'000	€'000	€'000
International Bank for Reconstruction:					
Loan No.310 GH	2,350,000	2,350,000	1,885,800	(39,867)	424,333
Loan No.618 GH	300,000	300,000	83,250	34,470	251,220
Loan No.1380 GH	1,950,000	1,950,000	378,000	(394,645)	1,177,355
Agency for International Development	1,147,500	1,145,351	635,250	—	510,101
United Kingdom Government	84,107	84,107	84,107	—	—
Export-Import Bank of Washington	413,752	413,752	383,201	—	30,551
Ghana Government	300	300	300	—	—
Ghana Government	1,305	1,282	—	—	1,282
Canadian Govt.	459,000	455,983	95,709	(86,826)	273,448
Canadian Govt.	1,750,000	1,749,353	—	(421,594)	1,327,759
Kuwait Fund	2,329,508	2,329,508	302,726	(183,414)	1,843,368
Arab Bank for Eco. Dev. in Africa (BADEA)	500,000	500,000	77,108	—	422,892
Saudi Fund for Dev. (S.F.D.)	1,711,043	1,711,043	331,069	(95,537)	1,284,437
European Invest. Bank (EIB.615)	586,221	586,221	153,590	—	432,631
European Dev. Fund (E.D.F.)	514,865	514,865	—	—	514,865
Opec Fund 120P	185,000	185,000	23,000	—	162,000
Opec Fund 192P	300,000	300,000	—	—	300,000
K.F.W.	546,000	350,343	—	—	350,343
14% V.R.A. Reg. Bonds	80,000	80,000	3,842	—	76,158
Canadian Govt. European Invest. Bank (EIB 864)	150,000	148,845	—	(35,872)	112,973
African Dev. Bank (ADB)	288,953	288,953	34,738	(45,188)	209,027
	339,255	339,254	13,828	(26,719)	298,707
	<u>15,986,809</u>	<u>15,784,160</u>	<u>4,485,518</u>	<u>(1,295,192)</u>	<u>10,003,450</u>
Deduct:					
Current portion of long term loans					874,661
As per Balance Sheet					<u>€9,128,789</u>

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regard the Authority's income from the sale of electricity as part of the general public revenue, and expected it to be disbursed by the government.

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C2,000,000 to the government on the latter's equity; and this appears to have encouraged the government to pay for the non-power activities. Moreover, international agreements to be executed by the Authority are always cleared with the government's Public Agreements Committee; and contracts to be awarded by the Authority are cleared with the government itself. Also, the government of the Netherlands was persuaded to donate a whole ship to the lake transport project in 1972, because it was agreed such a contribution would be more effective than another consultant's study, which would have added to the cost of the various studies--already US \$600,000--without any implementation.

No human endeavor results only in advantages or only in disadvantages, as the eminent American philosopher Ralph Waldo Emerson postulates in his Essay on Compensation; and the Volta River Project has been no exception. On balance, however, and taking a long-term view, it is felt that the Volta River Project has been of benefit to Ghana, and that the full potential has yet to be realized in the years ahead. However, until an alumina refinery is established to use Ghana's own bauxite at the aluminum smelter, the project cannot be regarded as a complete success, bearing in mind the original objective of integrated development. Furthermore, electrification of the country's railways should now seriously be considered as a potential contribution to the economy; this could be started with the Accra-Tema section.

In Retrospect

In retrospect, there are four main respects in which the project could have been improved. First, some irrigated agriculture would have been appropriate right from the beginning. Second, the resettlement program could have been more generous, treated as an integral part of the project, and a higher proportion of the cost could have been fairly charged to the power

aspect. Third, the power price charged to VALCO should have been higher and subject to periodic review, and the total VALCO revenues contributed in foreign exchange should have been used toward the cost of the subsequent Kpong development. Fourth, because the high cost of resettlement was necessary mainly for electrical power development, some provision should have been made to supply electricity in the resettlement villages and townships, and for general rural electrification in Ghana. Fortunately, this early omission is gradually being remedied, but the pace needs to be accelerated. Furthermore, the riverine breeding of shellfish at Ada and in the nearby lagoons at Anyanui on to Keta seems to have diminished with the now regular--instead of the previously seasonally irregular--riverflow.

