THE VOLTA RIVER PROJECT

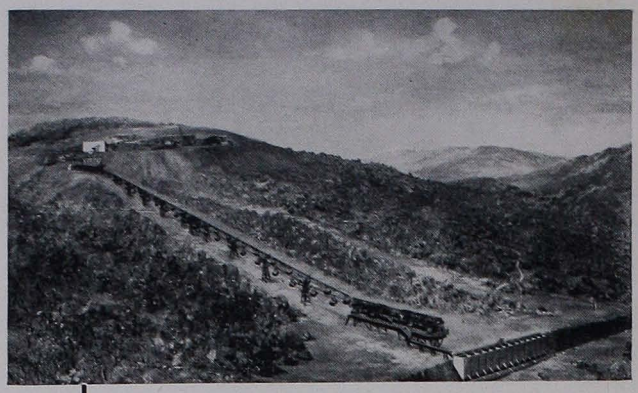
I: Report of the Preparatory Commission

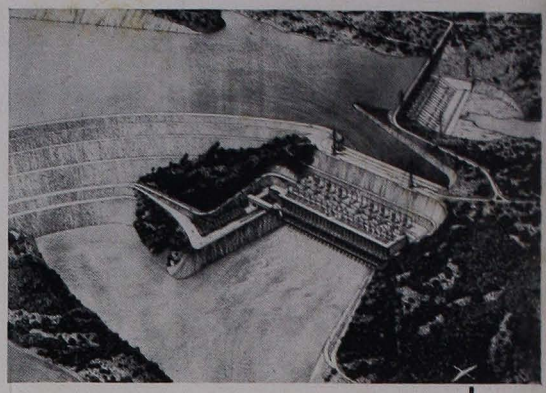
Reports of the Preparatory Commission for the Volta River Project

Report of the Preparatory Commission

Appendices to the Report of the Preparatory Commission

Engineering Report to the Preparatory Commission
(by Sir William Halcrow & Partners, MM.I.C.E.)





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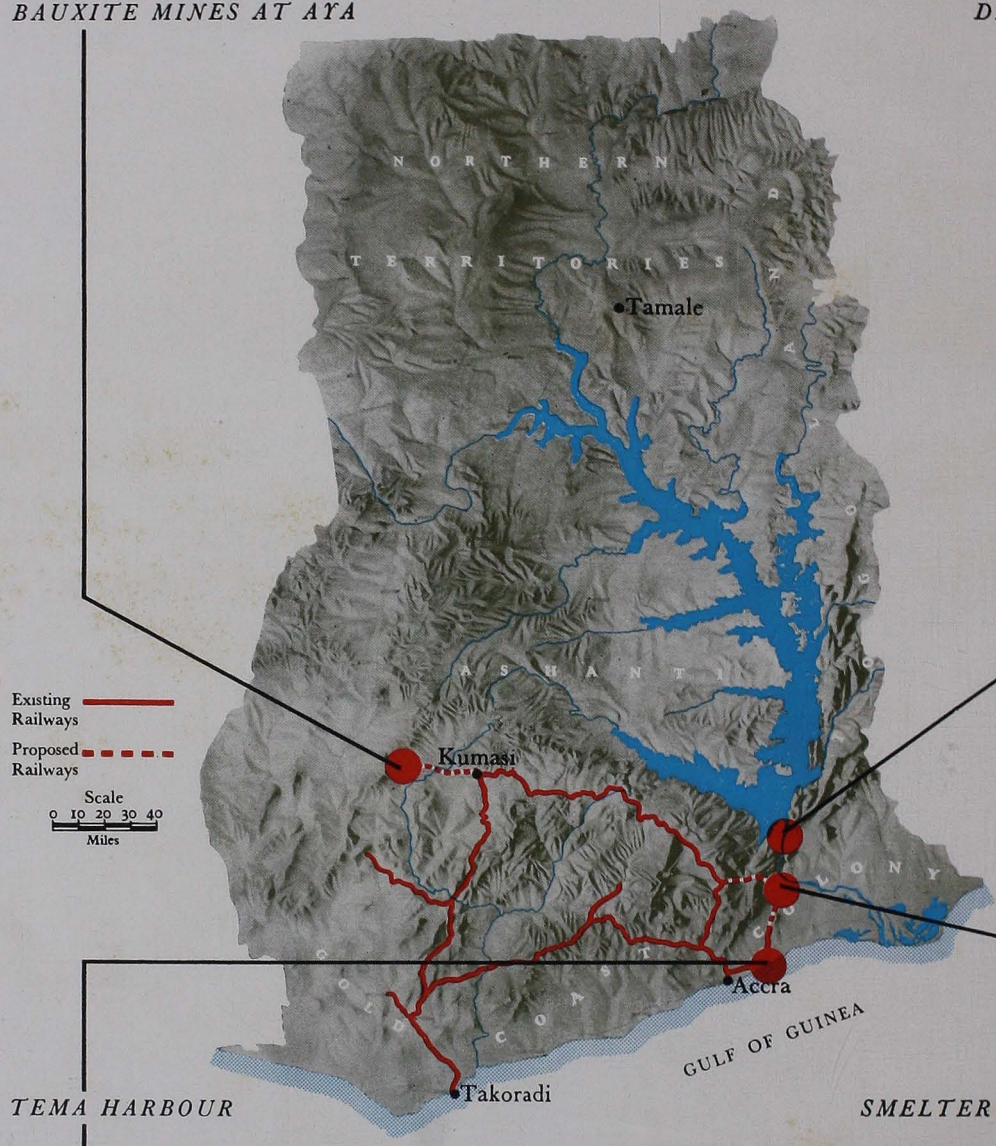

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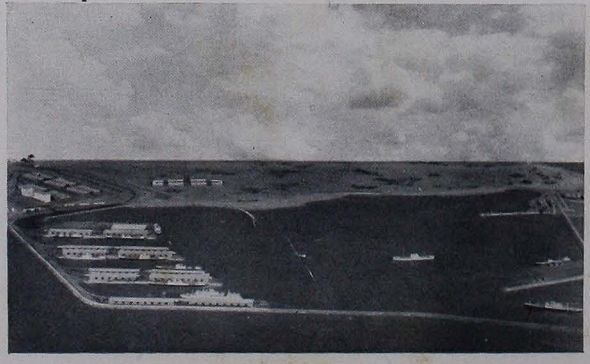

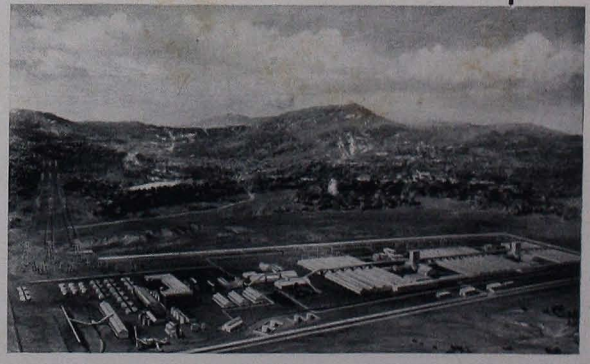

THE VOLTA RIVER PROJECT

I

REPORT OF THE PREPARATORY COMMISSION

LONDON

PUBLISHED FOR THE GOVERNMENTS

OF THE UNITED KINGDOM AND OF THE GOLD COAST

BY HER MAJESTY'S STATIONERY OFFICE

1956

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VOLTA RIVER PROJECT
PREPARATORY COMMISSION
ACCRA, GOLD COAST

31st December, 1955

My dear Prime Minister,

The Report on the Volta River Project containing the results of the investigations made by the Preparatory Commission is submitted herewith for consideration by the Government of the Gold Coast.

Copies of the Report are being sent to the United Kingdom Government, Aluminium Limited, and the British Aluminium Company.

It is hoped that the information which is now available will permit the Governments and the aluminium companies to decide whether they wish to proceed with the Project.

On behalf of the Commission, I wish to thank you personally and all the people in the Gold Coast with whom we have come into contact for the assistance we have received in our work, and for the courtesy which has been shown to us at all times.

Yours sincerely,

R. G. A. JACKSON

Hon. Dr. Kwame Nkrumah, LL.D., M.L.A.,
Prime Minister of the Gold Coast,
Accra.

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by Sir William Halcrow & Partners, MM.I.C.E.

(Published in a separate volume)

Chapter I

INTRODUCTION

1. This report is made by the Preparatory Commission which was set up in 1953 to carry forward the work which had already been done in investigating the Volta River Project, and to advance the planning of the scheme to a stage where a decision could be made whether it should be undertaken.

2. The report is supported by sixteen appendices which are being published simultaneously in a separate volume. A list of them will be found at page xv of this volume.

3. The Engineering Report of the consulting engineers, Sir William Halcrow & Partners, is also being published separately. It deals with the technical aspects of the dam and power installation and the new railways.

Description of the Project

4. A general description of the Project, which envisages a partnership between the Gold Coast Government, the United Kingdom Government, Aluminium Limited of Canada, and the British Aluminium Company, in order to develop large-scale aluminium production in the Gold Coast, is contained in a White Paper (Cmd. 8702) which was issued in November, 1952. A copy is reproduced as Appendix I.

5. The main works involved in the Project would be the development and operation of new bauxite mines; the building of approximately 83 miles of railways to transport the bauxite and ingot, etc; the construction of a large dam and power station (which would create a lake covering an area of approximately 3,500 square miles); the development and operation of an alumina factory and a smelter with an ultimate annual capacity of about 210,000 tons[1] of aluminium ; new roads to provide access to the main works and to replace those submerged by the lake; a new port to handle the flow of imports and exports associated with the scheme; and new townships at the site of the bauxite mines, the dam and the smelter. The geographical distribution of these works is shown on the frontispiece.

6. The fundamental element in the Project is the possibility of developing about 600,000 kilowatts of power from the Volta River cheaply enough to enable aluminium to be produced at an economic price from the great deposits of bauxite in the Gold Coast.

7. Exploratory discussions were held in late 1951 and during May and June, 1952. Both the United Kingdom Government and the Gold Coast Government favoured the scheme in principle, and believed it to be soundly conceived, but considered that the magnitude was such that " it should not be embarked upon without every practical assurance that it can be carried through to a successful conclusion."[2] The aluminium companies agreed with this view, and it was decided to establish a Preparatory Commission " to follow up the work which has been done already and to examine in greater detail the chief problems which would have to be overcome."[2]

Terms of Reference and Work of the Preparatory Commission

8. Broadly speaking, the Preparatory Commission was expected to survey the Project as a whole and to report on its feasibility. The original terms of reference in the White Paper were subsequently elaborated by the two Governments. These directions to the Commission, together with a description of its work, will be found in Appendix II.

9. In 1954, the two Governments agreed that, in order to preserve continuity, the Commission should remain in existence after it had reported and until a decision was taken about the Project. If there was agreement to proceed, the Commission would continue to function until a Volta River Authority was established on lines envisaged in the earlier discussions.

Consultation with the Governments and Aluminium Companies

10. In all the work of the Commission, constant touch was preserved with the Gold Coast Government by means of regular discussions with the Prime Minister and the two Ministers who were primarily responsible for dealing with the Project, and as a result of official meetings which affected virtually every Ministry and Department.

[1] The White Paper envisaged that there would be three stages of development. At the initial stage there would be capacity to produce 80,000 tons of aluminium annually; the intermediate and final stages would provide for 120,000 tons and 210,000 tons.

[2] White Paper (Cmd. 8702) " Summary of Proposals."

11. The progress of work was discussed periodically in London with the British Government and the British Aluminium Company, and in Montreal with Aluminium Limited. Reports were sent regularly to the Governments and aluminium companies throughout the life of the Commission.

Gold Coast National Committee

12. In July, 1953, the Gold Coast Government established a National Committee for the Volta River Project which included members of the different political parties. One of the main reasons for setting up this Committee was the desire of the Government to make the Project a matter of national concern. The background to the formation of the Committee is given in Appendix II. The Government arranged for all reports and documents prepared by the Commission to be considered by this Committee in order to have the benefit of its advice. Members of the Committee visited aluminium installations in Canada and the United Kingdom in 1953 and 1955.

Assistance from Other Authorities

13. In preparing its programme of work and in all its subsequent investigations, the Commission endeavoured to take advantage of knowledge and experience gained from major projects in other parts of the world, especially those undertaken since the end of the last war. Personal liaison was maintained with those concerned with the construction and administration of many of these schemes, and valuable assistance and guidance was received. Similarly several national Governments helped the Commission with its investigations of particular problems, and certain of the specialised agencies of the United Nations were consulted. Appropriate acknowledgements are made later in this report. These arrangements not only provided the Commission with valuable technical information; they often made it unnecessary to investigate to a further stage particular aspects of individual problems, and thus reduced the cost of the Commission's own investigations.

Responsibility for Statements and Opinions

14. The Commission received a great deal of help and advice in its work, but responsibility for statements and opinions expressed in this report rests with the Commission unless specifically stated otherwise.

General Considerations

15. Throughout its work, the Preparatory Commission kept certain general considerations constantly in mind. Since the Project would be constructed and operated in the Gold Coast,[3] it would be essential for it to be acceptable, both politically and economically, to the Gold Coast Government. The Project would have a greater relative importance to the Gold Coast Government than to the other parties, and some problems have therefore been discussed at length in this report (e.g. in Chapters 14 and 15) in order to assist the people of the Gold Coast and all others concerned to obtain a full understanding of the scheme. Furthermore, because of the close inter-relationship of many of these problems, certain statements have been repeated in various parts of the report in order to present a complete picture of each topic.

16. It was always appreciated that from the point of view of the British Government, and the aluminium companies, it would not be enough to demonstrate the technical and economic soundness of the Project; the great overseas investment involved in the scheme would also depend on the climate for investment in the Gold Coast. Another important factor was that the failure or success of this scheme could have a profound influence on the possibility of raising finance for the development of other large-scale schemes in the less developed parts of the world.

Basic Approach to the Project

17. These considerations, and experience with multi-purpose projects undertaken in other countries since the end of World War II, reinforced the Commission's basic policy of considering every aspect of the Volta River Project on a very conservative basis. The Commission requested the consulting engineers and the aluminium companies to adopt a similar policy, particularly when preparing estimates and making technical calculations. Whenever alternative estimates or possible developments were placed before the Commission, the least favourable was always accepted for the purpose of planning and analysis. In short, the Commission made no optimistic assumptions at any time about any aspect of the Project.

[3] Those readers who may desire to obtain more general information about the Gold Coast are referred to " Report on the Gold Coast for the Year 1954 " published by Her Majesty's Stationery Office.

Analysis of the Project

18. The Commission first studied the Project as a whole, and then, for purposes of analysis, divided it into five main component parts:

(*a*) the survey, development and operation of the bauxite mines in the Aya/Yenahin area;
(*b*) the analysis of the problems of communications and logistics involved in the moving of materials associated with the Project; and, in particular, the survey, construction and operation of the proposed new railway links between the mines and the smelter;
(*c*) the detailed investigation, construction, and operation of the dam and power installation at Ajena, and its effects on the surrounding country;
(*d*) the construction and operation of the alumina factory and smelter near Kpong;
(*e*) the construction and operation of the new port at Tema, which had already been authorised by the Gold Coast Government.

19. From the outset, it was decided that the analysis of these five component parts, and of the Project as a whole, should be carried out in three distinct stages.[4]

First: to demonstrate that each component part was sound from a technical point of view;
Second: to analyse all the economic and financial aspects of the Project;
Third: if the two earlier stages indicated that the scheme was technically sound and economically acceptable, to consider certain general factors which could exercise a decisive influence over the Project as a whole.

Results of Investigations

20. The results of the Commission's investigations are contained in this report and its appendices and in the Engineering Report of the consulting engineers. This report is divided into seven parts:

Part I: Technical Aspects and Human Factors.
Part II: Effects of the Dam and Lake.
Part III: Financial and Economic Aspects.
Part IV: Other Factors which could influence the Project.
Part V: Administrative and Legal Framework.
Part VI: Future Action.
Part VII: General Observations, and Acknowledgements.

General Conclusions

21. A large number of detailed recommendations have been made in the Commission's reports dealing with specific subjects; they are contained in the appendices.

22. In this report, six general conclusions are reached:

One: The Volta River Project can be regarded as technically sound, and could be carried out successfully.

Two: The Commission on the evidence available to it considers that the Project as conceived in the various technical reports is not capable of significant improvement from an economic point of view.

Three: Since the cost of power and rail freights would diminish sharply with increasing aluminium production, the greatest return from the Project would be derived by achieving maximum production as soon as possible.

Four: The Project should be competitive in relation to other schemes, provided that:
(*a*) it was completed according to the timetable of construction;
(*b*) a sound policy was adopted in the employment and provision of living conditions for the labour force;
(*c*) economic stability in the Gold Coast was maintained;
(*d*) the aluminium companies were satisfied that the internal cost of operating the smelter would be acceptable.