There has been some discussion of whether there should be one or two electricity authorities in the country, which might require some elaboration here. In 1963--two years before the Volta River Project started to produce electricity--the management of the Electricity Department (the forerunner of ECG) made representations to the government and to the Volta River Authority that the Volta River Project, when completed, should be handed over to the Electricity Department to operate. Among the benefits to the country that could be seen at the time were the following major ones:

- (1) The Electricity Department was already very well established, and had regional offices, regional stores, and regional administrations. Consequently, the Volta River Authority would not have to go to the trouble or expense of duplicating these facilities.
- (2) Considering the limited professional, technological, and technician manpower with expertise in electricity, duplications and transfers of personnel could be avoided.
- (3) The relatively better terms and conditions of service available to the Authority's personnel could then be extended the Electricity Department staff without civil service objections.

- (4) Excess staff and personnel in Electricity Department power stations could be redeployed to the Volta River Authority. Some objections were raised from certain quarters to this suggestion, principally, that with the very large investment in the Volta River Authority nothing should be done to jeopardize its success; and a "dead weight" like the Electricity Department might do just that! It must be remembered that the assets of the Electricity Department at the time amounted to only about £5m; but it was not generally known that the annual rate of return was approximately 20 percent. It looked like the tail wanting to wag the dog!

About three-and-a-half years later, the management of the Volta River Authority resuscitated this matter entirely on its own initiative, in the light of its operating experience, and in a forthright manner. This time the idea secured the approval of the government, the Board of the Authority, and a joint committee appointed by the government and the Authority to consider the details of the mechanics of implementation. The World Bank was not very supportive, and at most would say they "have no objection." Additionally, the staff of the Volta River Authority was also not very supportive, for fear of publicizing their conditions of service. So the matter was not pursued any further. In the meantime, the Electricity Department became ECG, and it was hoped that this would so improve performance as to render further consideration of the matter unnecessary.

Such improvement did not occur, however, and in the next phase the World Bank became increasingly interested in what had come to be known as the "amalgamation" of the two organizations. In the final analysis, the efficaciousness of the "best solution" will depend on the personalities and personnel available to operate it. For example, while a chief executive might find the Volta River Authority manageable by itself, it might become unmanageable if combined with ECG, and both organizations would suffer. Furthermore, a responsible managing director of ECG would very much resent losing organizational control, and would not be likely to contribute willingly and positively to a newly combined body.

Perhaps the decision should not be made until the whole subject has been examined again in depth, but the general trend of thought now is that especially after the passage of time--and with the two institutions already firmly established--it might be best to leave well enough alone, particularly as amalgamation at this stage might militate against the non-power activities of the Authority. A National Energy Board has recently been established in an effort to coordinate the policies of the two organizations and of petroleum and gas.

The Lessons of the Volta River Project

What lessons may be drawn from the Volta River Project by other African states for their river basin developments? Perhaps the following salient ones:

1. The development should be conceived and planned as multipurpose if at all possible, to provide the maximum benefits to the greatest number of the population, even if the realization of some aspects has to be phased over a period of time.
2. Adverse effects on the environment should be kept to a minimum.
3. The health aspects should be accorded paramount consideration at all times.
4. The matter of resettlement of any section of the population to be affected by the project should be treated as an integral part of the project, and should be planned and executed in close consultation with the people concerned.
5. The total cost of resettlement, or a substantial part of it, should be charged to the project, otherwise a true balance of costs of the various aspects of the project might be distorted.
6. Industries that benefit from the project should pay a fair proportion of the recurrent and repayment costs, unless there are certain clearly stated reasons that adduce comparable advantages to the country.
7. The governing body for the operation and administration of the project should be sufficiently autonomous to obviate the tardiness and bureaucracy of the government administration. It should also include some international or nonlocal representation to enrich its experience, and enhance its open-mindedness of judgment and prestige and the confidence of international lenders.

8. Within the aims and constraints of specified policies, the administration should be business oriented.
9. The head of the Administration should be a person of wide experience, proven competence, and integrity.
10. The project should, of course, be subject to the generally accepted rules of audit and accountability.
11. Where at all possible, it should contain elements for future growth and development.
12. Because of frequently varying currency-exchange rates, it would be useful to periodically carry out an exercise in revaluation for major projects to more accurately determine their true value.

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ARRANGEMENT OF SECTIONS

PART I—THE VOLTA RIVER AUTHORITY

Section

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2. Status of the Authority.
3. Constitution of the Authority.
4. Members of the Authority.
5. Chief Executive.
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PART II—FUNCTIONS AND DUTIES OF THE AUTHORITY

10. Primary functions of the Authority.
11. Flow of water and flooding.
12. Powers in relation to transmission system.
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14. Authority to have local government functions and planning powers over Akosombo township and lakeside area.
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18. Authority to co-operate with other public authorities.
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20. Directions to the Authority.

PART III—FINANCE

21. Authority to aim at making profit.
22. Borrowing powers.
23. Investment by the Republic.

Section

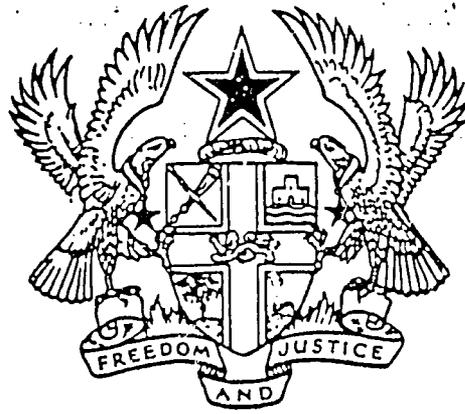
- 24. Exemption from income tax.
- 25. Government to re-imburse Authority for certain measures.
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PART IV—ACQUISITION OF LAND AND RESETTLEMENT MEASURES

- 27. Filling of the lake and acquisition of land.
- 28. Compensation.
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- 30. Defraying expenses incurred under this Part.

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- 31. Guarantees.
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THE FORTY-SIXTH

ACT

OF THE PARLIAMENT OF THE REPUBLIC
OF GHANA

ENTITLED

THE VOLTA RIVER DEVELOPMENT ACT, 1961

AN ACT to provide for the establishment of an Authority charged with the duties of generating electricity by means of the water power of the river Volta, and by other means, and of supplying electricity through a transmission system; for the construction of a dam and power station near Akosombo, and for the creation of a lake by the damming of the river; for giving the Authority power to administer certain lands liable to be inundated and lands adjacent thereto, and for dealing with the resettlement of people living in the lands to be inundated; for charging the Authority with certain incidental responsibilities; and for purposes connected with the matters aforesaid.

DATE OF ASSENT: *26th April, 1961*

BE IT ENACTED by the President and the National Assembly in this present Parliament assembled as follows:—

PART I—THE VOLTA RIVER AUTHORITY

1. There shall be established an authority to be called the Volta River Authority (referred to in this Act as the Authority) charged with the duties and responsibilities hereinafter specified. Establishment of the Authority.

Status of the Authority.

2. The Authority shall be a body corporate with perpetual succession and a common seal which shall be officially and judicially noticed, and may sue and be sued in its corporate name, and for and in connection with the purposes of this Act may acquire and dispose of land and personal property and enter into contracts and other transactions.

Constitution of the Authority

3. (1) The Authority shall consist of a Chairman, the Chief Executive appointed under section 5 of this Act and six other persons of whom one, who shall have had experience in financial matters may be appointed as finance Member, and two shall be appointed to represent major consumers of the electrical power to be generated by the Authority.