Five: The local effects of the dam and the lake could be dealt with satisfactorily.

Six: The Commission considers that the other factors enumerated in the report which might influence the Volta Project should not affect it adversely, provided

[4] Another advantage of analysing the Project in this sequence is referred to in Appendix II, paragraph 20.

that the future development plans of the Gold Coast Government were effectively co-ordinated with the Project, and that the efficiency of the Gold Coast Government was not prejudiced by serious shortages of administrative and technical personnel; and provided that the climate for investment in the Gold Coast was attractive; and assuming that the level of future world demand for aluminium[5] and future developments in the generation of power from nuclear energy did not make the Project uneconomic.

These conclusions are amplified in Chapters 12, 18, 26 and 34, and should be read against the background of general observations made in Chapter 44.

Estimated Cost

23. The financial and economic aspects of the Project are examined in Part III of this report but, for ease of reference, a summary of the estimated costs is given here.

Aluminium Production:	*Initial Stage 80,000 tons*	*Intermediate Stage 120,000 tons*	*Final Stage 210,000 tons*
	£m	£m	£m
Jointly Financed			
A. Dam and Power Installation	60.2	64.0	67.6
B. Smelter & Mines	43.1	57.9	91.2
Gold Coast Government Financed			
C. Railways	15.9	16.6	18.1
D. Other Direct Commitments	2.5	2.8	5.0
E. Other Possible Investments Arising from Project	1.5	4.2	10.0
F. Allied Development Expenditure[6]	39.4	39.4	39.4
Total	59.3	63.0	72.5
TOTAL	162.6	184.9	231.3

24. These estimates are based on an interest rate of 5% (which is above what the market rate has been in the United Kingdom in recent years) and indicate that at the final stage of development power would cost 0.199 pence per unit. The Commission believes that power at this price would be fully competitive with that produced from any other schemes of similar magnitude which have recently been completed, or those now under consideration for which estimates have been published.

25. The two Governments and the aluminium companies have always insisted that the Volta Project should be investigated with particular care, and this report indicates (amongst other things) the attention which has been given to every aspect of the costs which it is estimated would be involved in construction. As noted in paragraph 17, a conservative approach to the scheme has invariably been adopted by the Commission and its consultants, and it is believed that the estimates shown above now represent as accurate an assessment as can be prepared in advance of actual construction. Construction could not be completed for about another ten years, however, and the Commission feels that an effort should be made to predict possible increases in the ultimate cost of the scheme so as to assist the Governments (particularly the Gold Coast Government) and the aluminium companies in their planning of investment.

26. Having regard to world economic conditions during the past decade, and to experience in other parts of the world in building large projects over the same period, it is considered that it would be prudent to allow for an increase of the order of 40% to 50% in the estimates for the power project, the smelter and the railways, in order to obtain a realistic appreciation of the possible ultimate cost of the scheme. This problem is considered in detail in Chapter 28. Such an increase in the cost of the Project would, of course, be offset to the extent of any increase in the price of aluminium, and the competitive position of the Project would remain unimpaired since any increase in world prices would affect proportionately the cost of all other similar schemes.

[5] The spectacular increase in world production and consumption of aluminium during the last ten years is shown in the table in paragraph 615.

[6] The heading "Allied Development Expenditure" covers investment in port, town and road development which the Gold Coast Government has already decided to undertake for the general benefit of the country irrespective of the decision on the Volta Project. The expenditure would therefore form part of the normal development programme of the Gold Coast, but is included in the above table since all the works concerned would be essential for the operation of the Project.

PART I

Technical Aspects and Human Factors

Chapter 2

TECHNICAL ASPECTS

General Description

27. The geographical relationship of the five component parts of the Project (paragraph 18) may be observed on the frontispiece. A general description is now given of the main features of each component.

The Bauxite Deposits and Mines in the Aya/Yenahin Area

28. Bauxite for the operation of the smelter company[1] would be obtained from deposits in a range of hills rising to over 2,000 feet about 35 miles west of Kumasi. It has been estimated that there are about 200 million tons of bauxite in this general area. Exploratory drilling by the aluminium companies in 1945/46 and in 1953/54 has so far indicated the existence of about 140 million tons.

29. The bauxite would be extracted by opencast mining operations of a type similar to that already employed in the Gold Coast at the bauxite mines at Awaso operated by the British Aluminium Co., Ltd. The ore would be reduced to 5″ size in a crushing plant, and then conveyed by belt to storage bins which would feed into the buckets of an aerial ropeway system, leading to the railhead. At that point there would be large storage bins from which the bauxite would be drawn off by special ore-carrying railway wagons.

30. A new village would be needed to house the mine workers; it is referred to in Chapter 10.

The New Railways

31. The railways required to bring the bauxite to the smelter, and to connect the smelter with the new port at Tema are considered in Chapter 5. Three new links would be required: one from the area of the deposits to the existing railway at Kumasi, a second from Koforidua to the smelter near Kpong, and a third from the smelter to the existing railway which runs between Shai Hills and Tema.

The Dam and Power Installation at Ajena

32. A full description of the hydro-electric project is given in the Engineering Report of the consulting engineers; the most important aspects are summarised in Chapter 3 of this report.

The Alumina Factory and Smelter near Kpong

33. Earlier investigations suggested that the best location for the smelter would be in the general area of Kpong. During 1954 representatives of the aluminium companies examined the area in greater detail and selected a site immediately north of the road between Somanya and Akuse, and just to the north-east of Krobo Hill. The site is suitable for a large industrial plant (the total area needed for the smelter being slightly over a square mile), since it is extensive, level, and well-drained, and has a rock foundation sufficiently firm to carry heavy plant and structures. In addition, it provides suitable ground for the disposal of red mud, the main effluent from aluminium manufacture, and can readily be provided with the ample supply of good water required for the various processes by pumping from the Volta below the Kpong rapids. The site is readily accessible from the road which the Gold Coast Government is building from Tema to the new bridge across the river at Adomi, and could be reached by new railways without difficulty. There is at present very little habitation or cultivation in the immediate vicinity.

34. The works would consist of an alumina plant which produces aluminium oxide (i.e. alumina) from the bauxite, and a smelter which extracts aluminium metal from the oxide. In addition there would be numerous ancillary buildings. The processes in both the alumina plant and the smelter would be carried on 24 hours a day throughout the year.

35. It is anticipated that the working force (estimated at about 9,000) required for the full development of aluminium production, together with its dependants, as well as the people who would provide goods and services and undertake other activities normal to an urban community, would ultimately lead to the formation of a township with a population of about 50,000. This major development is considered in Chapter 11.

[1] It has always been envisaged that a single company would operate both the bauxite mines and the smelter.

The New Port at Tema

36. If the Volta Project was undertaken, a new port would be essential. The Gold Coast Government decided in 1952, irrespective of the decision on the Volta scheme, to go ahead with the construction of a deep-water harbour at Tema, about 17 miles east of Accra, to supplement Takoradi (which has just been expanded to its maximum capacity). The adequacy of port facilities in the Gold Coast, including the development at Tema, is discussed in relation to the Project in Chapter 4 as part of the general problem of logistics.

37. This site has an entrance depth of 42 feet of water with a small tidal range, with good foundation conditions and little risk of siltation. The plans for the new harbour provide for enclosing an area of about 500 acres of water between two breakwaters. Ultimate development would comprise 10 deep-water berths at the main breakwater, and three oil berths on the lee breakwater. In the first stage of construction the two breakwaters will be fully completed; but only one finger quay will be built giving four berths, one of which will handle passenger traffic. One oil berth will also be provided at the lee breakwater, and a fishing harbour will be constructed alongside this breakwater. The main contract for this work was let in July, 1954, the contract price being £7½ million. A new township is in course of construction at Tema.

Technical Investigations

38. When considering the technical aspects of the five component parts of the Project, the decisive effect of cheap power on the economic feasibility of the scheme made it imperative for the Preparatory Commission to ensure, to the best of its ability, that the dam and power installation was investigated with exceptional care and thoroughness. This procedure was reinforced by an arrangement which was made with Aluminium Limited, immediately after the Commission was established, by which the consulting engineers worked in close collaboration with the staff of Aluminium Laboratories (a subsidiary of Aluminium Limited) thus permitting their very wide knowledge and experience in the development of hydro-electric schemes to be applied to the Volta Project.

39. The Preparatory Commission also made arrangements for the problems of communications and logistics involved in the Project to be investigated carefully in order to ensure that the method of transport finally selected for the movement of bauxite and ingot, etc. would be the most economic and efficient. The technical factors associated with the proposed new railway links for the movement of bauxite and ingot, etc. were investigated with particular care by the consulting engineers, the Gold Coast Government, and the aluminium companies.

40. The exceptional experience of the aluminium companies in many parts of the world in mining bauxite, and in constructing and operating alumina factories and smelters, made it unnecessary for the Preparatory Commission to investigate the technical features of these component parts. Nor did the Preparatory Commission investigate the technical features of the new port at Tema since the primary responsibility for this work lay outside the Commission, and tenders for construction were invited very shortly after the Commission was set up.

41. The Preparatory Commission was thus primarily responsible only for the technical aspects of the dam and power installation and of the communications system which are dealt with in Chapters 3, 4 and 5; but it was vitally concerned with all five components of the Project in analysing the resources of materials and manpower which would be required for its construction.

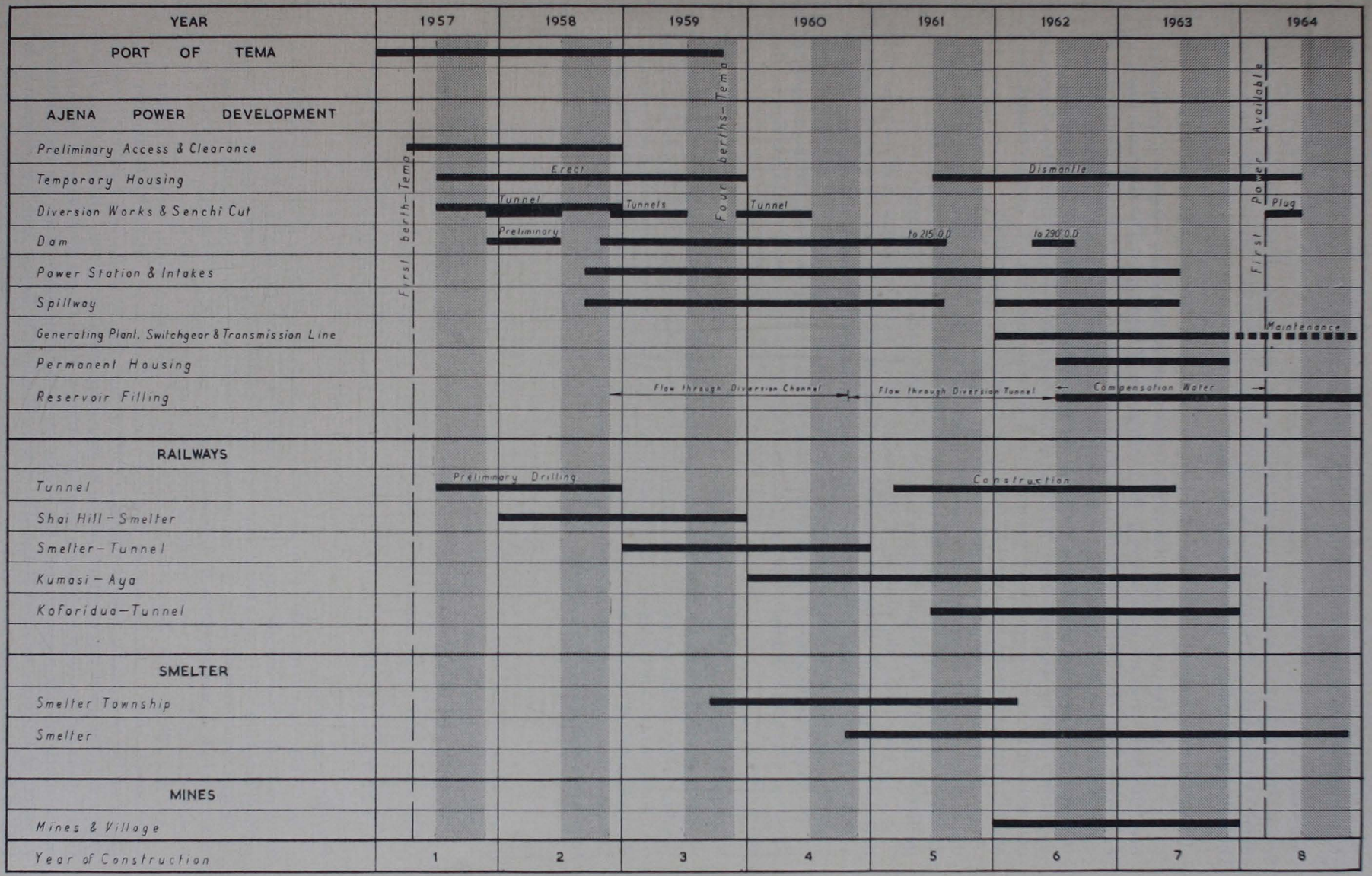
Resources

42. The earlier discussions about the Project in 1951 and 1952 had rightly emphasised the importance of ensuring that the necessary resources required for construction—particularly local manpower—could be provided, and the Commission therefore paid special attention to these problems. The materials needed for the Project are analysed in Chapter 6, and a wide range of problems relating to manpower, which the Commission believes could exercise a decisive influence over the success of the whole scheme, is considered in Chapters 7 to 11.

Co-ordination with Gold Coast Development Plans

43. The determination of materials and manpower required for the Project was also of major importance in analysing the effect it would have on the development plans of the Gold Coast Government. The need for ensuring that the requirements of materials and manpower for the scheme would be effectively co-ordinated with all other demands on those resources in the Gold Coast was fully recognised by the two Governments and the aluminium companies during their earlier discussions. The problem is considered in Chapter 28, which deals specifically

PROPOSED CONSTRUCTION PROGRAMME



with one aspect that could exercise a major influence on the Project, the availability of administrative and technical manpower to the Gold Coast Government.

Estimates

44. In this part of the report, certain estimates of cost are given, but are not discussed in detail. All financial and economic matters are considered in Part III. The costs given have been based on prices ruling at 30th September, 1955.

Timetable for Construction

45. It is thought that consideration of this report might be assisted by reference to the diagram overleaf which shows the main stages in the construction of the Project. The diagram is based on a decision about the Project being taken in sufficient time in 1956 to permit construction to commence in 1957. Throughout this report and its appendices, and in the Engineering Report, 1957 has been used for planning purposes as the base year for starting construction, since it is the earliest date by which work on the Project could begin. If a decision about the scheme was not reached in 1956, there would naturally be a consequential delay in starting construction, and all dates used in this report would need to be adjusted correspondingly.

46. As the dam and power installation would require the longest period for construction, this component part naturally determines the timetable for the Project as a whole. First power should be available early in 1964; the railways would have to be ready by that date; and the smelter would have to be sufficiently advanced to enable production to start.

47. In considering the phasing of construction of all five component parts, careful consideration was given to those arrangements which would contribute most to the development and maintenance of stable labour forces and would simultaneously ensure that the several parts of the Project were completed at the right time.

48. The effect on interest charges of the timing of the construction of each of the component parts was also borne in mind constantly when arranging the programme of construction for the entire scheme.

" *Construction Phase* " *and* " *Operating Phase* "

49. References in this report to " construction phase " cover the period of eight years (ending in 1964) during which the construction of all components of the Project should be completed to the initial stage. " Operating phase " indicates the period which would start on the completion of the " construction phase," i.e. for the purposes of planning, 1965. It should be noted, however, that the smelter would be brought into operation progressively from the time when first power was available.

Chapter 3

TECHNICAL ASPECTS OF THE DAM AND POWER INSTALLATION

Power from the Volta

50. When considering the proposed power development at Ajena, the Commission was sensitive to the fact that about 90% of the power generated would be required for aluminium production. Although it was obvious that the economic justification for the hydro-electric scheme at Ajena depended entirely on the use of a great proportion of the power for the manufacture of aluminium, it was apparent that genuine doubts might arise whether the long-term power requirements of the Gold Coast would be prejudiced by the Volta Project.

51. Accordingly, the Preparatory Commission in December, 1953, proposed to the two Governments that a general survey should be made of the power potential at another site, higher up the river, at Bui (about 120 miles north of Kumasi), so that a better picture could be obtained of the total power which might be generated from the Volta, and the Gold Coast Government thus enabled to plan its power policy on a much firmer foundation. The Governments approved this proposal, and the results of the investigations made by the consulting engineers at Bui are contained in Part III of their Engineering Report and are summarised in Section B of this chapter.