Amended by Act 338

(2) Subject to section 5 of this Act, the Chairman and other members of the Authority shall be appointed by the President acting in accordance with the advice of the Prime Minister.

(3) At every meeting of the Authority at which he is present, the Chairman shall preside and in his absence a member elected by the members present from among themselves shall preside.

Provided that the first such members to be appointed, other than those appointed to represent major consumers of electrical power, shall serve for the following periods, which shall be specified when they are appointed, that is to say, two such members shall serve for two years and the remaining two for one year.

(2) The appointment of any such member may be terminated at any time by the President if he is of opinion that it is necessary in the interests of the Authority to do so.

(3) Subject to the provisions of this Act, the terms and conditions of appointment of such members shall be determined by the President from time to time.

Chief Executive

Amended by N. L. C. D. 268

5 (1) The Authority shall have an officer to be known as the Chief Executive

(2) The Chief Executive shall be a person nominated by the National Liberation Council and appointed by the Authority, and shall hold office upon such terms and conditions as the Authority may determine.

(3) The Chief Executive shall devote his full time to the affairs of the Authority.

(4) Subject to the general control of the Authority on matters of policy, the Chief Executive shall be charged with the direction of the business of the Authority, and of its administration and organisation and with the employment, control and dismissal of all the Authority's staff and workpeople.

3. The person holding the office of Chief Executive of the Authority immediately before the commencement of this Decree shall be deemed to have been duly appointed under section 5 of the principal enactment as amended by this Decree.

Research
and records.

16. The Authority shall with a view to facilitating present or future research or planning, maintain and preserve such records relating to its functions as it shall consider proper; and shall have power to engage in research, and to assist others to engage in research, in respect of any matter relating to those functions and to publish such records and the results of any research in which it may engage.

Incidental
powers.

17. The Authority may carry on any activity which is reasonably requisite or convenient for or in connection with the discharge of its functions under this Act.

Authority to
co-operate
with other
public
authorities.

18. In the discharge of its functions the Authority shall co-operate fully with all Government departments and agencies and other public authorities.

Statutory
powers to be
exercised
consistently
with this
Act.

19. No person shall exercise any statutory power or duty inconsistently with the exercise of any powers or duties conferred on the Authority by or under this Act.

Directions
to the
Authority.

20. The President may after consultation with the Authority, give to the Authority in any matter of exceptional public importance, directions of a general character not being inconsistent with the provisions of this Act nor with the contractual or other legal obligations of the Authority as to the exercise by the Authority of its functions under this Act, and the Authority shall give effect to any such directions.

PART III—FINANCE

Authority to
aim at
making
profit.

21. (1) It shall be the duty of the Authority to conduct its affairs on sound commercial lines, and in particular, so to carry out its functions under this Act as to ensure that, taking one year with another, its revenues are greater than its outgoings properly chargeable to revenue account.

(2) The Authority shall charge to revenue account all charges which in the normal conduct of a business are proper to be charged to revenue account, including in particular, proper provision for depreciation of assets, or for renewal of assets, and in addition all interest on borrowings, repayments to be made each year in respect of loans incurred by the Authority to the extent that such repayments exceed provision for depreciation, and proper allocations to reserve.

of the Electricity Supply (Control) Ordinance (Cap. 66), to be exercised by itself, its workmen and agents, and be subject to the limitations and the duties there provided; and every person who has any estate or interest in any lands injuriously affected by exercise of the powers conferred by this section shall be entitled to compensation to be settled, awarded and paid in accordance (as nearly as may be) with the provisions relating to compensation which are contained in the State Property and Contracts Act, 1960 (C.A. 6).

13. (1) It shall be the duty of the Authority to take all reasonable measures, in co-operation with the Minister responsible for health, and with local authorities, to safeguard the health and safety of its employees and persons engaged on the construction of works referred to in section 10 of this Act and their families and dependents, and the inhabitants of Akosombo township and the lakeside area.

Health safeguards.

(2) The Authority shall, in and over the lake and the lakeside area, and in the township of Akosombo, be the authority for executing the provisions of the Mosquitoes Ordinance (Cap. 75), and shall have the powers referred to in section 3 of that Ordinance; and all amounts recovered under that Ordinance by the Authority shall be paid to the credit of the Authority.

14. (1) The President may by executive instrument make such provision as he thinks fit for constituting the Authority as the local authority for the township of Akosombo and the lakeside area, and for applying to the Authority, in its capacity as such, and with such modifications as may be expedient, the enactments relating to local government.

Authority to have local government functions and planning powers over Akosombo township and lakeside area.

(2) The Authority may, in consultation with the Minister responsible for town and country planning, exercise all the powers of that Minister in relation to town and country planning in the township of Akosombo and the lakeside area.

(3) The Authority shall take measures to enhance the natural beauty of the lakeside area by the planting of trees and otherwise; and shall be responsible for the development of Akosombo township in such a manner as to prevent the growth of slum or other conditions likely to be injurious to the health or well-being of the inhabitants.

15. The President may on terms to be agreed between the Government and the Authority and for the better discharge by the Authority of its functions under this Act require the Authority for such period as he may specify to perform any function of a Minister or any public authority or any body of which the Government is in control or over which it has powers of direction, in relation to the township of Akosombo and the lakeside area.

Additional powers.

- (b) the construction and operation of a transmission system for the distribution of the electrical power generated by the Authority;
- (c) the supply of the electrical power generated by the Authority to—
 - (i) any Government department or public corporation responsible for the supply of electrical power to the public;
 - (ii) the township of Akosombo; and
 - (iii) any other consumer, at voltages not lower than 11 kilovolts, and in quantities not less on the average in any period of twenty-four hours than 48,000 kilowatt-hours or its equivalent in terms of energy;
- (d) the provision, when and so far as practical, of facilities and assistance for the development of the lake as a source of fish, and as a route for the transportation of goods and passengers, and in any other manner; and
- (e) the development of the lakeside area for the health and well-being of the inhabitants, and people living adjacent thereto.

Amended by
N.L.C.D.
211.

(2) The Authority may also own, maintain, and operate vessels or craft of any kind and size for the purpose of transporting goods and passengers along the lake and may charge fares for the said services.

Flow of
water and
flooding.

11. (1) The Authority shall so control the dam as to prevent, so far as is practicable—

- (a) the harmful penetration of salt water up the River Volta to a greater degree than was normal at minimum river flow preceding the construction of the dam;
- (b) the level of the lake from rising to a height greater than 280 feet above mean sea level; and
- (c) such a flow of water past the dam as may cause flooding downstream from the dam above the levels which were normal preceding the construction of the dam.

(2) The Authority shall take all reasonable measures to give warning of possible flooding from the lake or from the River Volta downstream from the dam.

Powers in
relation to
transmis-
sion system.

12. For the purposes of constructing and operating the transmission system referred to in paragraph (b) of section 10 of this Act, or of preventing damage or obstruction thereto, the Authority shall have all the powers of the Chief Engineer set out in section 3

Cap 66 repealed
by Act 48 (8-24)
also repealed by
NLCD 125

6. (1) Any member, other than the Chief Executive, may at any time resign his appointment by notice in writing to the President. Resignation and re-appointment of members. Amended by Act 95.

(2) Every member shall, on ceasing to be a member, be eligible for re-appointment.

7. (1) The Authority may make, add to, amend and revoke standing orders, not being inconsistent with this Act, to provide for the application of the Authority's seal to legal documents, the proper conduct of the business and of the meetings of the Authority or any committee thereof, including the manner in which any matter is to be determined on behalf of the Authority, and the standing orders for the time being in force shall be observed by the Authority and its committees and members. Proceedings of the Authority.

(2) A quorum of the members of the Authority shall be four. The Chairman shall have an original and a casting vote.

(3) The validity of any proceedings of the Authority shall not be affected by any vacancy amongst the members thereof, or by any defect in the appointment of a member thereof.