A. POWER AT AJENA

Conclusions of the Consulting Engineers

52. Detailed investigations into the technical aspects of the proposed dam and power installation at Ajena were made by the consulting engineers in accordance with a programme of work approved by the Preparatory Commission and the two Governments. The results of the consulting engineers' investigations are contained in the Engineering Report in which their conclusions are summarised as follows:

> " As a result of five years of work on the Volta River Project and our deliberations with the Preparatory Commission and the aluminium interests, we are now able to present firm proposals for the development of the power potential of the Volta River. With the considerable fund of information now available, we have prepared designs and estimates of costs of the various components of the Project, and have conducted detailed analyses of the likely requirements of labour and materials. Our proposals are given in detail in the following chapters of this (Engineering) report and are summarised below.

Main and Ancillary Works

1. We consider that the water power resources of the River Volta can be developed most economically by the construction of a dam and power station at a site at Ajena Island.
2. After a detailed investigation of site conditions and careful consideration of the various factors, technical and economic, affecting choice of site and alternative designs, we recommend the construction of a rockfill dam, with a crest 4,100 feet long and with a height of 310 feet above the river bed in the deepest part, to be made impervious on the upstream face by a layer of compacted clay contained between filters of sand and graded crushed rock.
3. We propose a power system on the eastern flank of the dam, to consist of a forebay with control gates, and of steel-lined tunnelled penstocks leading to a power station and tailrace, which would discharge into the river channel immediately downstream of the dam. A natural saddle on the east flank, to be deepened by excavation and in which there would be constructed a concrete weir with control gates, would provide a spillway capable of dealing with all possible floods. Discharge from the spillway would be returned to the river downstream of the power station.
4. A small township for the accommodation of the station operating staff could be sited on a hill above the lakeside immediately to the north of the spillway. A new road could be constructed on the east bank of the river, leading northwards from the new Volta Bridge at Adomi to the Power Station and Township.
5. We recommend that the spillway weir should be designed so as to retain the reservoir water level at a maximum of 276 feet O.D., and that the crest of the dam should be at 290 feet O.D. Under normal conditions of inflow and usage the reservoir level would be controlled between levels 276 feet O.D. and 252 feet O.D., giving a drawdown of 24 feet. Under conditions of exceptional flood inflow into the reservoir the water level could rise to 280 feet O.D. but, except in extremely remote circumstances, no higher.

   The influence of the reservoir on river flow below the dam would be to even out the seasonal variations, and to reduce the frequency of normal floods and the magnitude of abnormal floods.

   It is proposed to increase the head produced by such a dam by cutting a channel 300 feet wide and 28 feet deep through Senchi Rapids, eight miles downstream of the dam, and at a later stage in the development of the Project, by forming an additional small cut in the crest of Kpong Rapids, five miles below Senchi.

6. *Available Power*

   With a normal reservoir drawdown of 24 feet and after allowing for an annual abstraction of water for irrigation not exceeding 710,000 acre-feet, we consider that the flow from the reservoir can be regulated to provide a firm output of 617,000 KW. of continuous power. Alternatively, if the project were allowed to develop its full power and any irrigation water needed were to be pumped using power derived from the station a firm output of 633,000 KW. could be generated.

7. *Disposal of Power Generated*

It is proposed that the bulk of the energy produced should be used for the smelting of aluminium at a site near Kpong to which it would be carried by overhead line at a voltage of 165 KV. It would be metered at this voltage and made available to both the aluminium industry and public supply, at a sub-station near the aluminium smelter, subject to agreement between the Gold Coast Government and the Aluminium Companies operating the smelter.

8. *Development of the Project*

It has been agreed that the Project should be developed in three stages, the first to provide for the production of 80,000 tons of aluminium annually.

We recommend that the first stage of development should provide for the installation of four units, each consisting of a Francis turbine and generator of 90 MW capacity, and for one double-circuit transmission line to Kpong. Each of the succeeding stages of development would require the provision of two additional units of the same size. The transmission would be supplemented by the erection of one additional double-circuit line which would suffice for both additional stages. The proposed cut in the crest of Kpong Rapids would be carried out for the final stage of development.

Provision would be made in the civil engineering structures for space for one additional unit, should this at some future date be required to deal with any change of load factor in the public supply.

9. *Flood Warning*

In order to assist in effective operation of the spillway whereby abnormally high levels in the reservoir and high flows downstream of the dam might be avoided, we consider it essential that arrangements should be made to enable the power station superintendent to anticipate unusually high inflows to the reservoir.

This would involve maintenance of some existing river gauges and the establishment and maintenance of additional gauges on the larger tributaries. It would require an assurance of prompt collection, co-ordination and despatch of rainfall records from all recording stations, both in the Gold Coast and adjoining French Territories, to an engineer who might be established at the power station and who would be responsible for assembling and evaluating the information, forecasting probable inflow into the reservoir, and advising the station superintendent, accordingly.

10. *Compensation Water*

Investigations have shown that during the conditions of continuous low flow which would prevail during the period of filling of the reservoir there would be penetration of salt water up river which would affect the drinking water supplies of riverside villages for some miles above the estuary. To counteract this, it is proposed that during the filling of the reservoir and until the first power unit is placed in regular operation provision should be made for passing a constant flow of 5,000 cusecs compensation water past the dam. Such loss of water must increase the time of filling the reservoir and accordingly delay the date of production of first power, and consideration should be given to the possibility of a periodic flushing of the river by regulation of the amount of compensation water being passed, so as to reduce the total quantity of water lost.

11. *Cost of the Project*

We estimate the capital cost of the works, embodying all our recommendations and including transmission to Kpong and the provision of H.T. metering and switchgear there, and inclusive of interest on construction costs during the estimated period of construction, to be £60¼ millions for the first stage, an additional £3¾ millions for the second, and a further £3½ millions for the final stage of development. These costs are calculated on prices ruling at 30th September, 1955, and make no allowance for any rises in prices in any country.

12. *Construction Programme*

We consider that the first stage of the development can be completed in seven years, and that if construction of the dam be commenced not later than mid-1957

and, given normal rainfall in the catchment, the reservoir should fill to a level sufficient to produce first power early in 1964 and full power for the first stage of development by the middle of 1966.

13. *Requirement of Labour and Materials*

The construction of the works would require a labour force which we estimate may reach a peak of about 5,000 by the fourth year, of whom we must expect some 250 to be overseas staff required for supervision and for certain highly skilled trades which cannot be filled locally. In order to keep this force stable, to reduce turnover and thereby to assist in ensuring a satisfactory rate of productivity, it is the policy of the Preparatory Commission to make provision for family life and to establish a normal community for the force during the period of construction. In our proposals we are therefore making the necessary provision, as recommended by the Commission, for the desired standards of living and for the amenities which are calculated to aid these objectives.

14. The community would not be required to outlast the period of construction, and accommodation of a temporary nature only would be required. With this in mind, and in order to reduce to a minimum the manpower required for its erection, we recommend that only prefabricated structures be used for the housing and ancillary community buildings.

15. We estimate that the cost of the temporary housing, inclusive of hospitals, schools, community centres and other amenities, of roads and other services, and of the supply of water and electric power, would be about £4½[1] millions. Allowing for contingencies, engineering and interest during construction this figure would amount to nearly £7 millions. A further investigation is being made in an effort to reduce the cost of such housing.

16. *Preliminary Works*

In order to ensure that the construction of the dam may be started without delay, it would be advisable to complete the provisions for access to the works, and for housing for the initial labour force, in advance of the main works, and we strongly recommend that, subject to a decision that the Project will proceed, contracts should be placed for the proposed new road from the Volta Bridge to the site, and for about 5% of the housing, not later than the end of the first quarter of 1957. The cost of these preliminary works is not expected to exceed £400,000.

17. *Form of Contracts*

We recommend that all civil engineering contracts and others, where appropriate, should be placed by competitive tender, on a schedule-(or unit-) price basis.

In view of the length of time of construction and uncertainty with regard to prices, we consider it essential that the contract should contain rise and fall clauses to allow for fluctuations in the basic costs of labour and materials outside the contractor's control."

Endorsement by Aluminium Limited

53. As indicated in paragraph 38, arrangements were made at an early stage for Aluminium Laboratories to co-operate closely with the consulting engineers in their investigations (particularly as the aluminium companies would be paying for so much of the power) and the Commission asked Aluminium Limited to indicate, at the proper time, whether it agreed with the investigations and conclusions of the consulting engineers. In addition to working with the consulting engineers, Aluminium Laboratories carried out independently a wide range of investigations into the power potential at Ajena.

54. Aluminium Limited informed the Commission in November, 1955, that "..... as a general observation, Aluminium Limited is satisfied that the consulting engineers have carried out a very thorough engineering investigation and that the conclusions and recommendations based upon their findings are sound in the light of the data now available. It is also considered that the preparation of relevant data, of associated general plans and report drawings, and the draft 'Agreement, General Conditions of Contract, Specifications, Descriptions of Works, Bills of Quantities and Tender and Bond for the Power Development Works' have been advanced as far as was possible within the time available....."

[1] This figure excludes recurrent costs of medical and education services which, if included, would increase the total to £4.9 millions (see paragraph 463).

55. Aluminium Limited have expressed differences of view on a small number of individual technical points, but they do not in any way invalidate the company's basic acceptance of the consulting engineers' work. Aluminium Limited has also expressed reservations on a small number of individual estimates; they are dealt with in Part III of this Report, but, again, do not basically affect their endorsement of the Engineering Report.

Endorsement by Doctor A. E. Morgan

56. Doctor A. E. Morgan visited the Gold Coast in the latter portion of 1953, to survey the scheme generally on behalf of the Gold Coast Government, and, in particular, to study the proposal for the dam and power installation. Subsequently, he has been kept fully informed of the Commission's investigations. He has said:

> " It is my considered opinion that the Project is sound and desirable from a technical engineering standpoint and from the standpoint of public policy. Taken all together, the studies and preparations for it have a degree of completeness and thoroughness which are unusual outside the well industrialized countries of Western Europe, the British Commonwealth and the United States, and compare favourably with the better planned projects in those countries....."

Endorsement of Estimates by Cooper Brothers & Co., Chartered Accountants

57. The consulting engineers' estimates of capital costs and operating charges have been examined by Cooper Brothers & Co. Their report is reproduced as Appendix XIV, and is discussed in Chapter 20 of this report. It is relevant to note here that (subject to detailed elaboration in their report) Cooper Brothers & Co. state that " accepting the technical foundation of the estimates as sound, we consider that the estimates examined by us have been properly compiled and fairly represent the probable cost of the capital and operating charges of the hydro-electric project."

Allocation of Power

58. At the time of the earlier discussions in 1951 and 1952, it was anticipated that 564,000 kilowatts of power would be available. Of this, 514,000 kilowatts would be used by the smelter company to produce 210,000 tons of aluminium; the balance of 50,000 kilowatts being reserved by the Gold Coast Government for other uses. During the course of the Commission's work it became apparent that a misunderstanding existed between the Gold Coast Government and the aluminium companies whether this 50,000 kilowatts should represent average or maximum demand. However, the later investigations into the potential at Ajena now show that (assuming evaporation at 55" per annum) 617,000 kilowatts could be developed there—representing an increase of about 10% over the earlier estimate—quite apart from the possibilities at Bui. It should not be difficult, therefore, for the Gold Coast Government and the aluminium companies to agree on the division of available power.

Evaporation

59. The Commission wishes to draw attention to the importance and also the difficulty of determining the rate of evaporation which may be expected from the new lake.[1] The consulting engineers have always been aware of the particular importance of this problem, and the Chief Meteorologist of the Gold Coast Government, Mr. H. O. Walker, B.Sc., has rendered most valuable service in seeking to ensure that as much information as possible was obtained so that the likely limits could be estimated with as great a degree of accuracy as possible.

60. Dr. H. L. Penman, M.Sc., Ph.D., F.Inst.P., of the Rothamsted Experimental Station, who has done outstanding research on evaporation, visited the Gold Coast in 1955 at the invitation of the Preparatory Commission and studied at first hand the problems of evaporation associated with the Project. Dr. Penman's report is reproduced as Appendix III. He concludes that the evaporation would lie in the range of 58" to 70" a year, and proposes that 66" should be assumed.

61. Arrangements were also made to consult authorities in various parts of the world on this subject, particularly the Air Ministry Meteorological Office in the United Kingdom, and the

[1] The Commission's general attitude was reinforced by the following observation made by the Task Force on Natural Resources in the Report to the United States Congress (in March, 1949) of the Commission on Organisation of the Executive Branch of the Government:

> " The really disturbing thing is that so little progress has been made in obtaining reliable hydrologic data in advance of project planning and construction. Though the necessity for more adequate data has long been recognised, we find ourselves embarking (in the U.S.A.) on the most gigantic water projects ever devised with alarming gaps in our knowledge of the probable behaviour of the waters we are trying to control and utilise. So serious are these deficiencies that it is estimated on the basis of experience that the limit of error or ignorance in present water developments is rarely less than 25% and is frequently greater than that."

U.S. Weather Bureau. The Chief Meteorologist in the Gold Coast co-ordinated the results of these enquiries with his own research, and his report is published as Appendix IV. He concludes that a figure of 65″ a year should be used.

62. Aluminium Limited have received all these reports. They have also "conducted an exhaustive study of probable evaporation losses based on evaporation pan data from world wide sources, from the evaporation pan data secured for the Volta reservoir area and environs by the consulting engineers, and upon all known empirical methods and basic approaches." They conclude that "in order to be conservative, Aluminium Limited is prepared to accept a probable mean annual evaporation of 60″."

63. The consulting engineers and all other authorities involved in the investigation of this problem of evaporation have worked together very closely, and the difference in opinion simply reflects a difference of judgment in analysing a problem which does not lend itself to accurate determination.

64. Both evaporation and the incidence of rainfall on the lake would affect the amount of power which could be developed.[3] The estimate of evaporation on which the consulting engineers have based their assessment of available power is 55″, rainfall on the lake surface being taken as 50.3″ per annum. The following table shows the effect on power output, in terms of gains or losses relative to the figure of 617,000 kilowatts, which would result from various combinations of evaporation and rainfall on the lake.

VARIATION OF POWER OUTPUT IN THOUSANDS OF KILOWATTS

Long Average Rainfall on Lake Surface \ *Long Average Evaporation from Lake Surface*	*50″*	*55″*	*60″*	*65″*	*70″*
45″	0	−18	−35	−53	−71
50″	+17	− 1	−19	−37	−54
55″	+38	+15	− 2	−20	−38
60″	+49	+32	+14	− 4	−22
65″	+66	+48	+30	+12	− 5

The effect of different rates of evaporation on the cost of power is considered in Part III, paragraph 509.

Permanent and Temporary Townships at Ajena

65. A permanent township to accommodate approximately 150 people required to operate the dam and power station, together with their families, and to provide normal Government and commercial services, would be needed at Ajena. A suitable site was selected, and preliminary plans prepared by Mr. Thomas Scott, O.B.E., F.R.I.B.A.

66. The temporary township required for the labour force building the dam and power project (which is described in paragraphs 258 to 263 and in Appendix XII) presents special difficulties. The only possible site is not ideal, for it is limited in area and on a relatively steep slope (the site selected for the permanent township could not, for technical reasons, be used for the temporary township). The labour force would have to live in this area for upwards of eight years and it is apparent, having regard to the great importance which the Commission attaches to the successful employment of all labour forces required during both the construction and operating phases of the Project (see Chapters 7 to 11), that particular care would be necessary to ensure that the standard of accommodation and amenities provided in the temporary township was satisfactory.

67. The consulting engineers carried out considerable surveys and investigations, and estimated that it would cost approximately £4.9 million to accommodate the labour force (at a peak of approximately 5,000 Africans and 250 overseas staff)—65% of them with families—in housing of a standard desired by the Gold Coast Government.

68. It was agreed by all parties to the Project that this cost should be reduced without seriously departing either from housing standards or, even more important, from the general working and living conditions advocated by the Commission (Chapter 11). Additional investigations were therefore carried out by Architects' Co-Partnership and by Dr. O. H. Koenigsberger,

[3] No doubt all concerned with the Project would continue to keep under review the results of research now being undertaken in various parts of the world into artificial rain making and the control of evaporation by the use of surface microfilm.

Dr.-Ing., F.I.I.A., M.I.E.(India), A.M.T.P.I., of the London School of Hygiene and Tropical Medicine, working in close collaboration with the consulting engineers and the Gold Coast Government. As a result of these investigations which were only completed at the end of December, 1955, it is estimated that the cost could be reduced by about £850,000. This assumes some modification to standards and making provision for the families of 50% of the labour force.

69. It was thus not possible to take into account this reduction in the total cost of the Project when analysing the financial and economic aspects in Appendix XIII, which was prepared in November, 1955.

Design of Power Station

70. Early in 1955, the consulting engineers asked the Commission whether the power station should be of the traditional " indoor " type, or the more modern and cheaper " outdoor " type. The Gold Coast Government clearly had a special interest in this matter since the Project would be carried out in the Gold Coast. The Government emphasised that the scheme, if undertaken, would have special national significance and the various works and installations should, therefore, be of good appearance. Accordingly, the Government desired that an indoor station should be built rather than the more utilitarian structure.

71. The British Government and the aluminium companies recognised the position of the Gold Coast Government, and the Preparatory Commission retained the services of Mr. G. A. Jellicoe, F.R.I.B.A., P.P.I.L.A., M.T.P.I., to prepare general layouts and perspectives of the power station. This was done, and subsequently a model of the proposed power station was made. Photographs appear opposite this page.

72. The general layout of the power station had to be prepared in advance of a decision about the Project so that the consulting engineers could be informed of the extent of excavations which would be necessary, and in order to permit the sub-structure to be designed. The preparation of detailed plans and architectural drawings would not be undertaken, however, until a decision had been taken to proceed with the Project.

73. The Gold Coast Government has, for the purposes of planning, approved Mr. Jellicoe's proposals. The consulting engineers estimate that the cost of the proposed indoor station might exceed that of an outdoor station by £330,000 for the first stage of development, and a further £50,000 for each of the two later stages.

Landscaping the Approaches to the Site of the Dam and Power Installation

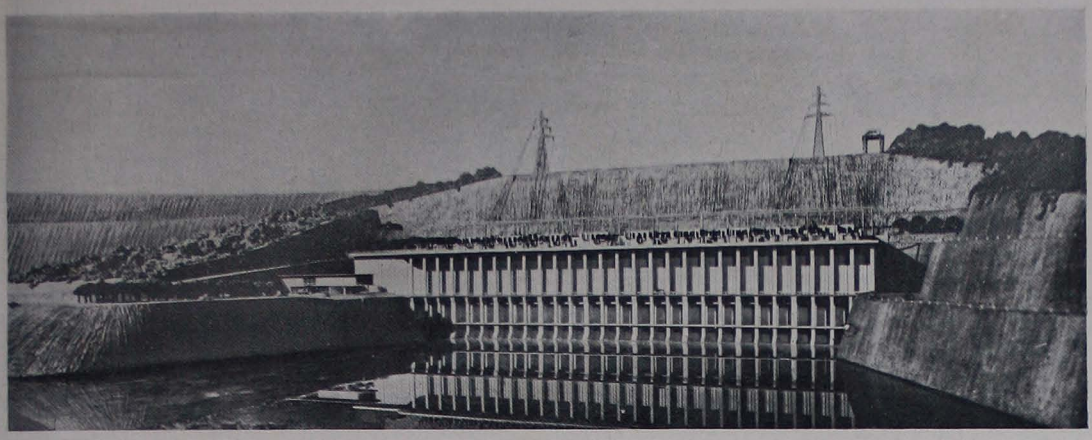
74. The Commission considered that the Project would present an unusual opportunity for landscaping the approaches to the dam and power installation as well as providing a safeguard against erosion. The area primarily concerned is between the site of the new bridge at Adomi and the dam about eight miles further upstream. Relatively little would need to be done in the positive sense; it would be more important to prevent the present landscape being spoilt. Another opportunity for effective landscaping would exist above the dam site.

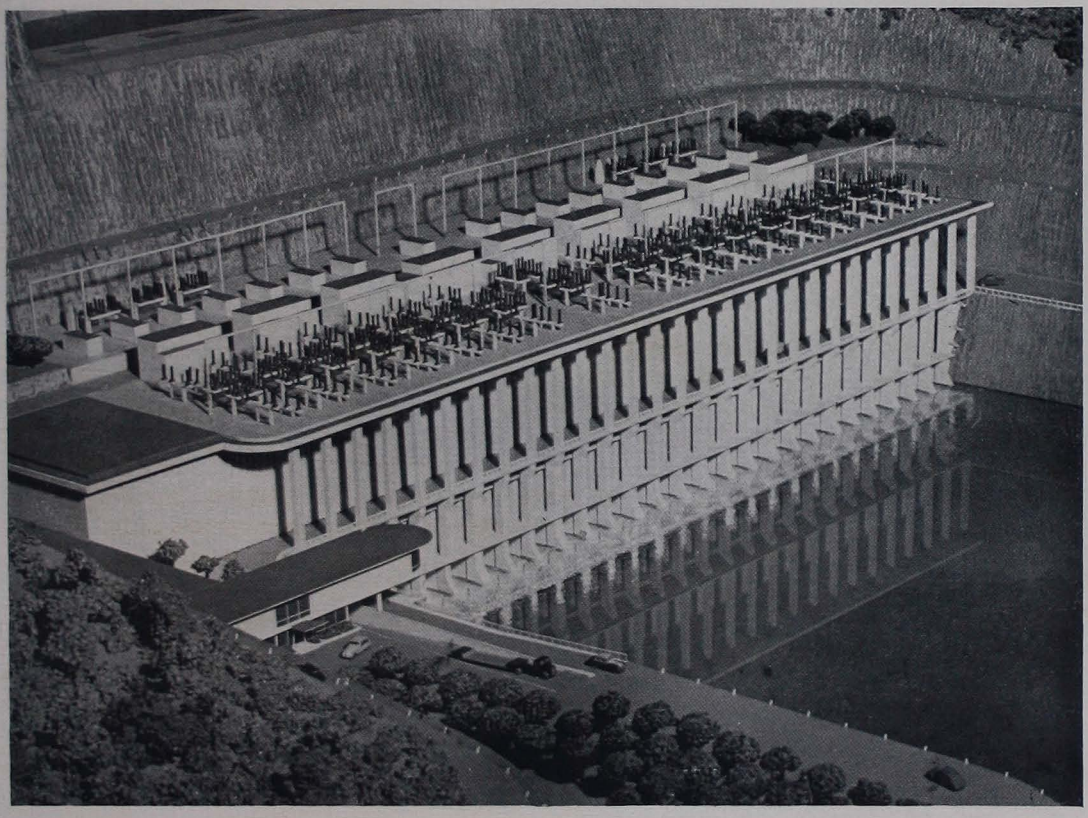
75. Mr. Jellicoe was good enough to provide the Commission with a report on landscaping, and this is reproduced at Appendix V. Mr. Jellicoe recommends, amongst other things, that a specific locality (marked on the general plan at the back of his report) should be treated as a National Landscape Area. The draft Bill for the Volta River Authority (Appendix XVI) makes provision for a landscaping function similar to that given to town planning authorities. None of Mr. Jellicoe's proposals would involve any appreciable direct expenditure in landscaping, but he recommends a route for the transmission lines which would cost about £40,000 more than that originally proposed by the consulting engineers. The matter should be settled at the time of negotiations about the future of the Project.

Construction

76. The size of this hydro-electric project, and the probable conditions under which it would be constructed, make it essential that the contractor or consortium of contractors carrying out the work should be of proven experience and efficiency, and strongly backed by all the necessary financial and material resources. This matter is discussed in Chapter 11 of the Engineering Report, and again in paragraph 711 of this report.

77. As to the preliminary works which the consulting engineers recommend should be undertaken in advance of the main works, the Commission recommends that this proposal should be considered by the parties to the Project during the course of negotiations. In paragraph 703 (e) the Commission recommends that the technical advisers of the Governments and aluminium companies should meet with the Preparatory Commission and the consulting engineers immediately a decision had been reached, in principle, to proceed with the scheme, in order to decide the detailed procedure for inviting tenders and awarding contracts.





A MODEL OF THE PROPOSED POWER STATION

B. POWER AT BUI

78. The investigations made by the consulting engineers at Bui are recorded in Part III of their Engineering Report. They have summarised their conclusions as follows:

> " After consideration of all hydrological, topographical and geological data at present available, we consider that the Black Volta at Bui can be economically developed by the construction of a concrete buttress dam in the lower Bui Gorge. Water from the reservoir thus formed would be passed through turbines situated in an underground power station in the right bank of the gorge. The Bungase saddle would require to be sealed by the construction of an earth embankment.
>
> We propose a maximum retention level for the Bui reservoir of 580 feet O.D., which, with a drawdown of 50 feet, would allow the utilisation of a storage of some 5.1 million acre-feet. We consider that an average output of power to the value of 65 megawatts continuous could be produced by this development and propose an installation of 120 megawatts, but the civil engineering works should allow for the possible installation at some future date of an additional set of 40 megawatts capacity.
>
> The electricity generated at Bui would be delivered by a transmission line, 140 miles in length, to Kumasi. At this point, the electricity could be fed into our proposed ring grid, should this come into existence.
>
> The total capital cost of the generation and transmission works would be £19,351,000 based on prices ruling on 30th September, 1955.
>
> The Bui Gorge development will result in the additional supply to any future electrical system in the Gold Coast of some 550 million kilowatt-hours per annum. The average cost of supplying this power at Kumasi would be 0.57 pence per kilowatt-hour."

C. POWER POLICY IN THE GOLD COAST

Available Power

79. In order to assist the Gold Coast Government in assessing the value of the Volta Project, an appreciation was made of the possible long-term needs of the country for power. The Preparatory Commission co-operated with the Government in this work, and, as a first step, a short-term policy was evolved which would provide for immediate needs.

80. A short- to medium-term plan has also been approved, the central feature of which is the construction of a new thermal station at Tema with an installed capacity of 20,000 kilowatts which could subsequently be expanded by another 10,000 kilowatts. Additional capacity is also being installed in Accra and other centres, which should cover the minimum needs of the Gold Coast until a decision is reached, possibly in 1956, about the Volta Project.

81. It is anticipated that the first stage of power from Tema, which should be available by about 1959, would, when added to the existing supplies, be adequate to meet requirements in Accra and Tema until (if the Volta scheme went ahead) power could be provided at Ajena about 1964. If the Volta Scheme was deferred, the Tema station and facilities in other important centres would need to be expanded as necessary.

82. As soon as a decision is taken about the Volta Project, the Gold Coast Government will be able to expand its medium-term power policy into a long-term plan. If the Volta Project was constructed, the Government should have an ample margin over its needs for many years to come. With a potential at Ajena of 617,000 kilowatts, there would be sufficient power at Kpong for the 514,000 kilowatts required by the aluminium companies to produce the 210,000 tons of metal originally contemplated, with about 100,000 kilowatts in hand. The Government might, of course, decide that the national interest would best be served by allocating part of the additional power now expected at Ajena to the production of increased supplies of aluminium, provided that the companies were in agreement. In the background, a further 65,000 kilowatts would be available at Bui.

Possible Grid

83. The Gold Coast Government, for its own part, also arranged with its consulting engineers to make a further study of the possibility of providing a grid which would connect the main areas of demand in the Gold Coast. A report was submitted to the Government in June, 1955. A considerable amount of work has now been done in this field, but there is general agreement between the Gold Coast Government and the Preparatory Commission that the grid proposal cannot usefully be taken further until a decision has been taken to proceed with the Volta River Project, since it would depend basically on a supply of power from Ajena.

84. The Gold Coast Government agreed, therefore, that the grid should be reconsidered after a decision has been taken about the Volta Project. If the Project was undertaken, the prospects for the grid (which could be considerably influenced by the needs of the mining industry) could be reviewed in 1959. A policy decision could be taken about 1960, and if it was decided to go ahead, the grid could then be built in about four years, thus synchronising with the availability of power at Ajena.

85. If a decision was taken in 1956 to defer the Project, or in 1959 not to proceed with the grid, then the Government's policy for providing power in the main centres would need to be adjusted accordingly. In the meantime, the Gold Coast Government has asked the Technical Assistance Administration of the United Nations to send a Mission to the Gold Coast to review the power position generally, (excluding the power potential of the Volta which is now known) and with particular reference to rural as well as urban needs. Such a survey could also consider the feasibility of producing fertilizers based on cheap power (paragraph 436). The Preparatory Commission believes that this general enquiry would pose complicated technical and economic questions, and its importance is such as to merit special arrangements being made for expert and detailed investigation.

86. It is apparent, of course, that if the Project was undertaken, the Gold Coast Government and the Volta River Authority would need to work together so as to ensure that the national power resources were used to the best advantage. Policy in relation to the power potential at Bui would be settled at an appreciably later stage and in the light of policy adopted towards the Ajena scheme.

Chapter 4

COMMUNICATIONS AND LOGISTICS

A. INTRODUCTION

87. One of the potential advantages of the Volta Project is the relatively short distance between the very large deposits of bauxite and an important source of potentially cheap power. The Commission therefore arranged for all aspects of the problems of communications and logistics involved in the scheme to be investigated with particular care in an effort to ensure that, if the Project was eventually undertaken, the maximum economic advantage would be obtained from this concentration of resources.

88. In the operating phase it would be necessary to ensure the economic procurement and continuous supply of the materials used in the manufacture of aluminium. The process continues 24 hours every day, and any break in the supply of materials would have expensive consequences. The method of transporting materials would therefore have a special importance in making the Project successful.

89. During construction, it would be essential for each of the five major component parts which make up the Project (paragraph 18) to be phased correctly with the others, and then carried out on schedule. Failure to achieve this objective would undoubtedly lead to a substantial increase in the cost of the Project as a result of large assets lying idle until one or more of the other components was completed and the scheme brought into operation. There are many examples in other parts of the world where insufficient attention to the provision of necessary facilities (e.g adequate port and rail capacity, access roads) at the right time has resulted in delays and in large increases in capital costs.

90. Within the framework of these general requirements for construction and operation, it can be said immediately that two fundamental objectives would have to be achieved. First, adequate port, rail, and road facilities would need to be provided in sufficient time to ensure that all materials and equipment required for construction could be moved efficiently. Second, during the operation of the Project, the large amount of bauxite would need to be moved by the most efficient and economic method.

Gold Coast Facilities in Existence or under Construction

91. Although the Gold Coast is a relatively underdeveloped country it already possesses facilities which could assist very appreciably in the construction of the Project. The existing and planned road system makes access to the construction sites a simple matter. Port facilities already in operation, and those being developed, should prove adequate and convenient. A railway system which could be suitably developed is also available.

92. Since the publication of the White Paper in 1952 improvements in the communications system of the Gold Coast, undertaken as part of the general development of the country, have greatly increased the facilities available for the Project. In particular, work has started on the new port at Tema (which is now joined by rail to Accra and the Shai Hills); the road system has been improved and extended, particularly in the Tema area and between Accra and Takoradi, and is being supplemented by additional roads to the north and by the bridge over the Volta at Adomi (which will greatly improve communications with Togoland); and the Achiasi to Kotoku railway link which reduces appreciably the rail distance between Takoradi and Accra is virtually complete.

93. The ports, railways, posts and telecommunications in the Gold Coast are operated by the Gold Coast Government. The continued efficient working of these services would be vital to the successful construction and operation of the Project as a whole and to the economic production of aluminium.

Geographical Pattern

94. Four of the five component parts of the Project determine the fixed geographical points which control any consideration of the problems of logistics and communications associated with the scheme. They are:

(*a*) the bauxite mines;
(*b*) the dam and power station;
(*c*) the smelter; and
(*d*) the new port.

(Although not regarded as a component part of the Project, the port of Takoradi with its road and rail links could make an important contribution to the success of the scheme).

95. The positions of these fixed points have been described in Chapter 2 and can be seen on the frontispiece and in the general map at the back of this report. More detailed maps are included in Appendix X, which records the results of the Commission's investigations in this field. The smelter is the focal point in the operation, and the distances separating it from the other sites are approximately:

(*a*) the bauxite mines—207 miles,
(*b*) the dam and power station—16 miles,
(*c*) the port of Tema—34 miles.

The Operating Phase and the Construction Phase

96. The long-term requirements for operating the Project would determine the physical pattern of the communications system, and they are therefore considered first so that the transportation needs at the construction stage can be considered against a background of the ultimate pattern of development.

97. The construction phase covers the period up to the initial stage of aluminium production. There would be further construction when the time came to expand production; but the greater part—the building of the dam to its full height, the completion of the spillway, the railways, the opening of the industrial and housing areas and the initial provision of services to them—would all be carried out in the construction phase.

B. REQUIREMENTS DURING THE OPERATING PHASE

98. During the operating phase the requirements would be:

(*a*) the movement of bauxite from the mines to the smelter;
(*b*) the movement of materials between the smelter and the port (this would involve both outward traffic of aluminium ingot for export and inward traffic of imported raw materials);
(*c*) port facilities at Tema;
(*d*) road communications to supplement the new railways and to serve the new communities;
(*e*) postal and telecommunication services.