8. (1) The Authority shall employ such staff and workpeople as may be necessary for the discharge of its functions, on such terms and conditions as it may think fit. Employees of the Authority.

(2) It is hereby declared that the terms and conditions referred to in subsection (1) need not be the same as those relating to the Civil Service.

9. The Authority shall, so far as may be consistent with the proper discharge of its functions, institute arrangements for the training of Ghanaians in administrative, technical, managerial and other capacities, with a view to securing the benefit of their knowledge and experience in the conduct of the Authority's operations, and with a view to all branches of the Authority's activities being, in due course, in Ghanaian hands. Authority to institute training programme.

PART II—FUNCTIONS AND DUTIES OF THE AUTHORITY

10. (1) Subject to the provisions of this Act it shall be the duty of the Authority to plan, execute and manage the Volta river development which comprises— Primary functions of the Authority.

(a) the generation of electrical power for the operation of an aluminium industry, and for general industrial and domestic uses in Ghana, by such means as the Authority may think fit, and in particular in the first instance, by the construction and operation of a dam and hydro-electric generating station in the vicinity of Akosombo;

(3) Without prejudice to the power of the Authority to establish appropriate reserves for replacements or other purposes, the Authority shall establish and out of its profits make payments to a reserve for the purpose of expending its activities.

(4) The Authority shall fix the rates at which it supplies the electrical power generated by it so as to ensure that it is able to comply with the requirements of this section.

22. (1) In order to enable the Authority to meet expenditure of a capital nature (including provision for working capital) for the discharge of its functions under this Act, and in particular for the financing of the operations referred to in section 10 of this Act, the Authority may borrow on such terms and in such currencies as may be agreed between it and any lender, such sums as it may require. **Borrowing powers.**

(2) The Authority may borrow temporarily, by way of overdraft or otherwise, such sums as it may require for meeting its current obligations or discharging its functions.

(3) The Authority may charge its assets, undertakings and revenues with the repayment of any money borrowed together with interest thereon and may issue debentures, bonds or other securities in order to secure the repayment of any money so borrowed together with interest thereon and may do all other things necessary in connection with or incidental to such borrowings as are authorised by this section.

(4) The President may, from time to time, prescribe the maximum sums which the Authority may borrow under either or both of subsections (1) and (2).

23. (1) During the ten years following the commencement of this Act the Republic shall invest in the Volta River development such sums, not exceeding thirty-five million pounds, as the Authority may require for the discharge of its functions under this Act. **Investment by the Republic.**

(2) The payment of the said thirty-five million pounds is hereby charged on the Consolidated Fund, and shall be made to the Authority in such instalments and at such times as may be agreed between the Minister responsible for finance and the Authority. **Amended by Act 95.**

(3) By way of return on the said investment the Authority may pay to the Accountant-General, out of income remaining available when the charges referred to in subsections (2) and (3) of section 21 of this Act have been provided for, such sums as the Authority after consulting the Minister responsible for finance, thinks proper having regard to its future financial requirements.

(4) When the Authority is of the opinion that its financial position justifies it the Authority may, by agreement with the Republic, repay in such amounts and at such times as may be agreed part or all of the capital sum invested by the Republic under the provisions of this section.

Amended by Act 95.

(5) Sums received under subsections (3) and (4) shall be paid in the Consolidated Fund.

Exemption from income tax.

24. The Authority shall be exempted from the tax imposed by the Income Tax Ordinance, 1943 (No. 27).

Government to reimburse Authority for certain measures.

25. The Republic shall pay to the Authority the net cost of any measures undertaken by it under sections 13 to 15 of this Act the necessity for which is not attributable to the creation of the lake or other activities of the Authority.

Accounts and audit.

26. (1) The Authority shall—

(a) cause proper accounts and other records in relation thereto to be kept;

(b) prepare an annual statement of accounts in such form and containing such particulars as the Auditor-General may from time to time direct, or as may be required to satisfy its undertakings or engagements.