99. Of these, the largest element would be the movement of bauxite. With aluminium production at 80,000 tons annually, about 500,000[1] tons of bauxite would need to be moved.

[1] These figures are slightly higher than those shown in Appendix X and other appendices. The aluminium companies informed the Commission in December, 1955, after the appendices had been despatched for printing, that recent surveys had shown that $5\frac{3}{4}$ tons of local bauxite (as opposed to the original estimate of 5 tons) would be required for each ton of aluminium. This development would mean a small increase in the amount of railway equipment which would be required, and would also affect freight rates slightly. The matter could be dealt with easily during negotiations.

Just over 1,200,000 tons of bauxite would need to be transported in order to permit aluminium production at 210,000 tons per annum.

Alternative Methods of Transportation

100. Three basic methods of transporting the bauxite were considered by the Commission; they were

(*a*) by rail,
(*b*) by road,
(*c*) by rail or road to the new lake, and then by water.

101. It became apparent at an early stage that road transport would be appreciably more expensive than other possible methods of transportation. The difference in costs between (a) and (c), however, would probably not be so marked. The aluminium companies indicated that they would prefer railways to be used for transportation and this arrangement was accepted by the Gold Coast Government as it would fit in with the general programme of national development. A through railway movement would have the advantage of keeping to a minimum the need for handling between the mine and the smelter, and it would thus achieve simplicity which is a fundamental factor in a good transport system. The new railways are considered in detail in the next chapter of this report.

102. In analysing these alternative methods of transport, the Commission received valuable assistance from Major-General G. N. Russell, C.B., C.B.E., Chairman of British Road Services.

103. Other new methods (for example, conveyor belts for long distances, pumping materials either dry in powder form or in suspension in liquids) were considered, but they have not yet reached a stage of development where the aluminium companies would contemplate them as economic alternatives to conventional methods of transport between the mines and the smelter.

Exports and Imports

104. In broad terms, the amount of exports at full scale production of the smelter (just over 200,000 tons) would be very close to the quantity of imports needed for production. There should be no difficulty in handling these amounts at the port of Tema, when completed to its first stage, but the remaining capacity might not be sufficient to meet the natural growth of traffic resulting from the general development of the country, and the Gold Coast Government may desire to proceed to a second stage of port development if a decision is taken to go ahead with the Volta Project.

105. Consideration is being given by the Gold Coast Government to allocating the smelter company one or more berths permanently so that the company could equip it to meet its own special needs. The arrangements finally agreed between the smelter company and the Government would be reflected in a Port Agreement (paragraph 695).

106. Movement between the port and smelter would be by rail in the early years of aluminium production, but the possibility of ultimately supplementing rail by road transportation is not ruled out. As part of the development of Tema, the Gold Coast Government is building a new trunk road from the port to Adomi, where a bridge over the Volta is being constructed, thus improving communications with Togoland. This new road would be of great importance to the smelter township and might possibly also have a significant value to the smelter itself.

C. REQUIREMENTS DURING THE CONSTRUCTION PHASE

Imports

107. It is estimated that about 50,000 to 70,000 tons of imports would be required annually during the first three years of construction, rising to a peak of just over 100,000 tons in the sixth year (1962); details are shown in paragraph 145. The existing and planned port capacity at Takoradi and Tema should be quite adequate to handle this material, but great advantage would be obtained if the first berth at Tema could be available by the contract date of mid-1957. There is still a margin of about 500,000 tons capacity at Takoradi and the completion in February, 1956, of the Achiasi to Kotoku railway will appreciably shorten the rail distance between Takoradi and Accra. There are obvious reasons for making the maximum use of Tema, however, at the earliest possible date.

Heavy Lifts

108. Heavy lifts in the early stages of construction would be in the order of 25 tons and no difficulty is anticipated in handling them. Later on, the heaviest lift would be transformers of about 100 tons, and it would be necessary to use a vessel equipped with tackle capable of handling such a lift without shore assistance. At present there is one ship trading on the West African Coast which is capable of handling such lifts.

Movement from the Port to Site

109. Imports of construction material and equipment would be moved to the various sites by rail and road. The present resources of locomotives and rolling stock on the Gold Coast Railways are fully extended and it would be essential to order more, immediately a decision was taken to proceed with the Project. It would be even better if some could be procured in advance and the Gold Coast Government is now considering this proposal.

110. The Volta Project would impose a very considerable burden on many roads; fortunately the Government's present programme of construction and improvement should be of major assistance in this respect. The matter is examined in detail in Appendix X. Some improvement of existing bridges would also be necessary.

D. OTHER FACILITIES FOR COMMUNICATIONS

Telecommunications

111. It would be essential for all important centres of activity to be provided with first class telecommunication facilities during both the construction and operating phases. These requirements could be met by a system of telephones and radio-telephony. The matter has been discussed in detail with the Gold Coast Government, and it would be essential to order equipment immediately a decision was taken to proceed with the Project. There would be advantage in procuring some equipment in advance of a decision; if not required for the scheme it could soon be used in the Government's own system.

Postal Services

112. It would be necessary for the Gold Coast Government to provide adequate postal facilities at all construction and operating sites.

Feeder Roads

113. The Gold Coast Government allocated a sum of £100,000 in 1952 in order to construct feeder roads which were designed to improve communications in certain outlying areas, and with the particular objective of facilitating and encouraging agricultural production. Good results have been obtained from the work already done. An extension of such roads could play a major part in opening up food-producing country, and in providing access to forests in the area subject to inundation which could become valuable sources of firewood. (See paragraph 425).

Helicopters

114. The use of helicopters is contemplated as part of the programme of health control (paragraph 401) and it may well be that they could provide additional communication services over the fairly dispersed area covered by the Project.

Spare Parts

115. The Commission recommends that adequate stocks of spare parts should be carried by all authorities and contractors associated with every aspect of the Project, both during the construction and operating phases. This policy could also have a special importance in helping to ensure the general efficiency of all the communication system.

Efficient Use of Roads

116. The Commission also stresses the necessity of ensuring that all roads which would in any way be affected by the Project should be used and controlled efficiently. There are considerable opportunities for improving present traffic conditions and the Gold Coast Police could give material assistance in achieving this objective.

Railway Crossings

117. The Commission recommends to the Gold Coast Government that all open road and rail crossings throughout the area which could be affected by the Project should be eliminated by the construction of bridges.

E. CO-ORDINATION WITH GOLD COAST GOVERNMENT DEVELOPMENT PLANS

118. The Volta River Project would obviously place a heavy burden on the Gold Coast Government in providing the necessary railway, port and road facilities.

119. In addition to the work on the port at Tema which has already started, a major programme of new railway construction, described in Chapter 5, would need to be carried out by the Government between 1957 and 1963, in order to complement the construction of the other component parts of the Project. Besides ensuring that the physical task of constructing these new railways was completed on schedule, the Government would need to take equally great care to ensure that the new locomotives and rolling stock were available when required.

120. The Government would also need to carry out a very extensive programme of road construction. An appreciable amount of this is already under way. The largest new items would be two trunk roads to the north which would be made essential by the creation of the new lake, but which are already included in the normal development programme.

121. All these demands point to the necessity for future Gold Coast development plans being co-ordinated most carefully with all aspects of the Project. This problem is dealt with more fully in Chapter 28.

F. EFFECT OF THE NEW LAKE ON COMMUNICATIONS

Roads

122. The effect of the new lake on existing communications is considered in detail in Appendices VI and X. The interruptions to the present main roads would be compensated by the two new trunk roads to the north to which reference has just been made. Some secondary roads would suffer, but here again alternative routes are already under consideration, and new roads would be constructed after a decision had been taken to proceed with the Project.

Ferries

123. Some ferries would be affected and consideration has been given by the Gold Coast Government to the form and site of replacements which would be needed.

Lake Transport Services

124. The creation of a lake over 200 miles in length would provide opportunities for the growth of a water transport system in the Gold Coast. The lake, however, would not lie along any existing transport route, and there would be no ready-made traffic for a service to tap. It might well be some years before any great use would be made of the new water highway, although from places such as Kete Krachi, where road communications would be completely changed, there might be a tendency for lake traffic to develop at an early date as part of the new pattern of transport. Another possibility would lie in the use of the lake for the distribution of agricultural produce from the Gonja district.

125. Preliminary consideration has been given by the Gold Coast Government to places where lake ports might ultimately develop. Further action would be required after a decision to go ahead with the Project had been taken; the Volta River Authority and the Gold Coast Government would, no doubt, jointly watch the possibilities for development.

Navigational Charts

126. It would be a relatively simple matter to produce navigational charts from the existing aerial survey maps of the area.

Clearing Approaches to Lake Ports

127. Terminals for the possible lake services and the new ferry services would have to be decided as soon as a decision had been reached to proceed with the Project, so that vegetation could be cleared before flooding took place. Adequate fairways would be required for each port and should be as wide as consistent with the site. The clearing of vegetation would be co-ordinated with the removal of undergrowth for health purposes, to which reference is made in paragraph 392. The subject is also considered in paragraphs 429 and 430.

CHAPTER 5

TECHNICAL ASPECTS OF THE NEW RAILWAYS

Policy

128. In the preceding chapter, and in Appendix X, it has been indicated that the aluminium companies and the Gold Coast Government have agreed that railways should be used in preference to any other method of transport for linking the bauxite mines to the smelter.

Route

129. In order to implement this policy, 39.8 miles of new railway would need to be constructed from the bauxite mines to the existing railway at Kumasi, and another 28.7 miles from Koforidua to the smelter near Kpong. A further new link, 14.6 miles in length, would be required from the smelter to the railway which already runs as far as the Shai Hills from Tema. The routes for the new lines can be seen on the frontispiece.

Surveys

130. Arrangements were made with the consulting engineers to survey these routes and in the Engineering Report the results of their investigations have been summarised as follows:

> " The result of our surveys and investigations into new railway routes required for the Volta River Project, to link the site of the bauxite mines near Aya, via the existing line from Kumasi to Koforidua, with the smelter site, and the latter, via the recently constructed line between Shai Hills and Tema, with that port is that we estimate that these works can be carried out for a total cost of £10,495,000. This figure includes engineering costs, contingencies and interest during construction.
>
> Of two alternative routes considered between Aya and Kumasi we recommend, from an engineering standpoint, the more southerly one.
>
> We have adopted for our plans and estimates, in deference to the wishes of the local Town Planning Authority, a route around Kumasi by-passing the town to the south, but estimate that a shorter route passing to the north would save £502,000 in construction costs and £60,700 per year in operation when the project has reached a stage when the transport of 1 million tons of bauxite is required annually.
>
> After consideration of three alternative routes to cross the Akwapim Scarp between Koforidua and the Smelter, we recommend the shortest of these, almost 29 miles in length, including a tunnel 2½ miles long. It is estimated that this tunnel, including a conservative allowance for contingencies and for construction interest, may cost as much as £2,681,000.
>
> Before commencing work on the tunnel and deciding upon its exact alignment, we consider it essential that a further investigation of the rock conditions in the ground through which it would be driven should be carried out. We recommend a programme of exploratory drilling or pilot headings or possibly a combination of both, and consider that this should be put in hand soon after any decision is taken to go ahead with the Project.
>
> We consider that the constructions can be carried out satisfactorily concurrently with the other works of the Project, to provide a through rail route from the Mines to the Smelter and from the Smelter to the Port of Tema, by the time that aluminium production is due to commence, without undue strain on other demands for labour, plant and materials."

The Alternative Route around Kumasi

131. The Gold Coast Government considers that the by-pass north of the centre of Kumasi would be unsatisfactory in relation to the planned development of the town. The alternative route, as indicated by the consulting engineers, would involve a higher capital cost and would increase freight rates. The interest of the aluminium companies naturally lies in restricting the total length and cost of the bauxite haul as far as possible. This matter would need to be negotiated between the parties to the Project at the appropriate time; and account taken of the ultimate decision when finally drawing up the Railway Agreement (paragraph 694).

Acceptance by Aluminium Limited of the Consulting Engineers' Recommendations

132. Apart from the alternative route around Kumasi, Aluminium Limited has indicated that the technical recommendations and proposals for construction made by the consulting engineers are satisfactory.

Equipment

133. It is at present proposed that the bauxite trains would be hauled by diesel-electric locomotives. The units would be of 1,000 h.p. and for the movement of bauxite they would work in pairs. These locomotives are only just being introduced in the Gold Coast, but several years of experience in working them would have been gained before bauxite haulage started if the Project went ahead. So far local experience is satisfactory. (A recent report made to the Government of Nigeria indicates that diesel-electric traction should show substantial advantages over the other types of rail traction in that country.) While plans are based on diesel-electric traction,

it would be important to watch any future developments in other forms of traction which might with advantage be used later for this traffic.

134. As to the most suitable design for bauxite wagons, consultation would take place between the Gold Coast Railways and the aluminium companies. The design would have to suit both the type of loading arrangements proposed at the mines and the tipping arrangements to be installed at the smelter. It is proposed that wagons with a capacity of 36 tons should be used. (Consideration is also being given to the design of rolling stock required for the movement of exports and imports between the smelter and the port.)

135. For bauxite movement at the first stage of aluminium production ten diesel-electric locomotives and about 136 wagons with appropriate shunting engines and brake wagons would be required. At the final stage of aluminium production it would be necessary to have 25 diesel-electric locomotives and 206 wagons. Additional locomotives would also be needed for the traffic between the smelter and the port.

Timetable of Construction

136. In deciding the timetable of construction of the various new rail links, the fundamental requirement is that they should all be available for traffic when the smelter came into operation. However, there are a number of other considerations which determine the particular order in which the separate sections should be constructed.

137. One of the earliest jobs would be the programme of drilling necessary to prove the route for the tunnel on the line between the smelter and Koforidua; but the actual construction of the tunnel would not be carried out until the main work on the river diversion tunnels at the dam site had been completed, thus avoiding competition for skilled tunnellers between two components of the Project.

138. The existing line from the Shai Hills to the smelter site would be extended at an early stage in order to provide rail access when opening up the industrial and housing areas. This extension would then be carried through to the eastern portal of the tunnel to facilitate its construction. The aluminium companies have indicated that they would not need rail access for opening up the mines.

139. The general timetable for railway construction is shown in the diagram on page 9. In order to minimise interest costs on railways before they came into operation, it is planned that the installation of the permanent way would be deferred where practicable until the later stages of the construction phase.

Estimated Costs

140. The cost of constructing the new railways is estimated by the consulting engineers to be about £10.5 millions. The Gold Coast Government assesses the cost of making essential improvements to the existing railway between Kumasi and Koforidua at about £3 millions. The Government also estimates that the cost of locomotives and rolling stock for the first stage of aluminium production would be about £2.3 millions and that an additional £2.2 millions would be required for the equipment needed for the final stage of aluminium production.

141. The estimated costs are considered in Part III of this report, which deals with the financial and economic aspects of the Project. It should be emphasised here, however, that they are very considerable and indicate the necessity for doing everything possible to keep freight rates to a minimum in order to preserve the basic advantage of having the bauxite deposits close to the potentially cheap power. The Gold Coast Government would undoubtedly study carefully any opportunities for getting more traffic on this route.

Endorsement of Estimates by Cooper Brothers & Co.

142. Cooper Brothers & Co. have analysed these estimates in consultation with the consulting engineers and the Gold Coast Railways and state that " the estimates examined by us have been carefully and properly compiled and fairly represent the capital charges relating to the new railways on the basis of prices, wages and other costs ruling at 30th September, 1955." (The detailed report made by Cooper Brothers & Co. is reproduced at Appendix XIV).

Chapter 6

MATERIALS

A. REQUIREMENTS

143. As indicated in paragraph 41, one of the first and most important tasks undertaken by the Commission was to determine what materials and manpower would be required for the construction of each of the five component parts of the Project. This Chapter deals with materials. Manpower is discussed in Chapters 7 to 11.

144. Estimates of the material resources needed for the dam and power installation and for the new railways and the port of Tema were prepared for the Commission by the consulting engineers. The aluminium companies similarly provided estimates of materials which would be required for the development of the bauxite mines and the smelter together with their townships.

145. The detailed figures for each component are tabulated in Appendix XI. They are summarised in the table below and indicate that a total of 532,000 tons of imported materials and 44,000 tons of local materials, excluding the much larger quantities of materials such as sand and rock which would be obtained at the construction sites, would be required during the period from 1957 to 1964 (the construction phase). The figures for 1957 and 1958 contain an element for the completion of the first stage of Tema harbour.

TOTAL MATERIALS NEEDED FOR THE CONSTRUCTION PHASE

(*Tons*)

	Imported						*Local*
Year	*Cement*	*Steel*	*Oil*	*Plant and Equipment*	*Other*	*Total*	
1957	13,000	3,000	14,000	8,000	9,000	47,000	2,000
1958	10,000	4,000	17,000	6,000	7,000	44,000	1,000
1959	27,000	7,000	17,000	11,000	5,000	67,000	5,000
1960	40,000	9,000	21,000	5,000	5,000	80,000	10,000
1961	53,000	9,000	20,000	9,000	5,000	96,000	11,000
1962	53,000	9,000	19,000	16,000	5,000	102,000	8,000
1963	15,000	26,000	15,000	20,000	1,000	77,000	5,000
1964	6,000	3,000	4,000	6,000	—	19,000	2,000
TOTAL	217,000	70,000	127,000	81,000	37,000	532,000	44,000

Note: The calculation of these resources was, of course, a basic preliminary to the Commission's study of the problems of communications and logistics involved in the Project. (See Chapter 4 and Appendix X).

B. PROVISION OF MATERIALS

146. The provision of materials (including plant and equipment) required for the dam and power installation and the new railways is dealt with fully in the Engineering Report. Responsibility for the provision of the necessary material resources for the mines and the smelter would naturally rest with the aluminium companies.

147. No serious difficulties are anticipated in the provision of these supplies, nor is it thought that any special difficulties would arise in moving them.

148. In the Commission's report on communications and logistics (Appendix X, paragraph 84), it is observed that contractors might wish, or be required, to stockpile adequate supplies of certain materials as an insurance against shortage, or interruption in transit.

Chapter 7

MANPOWER

General Policy

149. The starting point of the Commission's investigations into manpower was the establishment of the total requirements for the five component parts of the Project. These requirements were estimated in detail and the Commission then studied the implications of recruiting and maintaining the various labour forces. This led to the consideration of a group of inter-related problems which became known as " Human Factors " and which were to form a major part of the Commission's work. The investigations are fully described in Appendix XII, and the main findings are summarized in this and the following four chapters.

150. Bearing in mind the experience gained in other underdeveloped countries which have carried out large-scale development projects in recent years, the Preparatory Commission from the outset of its work emphasised the necessity for keeping the labour forces to a minimum. This policy was dictated by economic, technical and social reasons.

Economic Aspect

151. From the economic aspect, although daily wage rates in the Gold Coast may appear low in comparison with wages prevailing elsewhere, the cost of labour in the country is not equally low when considered in relation to local productivity, which is generally recognised as being capable of substantial improvement. Moreover, account must be taken not only of direct wage costs, but also of the substantial indirect costs in providing housing and health and other services for workers, and in the administration and supervision of labour. The cost of housing alone is a significant factor in the total investment as appears from the consideration of the estimates in Chapter 20.

152. Another argument on the economic side is that reduction of the labour forces to a minimum would reduce the vulnerability of the Project to local wage increases during the construction phase in so far as wage increases in the Gold Coast might outstrip the trend of general rises in external wages and prices. Apart from the world-wide tendency in recent years for wages to increase, there have been particularly striking increases in certain countries in a state of rapid political transition or economic instability. The economy of the Gold Coast has been remarkably stable in recent years, but avoidance of unnecessarily large labour forces would in any case be a wise insurance against the inflation of the cost of the Project through any disproportionate rise in local wage rates during the construction phase.

Technical Aspect

153. From the technical point of view, much of the construction work would be carried out on sites which are restricted geographically. This is particularly noticeable at Ajena where construction of the dam would take place in a narrow gorge and where there is only a limited area suitable for housing the construction workers. Any increase in the total labour force above the minimum requirements could lead to even greater difficulties in finding suitable housing areas near the place of work.

Sociological Aspect

154. The main sociological consideration is that the number of workers engaged on construction would be much higher than the number required later for operation. This factor is of particular importance at Ajena where the construction force would run into several thousands, whereas the only workers permanently required in the area would be about 150 needed for the operation of the power station. There would therefore be a considerable movement of population during and immediately after the construction phase, and it is obviously desirable to minimise the scale of the many attendant problems by the greatest possible reduction in the number of construction workers.

Employment Policy

155. Against these powerful arguments for reducing the labour forces there are no reasons of any weight for increasing the number of workers above the essential minimum. The Project would offer welcome opportunities for employment to the people of the Gold Coast, but the major opportunities in this field would be in the operating phase rather than in the construction phase, and would apply to skilled workers rather than to large numbers of unskilled labourers.

The construction of the Project has never been regarded as a means of creating employment over a short number of years for unskilled workers; the primary purpose of the construction works would be to create the foundation of an economically sound scheme, leading to the establishment of a prosperous industry as a source of permanent employment.

156. Certain other countries with entirely different labour situations from that in the Gold Coast have undertaken major construction projects with the provision of large-scale employment as one of the primary objectives. It has almost always proved a costly objective and has very often rendered the project itself uneconomic. Fortunately the Gold Coast Government is not obliged to consider such a policy.

157. For all these reasons the two Governments, the aluminium companies, and the consulting engineers, have all supported the Commission's policy of keeping the labour forces to a minimum.

Mechanisation

158. The most effective means of reducing the original estimates for the labour forces has been the decision to use mechanised methods of construction. These methods add a relatively small number of skilled workers to the labour force, but their major effect is to achieve a great reduction in the number of unskilled labourers.

159. The full implications of using mechanised methods of construction have been carefully considered bearing in mind experience of similar methods in other parts of Africa, which has not always been satisfactory. The Commission and its consulting engineers are satisfied, however, that general conditions in the Gold Coast and the particular conditions of the Project would permit the successful employment of a very high degree of mechanisation.

160. Many skilled workers in the country have already demonstrated that they are competent to handle the various types of machinery that would be employed in large-scale construction. In the Gold Coast, as in other parts of West Africa, it is now common experience to observe local staff handling efficiently such equipment as cranes, railway locomotives, tractors and scrapers, and a variety of workshop equipment. The Railway and Harbours Administration in the Gold Coast provides outstanding examples.

161. Difficulties have often arisen in the use of mechanised plant because of insufficient knowledge of the physical conditions in which the plant would be used. For the Project, however, the materials to be excavated and moved at the dam site (mainly earth and rock) have been tested and proved in great detail by the consulting engineers so that the conditions under which the machines would operate are known. Moreover, the construction areas are all relatively easy of access so that there should be no problems (such as have occurred in other schemes) through the remoteness of the construction site and the consequent complexities involved in maintenance and overhaul.

Maintenance

162. The use of mechanisation on a large scale carries with it the absolute necessity of establishing an efficient maintenance organisation as soon as the contractor undertakes the task of construction; and of ensuring that the organisation functions efficiently until construction is completed. The Commission has been greatly impressed by the manner in which failure to provide adequate maintenance organisations in sufficient time has led in many projects—even on certain recent schemes in North America which is the home of modern mechanical construction—to delays and increased cost.

163. It would be essential, therefore, as part of the policy of mechanisation, to ensure that all concerned with the Project were trained in the importance of maintenance and in the requisite techniques. Provided that the importance of maintenance is fully recognised, the achievement of a high degree of mechanisation appears entirely practicable. The effect on productivity is discussed in paragraphs 182 and 183.

Manpower Requirements

164. Working on the above principles, estimates of the manpower required for the five component parts of the Project were prepared, and the Commission found that it was possible to reduce substantially the original estimates of the total labour forces. The consulting engineers helped to secure a major economy by means of further study which reduced the maximum labour force required for the dam and power installation to about 5,000 compared with the earlier estimates in the region of 10,000. The peak labour force for the construction of all five component parts of the Project is now estimated at about 15,000, showing a reduction of some 10,000

from the earlier figures. Requirements of manpower both for the construction and operating phases can be summarised as follows:

TOTAL MANPOWER REQUIRED DURING THE CONSTRUCTION PHASE

Year	*African Staff*				*Overseas Staff*
	Professional and Skilled	*Semi-Skilled*	*Unskilled*	*Total*	
1957	1,020	535	2,720	4,275	210
1958	1,845	1,020	4,170	7,035	340
1959	2,300	1,230	3,630	7,160	325
1960	3,575	1,790	6,140	11,505	470
1961	4,630	2,265	7,835	14,730	660
1962	4,650	2,340	8,305	15,295	785
1963	4,110	1,830	7,825	13,765	770
1964	1,390	575	2,550	4,515	245

Notes: (*a*) Volta River Authority staff, including those engaged on lakeside health measures, are excluded from the above figures. They would be relatively few in number.
(*b*) Labour figures include a 10% allowance, based on Gold Coast experience, for sickness and absenteeism.
(*c*) The figures for 1957 and 1958 include the working force for completion of the construction of the first stage of Tema harbour. No figures are included for extension of the harbour; if this was undertaken immediately after completion of the first stage about 1,000 workers might be needed in 1959 and 500 in 1960.
(*d*) No figures are included for workers engaged in the construction of the township of Tema. This might involve 5,000 to 7,000 up to 1959 and rather fewer thereafter.
(*e*) Separate tables for each of the five component parts of the Project are contained in Appendix XI.

TOTAL MANPOWER REQUIRED DURING THE OPERATING PHASE

	Initial Stage	*Intermediate Stage*	*Final Stage*
Mines			
Supervisory	20	30	40
Skilled and semi-skilled	290	410	560
Unskilled	160	180	220
Total	470	620	820
Power Project			
Supervisory	18	18	18
Skilled and Semi-skilled	49	63	67
Unskilled	48	55	60
Total	115	136	145
Smelter			
Supervisory	170	240	400
Skilled and Semi-skilled	3,180	4,600	7,670
Unskilled	600	860	1,430
Total	3,950	5,700	9,500

Note: The above table excludes the number required for the operation of the railways and the port of Tema. The port would probably employ a total of about 1,200 (including marine workers and stevedores) in the four-berth stage, and about 2,400 after final development.

Chapter 8

HUMAN FACTORS

Importance of Human Factors

165. Throughout its work the Commission believed that the treatment of the basic problem of human factors could exercise a vital influence on the success or failure of the Project. The Commission therefore endeavoured to investigate the subject with particular care and to take the maximum advantage of experience in the Gold Coast and elsewhere. It is abundantly

evident from the experience of major construction works in recent years that success does not depend on technical achievement alone, but that it must be matched by equal effort in planning and administration in the human field.

166. Relations between management and labour, between workers on the Project and people already living in the areas concerned, and between people of different races and different backgrounds, would need to be maintained and developed on a satisfactory basis if the Project was to go forward free from the difficulties and interruptions which would follow from failure in any aspect of these relations.

167. The Commission has regarded it as axiomatic that the Project would be undertaken in the spirit of racial harmony which today characterises the Gold Coast, and that there would be no question of segregation in the organisation of working or living conditions.

168. Speedy and economic construction must depend on the building up of stable and efficient working forces, and this in turn requires constant attention to be paid to the working conditions and training of the labour forces, to their needs for family life, and to their requirements for housing, feeding and maintenance of health.

169. Successful treatment of this wide range of human problems, together with the introduction of mechanisation as described in the previous chapter, could pave the way to greater productivity and lower costs, with consequent improvement in the economic basis of the Project. Failure to handle effectively these human problems would lead inevitably to industrial unrest, rapid turnover of labour and delays in construction, and finally to greatly increased costs.

170. In the Gold Coast, the question of human factors becomes of even greater importance when considered against the present background of rapid political progress and significant social developments, particularly the trend from rural towards industrial communities, which the Project itself would accelerate. Another factor reinforcing the Commission's assessment of the importance of human factors was that the understanding which could be created during the construction phase between the Gold Coast Government and the other parties responsible for building the Project could itself be a decisive influence in laying the foundation of a long-term partnership between the smelter company and the Government and people of the Gold Coast.

Economic Aspects of Human Factors

171. As with all projects, whether undertaken by public or private enterprise or by a combination of the two, cost is a limiting factor. The Commission therefore constantly considered the financial implications of these human factors, and appreciated that the raising of standards and social services beyond a certain point would make the Project uneconomic. Another factor limiting the standards of housing and services is the need for the Gold Coast Government to have regard to the standards generally prevailing in the country, and to the claims from other parts of the country for improvements. When planning the working and living conditions for permanent communities, therefore, the general objective was to create conditions which would be in advance of those prevailing in the Gold Coast today and which took proper account of the present rate of improvement in the country and of the aspirations of the people towards a better standard; but which, nevertheless, did not represent extravagant ideals framed without regard to cost, or involving such high expenditure as to imperil the economics of the Project.

172. It was also recognised that the improved conditions in the new communities would in many cases be achieved only gradually over a period of years. Moreover, it was fully realized that it is not possible by planning, however careful, to solve in advance all the difficulties which could arise in the field of human factors in a scheme of this size. The important feature at this stage is that there should be early recognition of the general objectives to be achieved, and that the parties to the Project should agree on these objectives. It will be seen later that the Commission believes this to have been secured (paragraph 185).

Method of Investigation

173. The Commission arranged for the problems associated with human factors to be studied under five main headings:

(*a*) labour;
(*b*) sociological factors;
(*c*) housing and town planning;
(*d*) feeding;
(*e*) health and sanitation of the new communities.

174. In order to investigate these questions in detail, the Commission set up five Working Groups in conjunction with the Gold Coast Government, and with the collaboration of the aluminium companies and the consulting engineers. The Working Groups consisted mainly of experienced officials of the Gold Coast Government who were assisted by the various specialist

experts advising the Commission, notably Professor Hylan Lewis of Atlanta University, dealing with labour and sociological aspects; Professor George Macdonald and the late Dr. Andrew Topping of the London School of Hygiene and Tropical Medicine, who advised on the health and sanitation aspects; and Dr. Koenigsberger, also of the London School of Hygiene and Tropical Medicine, who examined the housing and town-planning questions. The Commission also consulted representatives of commerce, industry and organized labour in the Gold Coast, and a number of specialised agencies outside the country such as the U.S. Public Health Services, the Human Nutrition Unit in the Gambia, various health authorities in Nigeria, and many organisations throughout the world which had been confronted with similar problems in large-scale construction projects. In addition other advisers, called in either by the Gold Coast Government or the Preparatory Commission to assist in certain aspects of the Project, all recognised the importance of human factors. Among these advisers was Dr. A. E. Morgan, who made a number of suggestions in this field, based on his very wide experience.

175. The main recommendations of the five Working Groups are included in the Commission's report on human factors which appears as Appendix XII. That appendix also includes or summarises the reports of advisers who made special investigations into the planning of particular communities, such as the smelter township near Kpong and the temporary and permanent communities at Ajena (Chapter 11).

176. Throughout the consideration of the many problems associated with human factors the principle of reducing the labour force to a minimum was always borne in mind. One other policy of major importance in this field was advocated by the Preparatory Commission from the outset, and subsequently accepted by all parties; that policy dealt with families.

Policy in Relation to the Families of the Labour Forces

177. In the Commission's view it should be possible to solve many of the problems associated with the maintenance of stable and contented labour forces by providing facilities for families to accompany those workers with reasonable prospects of long-term employment in the area. This policy was endorsed by the Working Group on Sociological Factors, and then interpreted by the other Working Groups in terms of housing, education, welfare and health services.

178. In the operating phase there would be decisive arguments for such a policy. The Commission is also convinced, having closely investigated local conditions, that the policy should in addition be applied to some degree in the construction phase, extending as it does for up to eight years, in order to avoid a repetition of the very expensive and inefficient turnover of labour which has characterised so many large post-war projects where facilities for families have not been provided.

179. An important aspect of rapid labour turnover is the unfortunate effect which can be produced in the relations between labour and management, and between people of various races. The more that confidence could be built up between all persons engaged on the Project, obviously the better would be the prospects for its success. Continuity in individual relationships would play a valuable part in building and maintaining such confidence. This has a direct bearing on the efficiency with which the training of Africans could be carried out.

180. The Commission therefore recommends for the operating phase the adoption of a comprehensive policy for the provision of facilities for family settlement; and that the policy should apply also in the construction phase, though with some modification in degree so that the extent of provision for families would diminish for the shorter construction tasks within the Project. This policy would not only be essential for the establishment of satisfactory social conditions; it would also be a sound policy economically as indicated in the fuller discussion in paragraphs 552 to 556. It should be noted that a similar policy has been endorsed by a number of authorities (consulted by the Commission) who have been responsible for recent large-scale projects in underdeveloped countries; and it is becoming generally regarded as a most important step towards the creation of stable and efficient labour forces.

181. The policy applies with special force to overseas staff where it would be most desirable to keep turnover to a minimum in order to reduce costs and above all to preserve continuity in labour-management relations. The presence of families could probably do more than anything else to promote stability of overseas staff; especially when it is remembered that many of the men would be required for practically the entire construction phase extending over eight years. This problem is discussed in detail in paragraphs 89 and 90 of Appendix XII. A consequence of the family policy would be that endeavours should be made to ensure that the wives of overseas staff were suited to present-day conditions in the Gold Coast, and could play some part in the general well-being of the new communities, e.g. by participating in welfare, education, or other work. When selecting overseas staff for any element of the Project due consideration should be paid to the suitability of the family as well as of the man.