(2) The accounts of the Authority shall be audited by an independent auditor to be appointed annually by the Authority subject to the approval of the Auditor-General, and the auditor shall make a report in each year on the accounts audited by him. The remuneration of the auditor shall be determined by the Minister responsible for finance and shall be paid out of the funds of the Authority.

Amended by Act 95.

(3) The Authority's financial year shall end on the last day of December in each year, and the period between the commencement of this Act and the last day of December, 1962 shall be the Authority's first financial year.

PART IV—ACQUISITION OF LAND AND RESETTLEMENT MEASURES

Filling of the lake and acquisition of land.

27. (1) The Authority shall, upon the completion of the dam, so operate the dam as to cause the lake to fill by the accumulation of water in the area upstream of the dam.

Amended by N.L.C.D. 211.

(2) The National Liberation Council shall cause to be acquired lands which in the opinion of the Authority:—

(a) may require to be inundated by the filling of the lake together with any other land not extending beyond one mile from the shores of the lake at its maximum fill;

- (b) may be required for the development of Akosombo township;
- (c) may be required for the use of persons being resettled as a result of the inundation of their lands by the filling of the lake;
- (d) are necessary to acquire for the proper discharge of the Authority's functions.

(3) All lands acquired under paragraphs (a), (b) and (d) of subsection (2) of this section shall immediately after their acquisition vest in the Authority without any further assurance than this subsection free from any incumbrances whatsoever and the Authority shall have power to sell, transfer, exchange, let or demise or otherwise dispose of all or any of them to or with any person and on such terms as it shall consider necessary for the proper discharge of its functions.

(4) Notwithstanding the provisions of any enactment under which the same were acquired all lands falling under both or either of the descriptions set out in paragraphs (b) and (d) of subsection (2), of this section being lands which have been acquired at any time before the commencement of this Decree and vested in the National Liberation Council immediately before such commencement are hereby vested in the Authority and shall be subject to the powers conferred on the Authority by subsection (3) of this section.

(5) Any land acquired under paragraph (c) of subsection (2) of this section may be transferred, exchanged, let, demised or otherwise disposed of by the National Liberation Council to or with any person whether or not that person is included among the persons being resettled and upon such terms as may be necessary for the promotion of the well-being of the resettlement areas and the inhabitants of those areas.

(6) No legal proceedings shall lie against the Authority as a result of the inundation of any lands caused by the filling of the lake.

28. The provisions of the State Lands Act, 1962 (Act 125) (relating to the acquisition of land) shall, subject to the following and such other modifications as may be required by the provisions of this Act, apply to all lands acquired under subsection (2) of section 27:—

- (a) the market value of any property so acquired shall be the amount which that property might have been expected to realise if sold in the open market by a willing seller to a willing buyer on the sixth day of March, 1957;

Compensation.
Amended by
N.L.C.D.
211.

- (b) compensation may be paid in money or in the case of lands acquired under paragraph (a) of subsection (2) of section 27 in non-monetary assistance towards settlement or both and no person shall be entitled to dispute the compensation offered to him by reason only that it is not in money, whether in whole or in part;
- (c) lands subject to the Administration of Lands Act, 1962 (Act 123) may be acquired under this Act."

Resettle-
ment
measures.
Amended by
N.L.C.D.
211.

29. The Minister responsible for social welfare (referred to in this section as the Minister) shall be charged with the duty of taking all reasonable measures to assist in the resettlement of the people inhabiting lands liable to be inundated and lands adjacent thereto which are needed by the Authority for the discharge of its functions, and it shall be the responsibility of the Minister to ensure, so far as is practicable, that no person suffers undue hardship or is deprived of necessary public amenities, as a result of his resettlement.

Defraying
expenses
incurred
under this
Part.

30. Expenses incurred in pursuance of this Part of this Act shall be defrayed, as to the first three million pounds by the Authority, as to the next million pounds by the Authority and the Government equally, and as to any excess over four million pounds by the Government.

PART V—MISCELLANEOUS

Guarantees.