Productivity

182. It has been pointed out that the productivity of labour in the Gold Coast is capable of substantial improvement, and many enterprises in the Gold Coast in recent years have achieved remarkable results in this field. Much depends on the quality of management and on its attitude to this particular problem. The Chairman of one of the large mining companies commented early in 1955 that improved labour administration and plant layout had had the equivalent effect of adding 2,000 men to the labour force of one mine. The manager of the largest construction job now under way in the Gold Coast has been " very pleasantly surprised " by the degree of skill shown by local workers in handling mechanised equipment.

183. The Commission believes that if a stable, contented, and efficiently trained labour force could be developed and maintained, and applied to a highly mechanised operation under enlightened management and supervision, there could be striking improvements in the level of productivity, with corresponding reductions in cost. It is probable that industrial consultants with experience in the Gold Coast could provide valuable assistance towards achieving this objective.

Security

184. It is well known that in a number of recent large-scale projects in many parts of the world, subversive elements have made very active efforts, often over prolonged periods, to disrupt the progress of work by creating unrest among the labour force. This is a danger which should be guarded against constantly by the Gold Coast Government and by all employers and trade unions associated with the Project. The effects of malicious agitation would be minimised if the opportunities for sowing discontent were reduced by the establishment of good working and living conditions. However, there would still need to be reasonable security measures. On certain projects in other countries notable success has been achieved in this field by enlisting the full co-operation of the trade unions in the maintenance of good labour relations and in the discouragement of unofficial strike action.

Conclusions and Recommendations

185. The Commission's investigations into the problem of human factors resulted in over a hundred conclusions and recommendations which are set out in full in Appendix XII. The most important of these findings are referred to in the following three chapters. The full report in Appendix XII was circulated to the Governments and the aluminium companies in 1955 and was broadly accepted by them. The Commission feels that the acceptance of its general approach to human factors by the parties concerned is encouraging, and could exercise a great influence on the prospects of successfully constructing and operating the Project. In one or two instances, detailed recommendations as to specific standards would need further consideration by the parties before commitments were made to proceed with the scheme, and in a few cases the parties would need to study further the proper balance between the natural and understandable desire of the Gold Coast to achieve higher standards and the need to preserve the economic viability of the Project.

186. Another encouraging feature is the proved performance of the aluminium companies, who have shown by their handling of construction schemes and their operation of facilities in many parts of the world, that they are fully aware of the importance of human factors. Any negotiation about the exact nature and scale of specific facilities would therefore take place against the background of a common approach to human factors which would provide every hope for a satisfactory settlement.

Chapter 9

RECRUITMENT AND EMPLOYMENT OF LABOUR

Analysis of Requirements

187. At an early stage of its work the Commission carried out a detailed analysis of the manpower requirements of the five component parts of the Project. These needs were analysed separately for the construction and operating phases. For the construction phase they were further divided into annual requirements, and for each year estimates were made of the numbers of supervisory, skilled, semi-skilled and unskilled workers. Details are shown in the tables supporting Appendix XI. Within the field of skilled workers an additional analysis was made of individual trades and skills; the results of these investigations are summarised in Appendix XII.

The broad trend during the construction phase shows a total working force increasing gradually to a peak of about 15,000 in the sixth year, and then declining to the 4,000 workers needed subsequently for the operation of the first stage of aluminium production. Expansion to the final stage of production would at some future date increase the operating force at the smelter to about 9,000. Within these totals there would be high proportions of skilled and semi-skilled workers, amounting to about 40% during construction and 75% during operation.

Phasing of Labour

188. The Commission investigated the possibility of phasing the components of the Project so as to reduce to a minimum the peak labour force and diminish the rate of growth and the rate of decline. The phasing originally contemplated during the 1951 and 1952 discussions has been greatly improved, largely through the Gold Coast Government's decision to start construction of the port of Tema and ancillary communications in advance of any decision to proceed with the Project. Limits to any further improvement in the phasing are set by the technical and economic requirements of the Project. On the one hand, all components would need to be ready for operation by the time power was available, while on the other, completion of sections of the works at any appreciable period before they were required would involve the accumulation of heavy interest charges. For these reasons there would necessarily be a period towards the end of construction when relatively large forces would be employed both at Ajena and at the smelter (see paragraph 193). It has been possible, however, to plan the building of the various railway links in such a way as to even out the total labour requirements over the years of construction.

General Availability of Labour in the Gold Coast

189. The requirements of the Project have been examined against the known information about the supply of labour in the Gold Coast. The total demand for the scheme is not large compared with the total working population of the country; furthermore, the peak is reached gradually over a period of years. Local experience shows that no difficulties have been found in the recruitment of working forces amounting to some thousands for new construction projects. Moreover, the adult male population is estimated to be rising by about 20,000 a year through natural increase and net immigration from surrounding territories.

190. The existence of a large source of migrant labour has undoubtedly assisted recruitment for development works in the Gold Coast and it is probable that this source will continue. Inquiries by the Commission indicate no reason to suppose that any developments in adjacent territories would diminish the regular supply of workers to the Gold Coast. At the same time, it is not thought that the Project would depend on migrant labour to an abnormal degree and the supply from this source would be unlikely to exceed 30% to 40% of the total, the remainder being recruited from those parts of the country in the neighbourhood of the Project and other districts of the southern half of the Gold Coast.

191. The Commission concludes that provided there was no increase in the rate of other development in the Gold Coast, and provided that high turnover of labour did not multiply the number of recruits required, there should be no difficulty in obtaining the total labour requirements for the Project. The special requirements of skilled workers are examined further in paragraph 199.

192. Each of the provisos to the above conclusion should be satisfied, since in the first place the Gold Coast Government has already given specific assurances to the Commission about the rate of future development (paragraph 584), and in the second place the general recommendations about working and living conditions should ensure that labour turnover was kept within reasonable bounds.

Decline of Labour Forces after End of Construction

193. The comparatively rapid fall in the total numbers employed as the construction phase ended, and the operating phase began, would require careful consideration at the appropriate time. It is probable that many of the skilled and semi-skilled workers employed on construction would find employment in the operating phase, particularly at the smelter, but the Gold Coast Government appreciates the importance of making the best use of any excess of construction labour over the permanent requirements, and would consider the introduction of suitable development projects at the proper time and place which might employ this labour to good advantage. Another possible solution would be found if it was decided to extend the Project almost immediately the first stage was completed. With careful planning, such a decision could lead to a relatively steady level of employment until the operating force was built up to a figure considerably higher than the 4,000 required for the initial stage.

Recruitment

194. The Commission concluded, in the light of advice received from the Gold Coast Government, that labour would probably apply for employment in sufficient numbers without any special or elaborate recruiting organisation. Normal publicity should ensure that adequate numbers sought employment, and the only special measure might be to publicise the opportunities for skilled employment among those leaving school or technical institutes. A labour organisation would naturally be required at the site, and the Government would open an office of the Labour Department which would work in collaboration with the Volta River Authority and the various contractors.

195. The Gold Coast Government has had under consideration for some time the establishment of a transport scheme to assist the migrant labour from the north to overcome the present hardships of the journey, which are liable to impair the health of workers. If the Government should proceed with such an arrangement, the Volta River Authority should work in co-operation with the system adopted and make valuable use of it. The Commission does not feel, however, that in the absence of Government action there would be a convincing case for a special recruiting and transport scheme to be adopted at the outset of construction solely for the purpose of the Project. This, however, is a matter which should be kept under review, particularly if it was found that large numbers of migrant workers were employed on construction, and that the conditions of their journey to the site were impairing their health and reducing their efficiency.

Effect of the Project on Other Employers of Labour

196. The Commission considered carefully whether the labour demands of the Project would prejudice the labour supplies of other essential industries, thus adversely affecting the economy of the Gold Coast. This problem was discussed with the Ministry of Agriculture and with the Gold Coast Chamber of Mines, recognising the vital importance of the cocoa and mining industries to the Gold Coast.

197. The conclusion of the Commission is that no serious adverse effect on other industries need be anticipated. There would naturally be temporary movements of workers from one sector of the economy to another, as there are at present, but a reasonable wage policy throughout the country should ensure that such movements were not appreciably to the disadvantage of existing industries. In the long run the growth of a new and substantial source of employment of skilled labour, with the opportunities for training which the new industry would offer, should be to the general advantage of Gold Coast industry. This particular problem is referred to again in paragraph 588.

Professional and Technical Staff and Skilled Labour

198. The general objective in the recruitment of supervisory and skilled workers should be governed by the imperative need to secure economic success for the Project. The selection and retention of responsible staff of high quality would be essential for efficient and economic construction. It is clear, therefore, that the primary criterion for employment on the Project would need to be that of efficiency without regard to race, creed or colour. This criterion has been accepted by the Gold Coast Government and the other parties to the scheme, together with the consequence that overseas countries would need to assist in the provision of supervisory staff. Even if the field of recruitment were to be extended world wide, it would still not be easy to recruit men of the outstanding qualifications needed for the supervision of a scheme as large as the Volta Project; the general difficulties in the supply of key technical men are discussed further in paragraph 598.

199. The bulk of the requirements of skilled workers should be found within the Gold Coast, but the detailed study undertaken by the Commission in association with the Gold Coast Government indicates that there might be difficulties in the supply of a few trades and skills in adequate quantity and quality. (This problem is directly related to the size of the next Development Plan in the Gold Coast which is discussed in Chapter 28.) The trades in question are those of electricians, fitters, welders and pipe-fitters, and shorthand-typists. The present training schemes in the Gold Coast should go some distance towards remedying the shortages, but there would remain the need to recruit a number of skilled workers from overseas.

Foremen

200. The Commission regards the recruitment and employment of suitable foremen as a crucial problem in the labour field. The relation between foremen and workers is one of the most important links in the chain of efficient handling of labour and in the development of

good labour-management relations. There would be marked advantages in employing trained and competent African foremen if available in sufficient numbers, but here again it would be necessary to supplement the local supply by a degree of recruitment from overseas. It would be essential to provide opportunities for those skilled African workers who appeared to have the necessary qualities to be trained for employment as foremen as the work advanced, and this principle is endorsed by all parties to the scheme.

Training

201. In accordance with normal practice on construction projects in the Gold Coast, employers would naturally introduce schemes of training on the job. By this means it should be possible to diminish the dependence on skilled workers from overseas, and to reduce the cost of construction by the consequent saving of passages, etc. As indicated in paragraph 162 it would be necessary for any training in the operation of plant and machinery to place emphasis on efficient maintenance.

202. During the operating phase, there would be greater opportunities for training and promotion of Gold Coast workers. Provisions are contemplated in the draft Volta River Authority Bill (Chapter 36), and in the draft Master Agreement (Chapter 37), which would place obligations on the Authority and on the smelter company to institute training schemes with the object of assisting Africans to fill skilled, technical and supervisory posts. It is suggested that this would be a general objective shared by the Gold Coast Government and all concerned with the Project, and that no specific targets or proportions would be stipulated in advance. This is in conformity with the statement on foreign investment made by the Prime Minister of the Gold Coast in 1954 which is referred to in paragraph 604 and reproduced in full as Appendix XV.

203. In addition to schemes for training on the job, the Gold Coast Government, in formulating its general plans for technical training, would take into account the needs of the Project, in order that a greater number of Gold Coast workers in the technical and skilled grades would be available for such employment. Normal employment in the construction and operating phases would be determined by the criterion of efficiency, but in order to take advantage of the instructional opportunities offered by such a large scheme, it is proposed also that a number of qualified Africans should be attached for training and experience in addition to those who obtained employment in the ordinary competitive way. The draft contract for constructing the dam and power installation (referred to in Chapter 39) provides for this.

Feeding

204. In the Gold Coast and other parts of West Africa, an outstanding contribution to increased production can be made by a balanced diet. Many employers have found that expenditure on improving the diet of workers is amply repaid by better performance. The Commission recommends that supplementary feeding schemes should be introduced on all major construction sites, and that at least one main meal per day of properly balanced dietary composition, and including adequate protein content, should be available to workers. It would be important not only that dietary considerations should be taken into account, but also that the type of food provided should be acceptable to workers and not unfamiliar to them. In order to ensure that the meal was generally accepted it would be necessary to subsidise the price at which it was provided, at least to the lower paid workers.

205. In addition to the main meal, there would be advantage in providing drinks and snacks and possibly other meals at certain times. Careful thought would need to be given to the administration of all organised feeding arrangements in order to obtain full co-operation from the workers. Measures of control would likewise be necessary over the provision by local traders of cooked food (often of inferior quality or poor nutritional value) in the vicinity of construction sites, so that the health of workers would be protected, and so that they would not be discouraged from buying the properly balanced meals offered by the employer. To ensure that proper attention was paid to catering and diet, qualified staff would need to be retained by the Volta River Authority and by the contractors.

Overseas Staff

206. Special consideration has been given to the recruitment and employment of overseas staff who although comparatively few in number (about 5% of the total employed) would occupy key positions in the supervision and technical execution of the Project. Great care should be taken in ensuring that staff recruited from overseas were of adequate quality and were physically and temperamentally suited to the conditions in the Gold Coast. Reference has already been made in paragraph 181 to the advisability of ensuring that their families were likewise suited for life in the Gold Coast.

207. Experience in the Gold Coast points to the advantage of employing overseas staff for relatively short tours of not more than one year's duration, followed by a correspondingly short period of leave. This should increase efficiency and should reduce to a minimum the discontinuity caused by longer periods of absence. Reasonable continuity of supervision should assist in the development and maintenance of good racial and labour-management relations. Such continuity would also be aided by an acceptance, on the part of those employers with enterprises in other parts of the world, of the value of keeping in the Gold Coast those members of their overseas staff who had acquired local experience and had gained the confidence of workers.

Labour-Management Relations

208. The greatest attention should be paid to the development of good labour-management relations, which could have an important effect in improving the efficiency of labour. The aluminium companies have an outstanding record in this respect, and it would be vital that all contractors engaged on the Project should likewise have a full understanding of the importance of the matter. The Commission is of the opinion, judging from industrial experience in the Gold Coast, that the development and use of labour incentives could promote productivity and improve labour relations, and this is another aspect in which industrial consultants should have a contribution to make (see also paragraph 183).

209. Relations with the trade unions are naturally of cardinal importance in the labour-management field, and all employers would need to facilitate the speedy establishment of adequate machinery for consultation and conciliation.

Health of Workers

210. The first essential in the safeguarding of the health of workers would be to institute a system of medical examination on recruitment. This would ensure that no worker would be engaged who would be unable to carry out his task for medical reasons and would also protect the remainder of the labour force from infection.

211. A health organisation would also be needed to provide a general medical service for the labour forces, and to protect them from ordinary industrial and construction risks. It is proposed that full hospital facilities should be available on the main sites, adequate to provide not only for the labour forces, but also for their families (as will be seen in paragraphs 231 and 232, which deal with environmental sanitation in the new communities).

212. The Commission recommends that, as advocated by Professor Macdonald and by Dr. Topping, the health arrangements for the whole Project during and immediately after the construction phase should be under the charge of the Volta River Authority which would have a Health and Safety Division for this purpose. The statutory responsibilities of the Authority in regard to health are dealt with in Chapter 36.

Medical Research

213. The Commission has observed that there is little assembled knowledge about the conditions which lead to the highest productivity in tropical climates either for indigenous or overseas staff. It may well be that research into this subject during both the construction and operating phases of the Volta Project would lead to significant gains in the limited knowledge available, which could then be put into practice with marked results in the improvement of productivity and reduction of cost. Research is being carried out in West Africa at the Hot Climate Physiological Research Unit near Lagos, and all concerned with the administration of the Project would be well advised to keep closely in touch with the results of this organisation's work.

Chapter 10

LIVING CONDITIONS IN THE NEW COMMUNITIES

214. The previous chapter has dealt with the necessary conditions governing the employment of labour, but it is clear that those conditions alone would not be sufficient to produce the stable, contented and efficient labour force necessary for the successful execution of the Project. It would be essential to give equal attention to the problems of the worker as a member of the community in which he lived, and to study the full implications of the recommendations about family life which have been made in Chapter 8.

The Implications of Family Policy

215. In order to carry out the recommendations about families it would be necessary to provide housing, education, welfare facilities, and health services on a family basis. The Commission therefore estimated the size and population structure of the new communities that would be likely to grow up around the labour forces and was thus able to assess the extent and cost of the various facilities required. The objective was not to plan the provision of these items to the last detail, but rather to establish a general framework within which the new communities would be built in the light of experience in the earlier years; and to take account at the outset of the full financial implications.