31. (1) In the name and on behalf of the Republic, the President may in writing guarantee the performance of any obligation undertaken by the Authority.

(2) Moneys payable under any such guarantee are hereby charged on the Consolidated Fund.

Annual
report.

32. The Authority shall annually, not later than six months after the end of its financial year, present to the President a report dealing generally with the activities and operations of the Authority during the preceding financial year and containing:—

- (i) such information with regard to the proceedings and policy of the Authority as the Authority considers may properly be given without detriment to the interests of the undertaking of the Authority; and
- (ii) a copy of the statement of accounts referred to in section 26 of this Act, together with a copy of the report made by the auditor on that statement or on the accounts,

and the report shall not later than seven months after the end of the Authority's financial year be laid before the National Assembly.

33. (1) The Authority may, by legislative instrument, make regulations—

Power to make regulations.

- (a) prohibiting, restricting or regulating the use of the lake and the lakeside area;
- (b) prohibiting, restricting or regulating the abstraction of water from the River Volta or the lake otherwise than for the purpose only of obtaining water for domestic use in any village, town or house situate within the catchment area of the River Volta;
- (c) for the protection of any transmission lines erected by the Authority or any works or apparatus connected therewith;
- (d) imposing penalties on persons trespassing on any land in the ownership or possession of the Authority;
- (e) prohibiting, restricting or regulating the movement of motor or other traffic on or in the vicinity of the dam;
- (f) for the better discharge of the Authority's duties under section 13 of this Act; and
- (g) generally for the purpose of enabling the better discharge by the Authority of its functions under this Act.

(2) Any regulations made under this section may, in addition to the penalties which can be imposed by virtue of section 9 of the Statutory Instruments Act, 1959 (No. 52), impose in the case of continuous offences, a fine of £G5 for each day during which the offence continues.

(3) In lieu of prohibiting, restricting or regulating any activity, regulations made under this section may prohibit, restrict or regulate such activities without a licence to be granted by the Authority. Such regulations may prescribe the forms to be used and fees to be paid for such licences, and may provide for the delegation of the power to grant licences to a local authority.

(4) Proceedings for offences against any regulations made under this section shall not be instituted except by the Attorney-General, or by, or with the consent of, the Authority.

34. No matter or thing done by any officer or employee of the Authority shall, if the matter or thing be done bona fide for the purpose of executing any provision of this Act, subject such officer or employee or any person acting by his directions, personally, to any civil liability.

Protection of officers.

Interpreta-
tion.

35. (1) In this Act unless the context otherwise requires—
- “abstract” includes divert, or by any means cause to flow;
 - “Akosombo township” means such area as the President may by executive instrument specify in that behalf;
 - “the dam” means the dam referred to in paragraph (a) of section 10 of this Act;
 - “the lake” means the lake to be created as a result of the construction of the dam, as the waters thereof extend from time to time (including any islands therein);
 - “the lakeside area” means such of the lands referred to in paragraph (a) of subsection (2) of section 27 of this Act as are not for the time being comprised in the lake;
 - “the river Volta” means the following rivers so far as they are within Ghana, that is to say, the Volta, the Black Volta, the White Volta, the Red Volta, and the Oti river, and includes all rivers, streams and watercourses which are tributaries whether direct or indirect of any of the aforesaid rivers, or whose waters flow directly or indirectly into the lake, but does not include any part of the lake;
 - “supply” in relation to electrical power includes maintaining potential, whether or not the power so supplied is taken.

(2) For the purposes of the Rivers Ordinance (Cap. 226), and any other enactment the lake shall not be deemed to be a river; and section 10 of the Rivers Ordinance shall not apply to any part of the River Volta upstream of the lake.

(3) Officers of the Authority shall, for the purposes of the Criminal Code, 1960 (Act 29) and the Criminal Procedure Code, 1960 (Act 30) be deemed to be public officers.

Commence-
ment.

36. This Act shall come into force on such day as the President may, by legislative instrument, appoint.