216. The problems would not arise with equal force for each of the five component parts of the Project. For example, the construction force for the railways would be relatively mobile in character owing to the nature of the work, and no appreciable provision for families would be required. The planning of Tema township has been fully studied by the Gold Coast Government, and has not been the subject of separate investigation by the Commission. The Commission, however, initiated a special examination of the problems of the Ajena communities (both in the construction and operating phase); and with the assistance of Aluminium Laboratories and their town-planning consultants, conducted a similar investigation into the future of the smelter township. The results of these three studies are included in the next chapter, which deals with the application to specific areas of the general principles governing living conditions in the new communities. No special investigation has been made at this stage into the planning of the mining village since there would be adequate time after a decision had been taken to go ahead with the Project, and the area is sufficiently remote from the other components of the Project to enable its problems to be considered separately.

Education

217. The people of the Gold Coast are naturally and vitally concerned with the education of their children, and the provision of adequate schooling would therefore be an important factor in stabilising the labour force. Detailed consideration has been given to the needs of the new communities for primary, middle and secondary schools and for technical education. Recommendations are set out in full in Appendix XII, which deals also with the contribution which the mass education branch of the Gold Coast Government could make in the new communities by encouraging communal activities and by promoting literacy.

Recreation and Welfare

218. Appendix XII also records the results of investigations made into the facilities for recreation which would be needed by the new communities in the light of Gold Coast experience. It is suggested that workers should pay a modest contribution from their wages towards the provision of recreation facilities, and that they should be encouraged to organise such activities themselves rather than leave everything to management.

219. Group welfare services should be provided by the various employers, and it is recommended that proper clauses should be included in the contract documents to ensure that facilities were available at the right time and of adequate quality. It is recommended also that the Volta River Authority and other employers should engage responsible and suitably qualified welfare officers.

220. Individual welfare and remedial services of the type normally provided by the Central Government would naturally be the responsibility of the Gold Coast Government, which has considered what extensions would be needed to their present organisations in order to deal with the additional problems arising in the new communities.

221. Voluntary and religious bodies could play an important part in the new communities, and it is recommended that they should be allowed every facility to do so.

Racial Partnership and Committee on Human Relations

222. Everything should be done to promote an active sense of racial partnership and to maintain and improve the harmonious relations between people of different countries and races which at present prevail in the Gold Coast. One means of fostering this would be to issue to all staff—both overseas and local—on recruitment, a brochure explaining the main features of Gold Coast life, and indicating the place of the Project in the Gold Coast. Another possible contribution to the same objective might be the establishment in the Gold Coast of a committee made up of members who were either directly associated with the Project or who lived in one of the localities affected by it. This Committee could give early consideration to any problems likely to cause friction before they became acute.

Housing Design and Layout

223. A special study was undertaken into the best design and layout for housing the new communities, in the light of the particular conditions imposed by the local climate, the traditional ways of life of the Gold Coast people, and the economic limitations. In making this study, full advantage was taken of building experience in the Gold Coast over many years, of the specialised knowledge of the Building Research Station in England, the West African Building Research Institute, a number of other technical research organisations, and of Dr. Koenigsberger's special work on tropical housing. A number of specific recommendations for housing design appear in Appendix XII, dealing with both temporary and permanent housing, and with low-cost and more expensive housing. The Commission is impressed by the possibility of large savings in cost that might be obtained as a result of applying the best technical results of continuing research, and endorses Dr. Koenigsberger's recommendation that close attention should be paid to the development of new and cheaper building techniques (Appendix XII, Chapter 8). This would be of particular importance to the aluminium companies in view of the great investment which they would make in the housing at the smelter township in future years.

224. The advisability of installing air-conditioning in a limited number of houses, offices and public buildings, was examined. The use of air-conditioning in the Gold Coast is increasing rapidly and the Commission considers that it could be used with advantage in some of the buildings and houses required for the Project.

Rents

225. Study of housing problems must naturally include consideration of rents. The Commission, in conjunction with the Gold Coast Government, examined the economic implications of the housing standards proposed. It appears possible that fully economic rents might be charged to the higher-paid workers, but that the unskilled worker might for some time need to be assisted by subsidy since he could not meet the full rent for even the lowest-cost housing without setting aside a disproportionate amount of his income. A rent policy would need to be developed which took proper account of such practical limitations, which was broadly equitable, and which approximated as closely as possible to economic reality. Dr. Koenigsberger put forward some suggestions based on his experience of new communities in India (Appendix XII, Chapter 8). This subject is already receiving further consideration by the Gold Coast Government and the aluminium companies.

226. The Commission recommends that rent should be charged in the construction phase as well as during operation, so that a system of paying rent could become well established, and the difficulties of a sudden change of policy would be avoided. Tentative figures have been suggested for the rent of types of temporary housing at Ajena. In the Commission's view, the parties to the Project should take particular care to establish a sound rent policy from the outset, for failure to do so would be a constant source of friction.

227. Systems for encouraging home ownership have also been considered, and the aluminium companies would hope to introduce some such system for the smelter township.

Town Planning

228. Appendix XII sets out the main principles which should be followed in the planning of the new communities in order to meet the sociological requirements indicated in this and earlier chapters. One of the main principles should be the development of communities in such a way as to provide to the individual the maximum freedom in choosing where and how he should live, within the necessary limitations of his economic means. No attempt would be made to allocate specific districts or types of houses to particular classes of persons because of the nature of their employment or for any other reason. The detailed application of the principles of town-planning would naturally differ in accordance with the geographical conditions of the site and the nature and structure of the community that would live there. These factors vary greatly as between the different communities, and the specific problems of Ajena and of the smelter township are described in the following chapter.

229. In planning the new communities it would be very important to have regard not only to the layout of the communities themselves, but also to the conditions in the area surrounding them and in particular to the impact which the Project would make on nearby existing communities. This subject is vital in the area of the smelter township which would come into being within five or six miles of a belt of thickly populated villages, with a total population of about 18,000. The implications of this situation are discussed in the next chapter.

Shopping Facilities

230. A vital feature in planning the new communities would be the provision in good time of sufficient commercial facilities to supply the necessities of life to the workers and their families.

Attention should be given to this at a very early stage in construction, and it is thought that the greater part of the necessary trading activities would be carried out in the normal course of events by commercial firms in the Gold Coast. It would be necessary to provide them with suitable sites on reasonable terms. As a safeguard, however, particularly in the initial period of construction, it would be advisable for normal commercial facilities to be supplemented by officially sponsored retail stores which could provide the basic necessities of life. Such stores could also assist in ensuring that prices were maintained at reasonable levels.

Health and Sanitation

231. The sites for the new communities are regarded as satisfactory from the health point of view, but precautions would need to be taken against insect-borne and water-borne diseases. Recent research indicates that the most effective protection against insect-borne diseases would be the application of residual insecticide to all low-cost housing, together with the construction of effective mosquito proofing in the more expensive housing where insecticides could not be so readily applied. Detailed recommendations on this subject appear in Appendix XII, which also specifies the necessary steps to be taken to in the provision of water supplies and drainage and sewerage. It is contemplated that all communities would have a good supply of piped water, but the sewerage arrangements might vary from site to site.

232. Appendix XII also sets out in detail the hospital services that would be required for the labour force and their dependants, including maternity and child welfare services. Major hospitals would be needed at Ajena and near Kpong for the construction phase; the latter would subsequently serve the needs of the smelter company. Another hospital would be required in the general area of the smelter township to provide a Government health service for the increased population.[1] The possibility of meeting the joint needs of Ajena and Kpong by a single hospital was carefully examined, but proved to be impracticable (Appendix XII, paragraph 358).

Administration

233. The Commission was concerned not only with advocating desirable courses of action, but also with the administrative implications of carrying out its recommendations. It is clear that a strong and efficient local authority would be required in each of the new communities if the town planning and the health recommendations were to be carried out, and if the substantial expenditure on good standards and services was not to be wasted by poor maintenance or lax administration. On the other hand, it would be desirable to associate the people of the new communities as fully and as early as possible with the local administration so as to avoid creating an atmosphere of dependence which would hamper the development of popular initiative. The ultimate objective for all permanent communities would be to set up normally elected administrations on the lines now generally accepted in the Gold Coast.

234. The situation would be relatively simple at Ajena where the circumstances of construction would dictate that the Volta River Authority should have full powers of a local authority during the construction phase. In the permanent smelter township the problem is more complex and is further considered in the next chapter.

235. The special problems of health administration in the various areas of the Project have been very carefully considered and one of the most important recommendations of the expert advisers on this subject has been the selection of the Volta River Authority as the agency responsible for the effective supervision and co-ordination of all health measures in the area of the Project during the construction phase (see paragraph 212).

Chapter 11

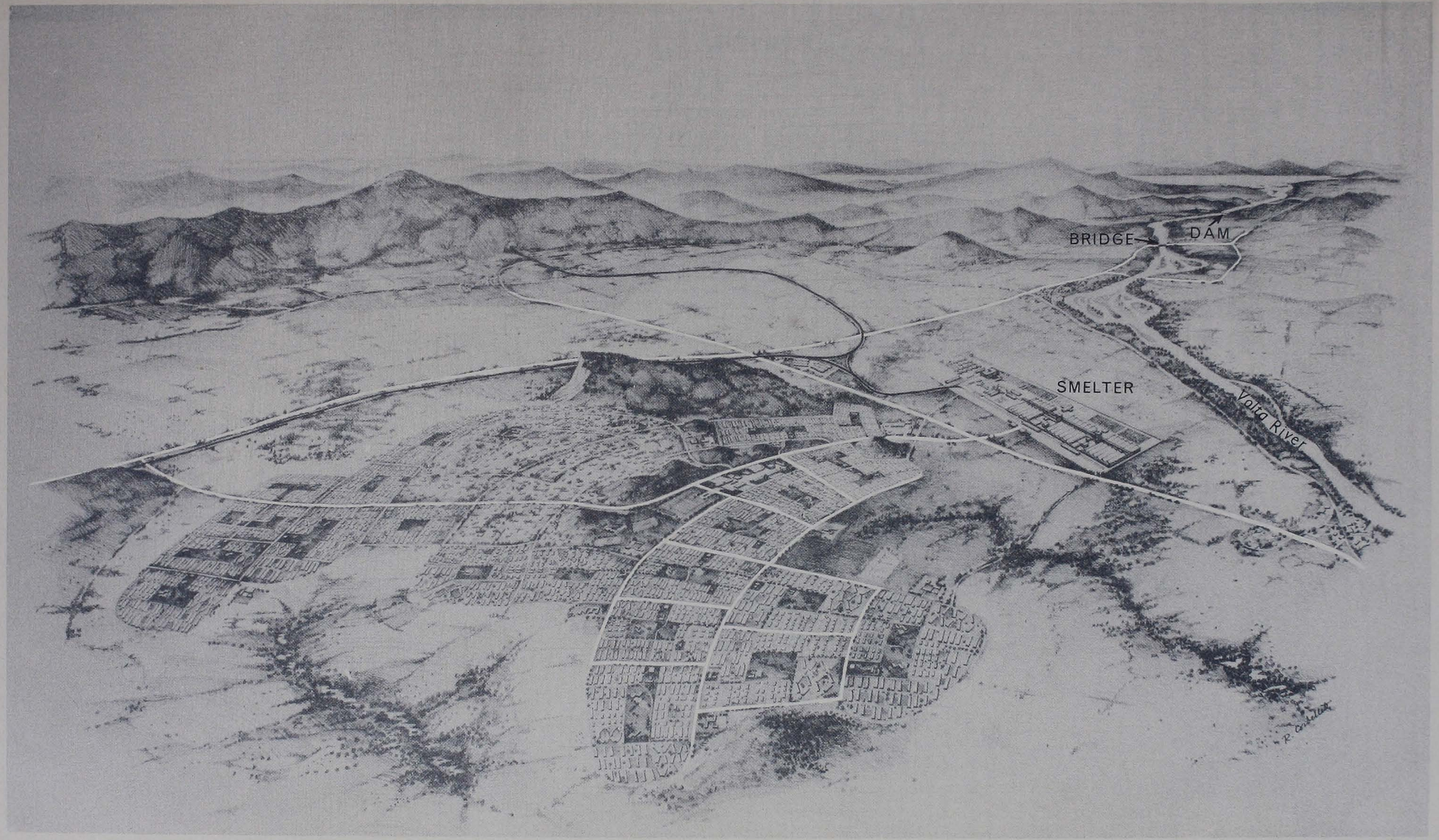
SPECIAL INVESTIGATIONS INTO THE PLANNING OF NEW COMMUNITIES

Smelter Township

236. The main permanent community that would arise in the Gold Coast as a result of the Volta Project would be the township near Kpong which would house the employees of the smelter company, the dependants of those employees and various other people who would find a place in the new community. The population corresponding to the final stage of the aluminium production has been estimated at about 50,000. An artist's impression of the new township is shown opposite.

237. A careful study was made of the general sociological implications of setting up a large

[1] Subsequent to the preparation of this report, the Gold Coast Government has informed the Commission that the Second Development Plan will provide for the building of a new hospital at Somanya which would thus meet this requirement.



ALUMINIUM SMELTER TOWNSHIP

C.B.H. 27336

VOLTA RIVER PROJECT

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new industrial community in what is at present a thinly-populated agricultural environment, and the relationship of the new community to the country as a whole and to the immediate neighbourhood in particular.

238. During 1954 a series of discussions about the smelter township took place in Accra between representatives of the aluminium companies, the Gold Coast Government and the Preparatory Commission. Aluminium Laboratories were assisted by their town planning consultants, Messrs. Mayer and Whittlesey, who have worked with the company in the planning of townships in other parts of the world, and the Preparatory Commission had the benefit of advice from Dr. Koenigsberger. These discussions resulted in general agreement about the objectives to be attained and the means of achieving them.

239. The first principle adopted was that the township should be planned, in accordance with the considerations in the previous chapters, without reference to race, creed or colour; and that provision should be made for individuals to live in the place and fashion of their preference within the economic limitations set by their family circumstances.

240. The main conclusion about the general social structure of the township was that it should not be a one-industry town with its usual attendant disadvantages. It was proposed, therefore, that housing accommodation should be provided for many others besides the employees of the smelter company and that allowance should be made for the full development of local trade, services, business and professions. On this basis it was thought, judging from experience in the Gold Coast and elsewhere, that ultimately about three-eighths of the total employed population would be in occupations other than the aluminium industry. At the same time it was clear that the smelter company, which would employ 9,000 people at the final stage of development, would inevitably maintain a dominating position as the major industry in the township. No provision has been made in the plan for any other major industry employing a labour force of comparable order. It is possible that other independent industries would develop in or near the smelter township, but if any such industries were to employ a labour force running into thousands, then new planning problems would arise and consideration would have to be given, before they were established, to the question whether the better answer would be an extension of the smelter township or the setting up of an entirely separate community.

241. The township would be laid out in accordance with modern practice so that the community would be grouped in a series of neighbourhoods, each with ready access to the town centre. A diagram of the proposed layout is contained in Appendix XII.

242. In considering the design of houses and their layout within the neighbourhoods, study was devoted to the problem of establishing a general framework that would be suitable for the varying requirements of a society in a state of transition. It was recognised that the nature of the social structure in the Gold Coast was changing with the development of urban communities and that, in particular, the wider family responsibilities associated with traditional village life were becoming modified. Possible housing layouts have been suggested, therefore, that would be suitable either for traditional family grouping or for the separate life of individual families.

243. The companies have suggested standards of housing and services which are higher than any prevailing in the industrial housing in the Gold Coast today. The Gold Coast Government, while recognising that the economic consideration would have to be carefully weighed, has suggested that still higher standards might eventually be adopted in recognition of the general progress which has taken place in the country over recent years and which would be expected to continue in future. It should be noted that the township plan put forward by the companies provides for the possibility of improved standards in the later stages of development.

244. The precise definition of standards would need to be agreed during negotiations. At the same time it should be emphasised that the differences of opinion are very small in relation to the total expenditure involved, and that the great majority of proposals in relation to the township, such as the recommendation to instal a water-borne sewage system, have been generally accepted as satisfactory.

Administration

245. For the administration of the new township it is recognised that a special form of municipal authority would be required until the community had settled down. Consideration was given, therefore, to the constitution of a nominated body on which the aluminium companies would be strongly represented, and to the methods by which over a period of time this special authority would be superseded by a normally elected municipal council. It is generally agreed that the objective should be to associate the people of the township with its administration as soon as possible in order to foster a spirit of communal responsibility instead of one of dependence

which can so easily arise in a " company town "[2]; but the actual phasing of the transfer to an elected authority would need to be carefully considered in order to reconcile this objective with the efficient maintenance of essential services, and the preservation of satisfactory standards of housing.

246. An area of responsibility for the smelter township authority has been provisionally determined, extending for a radius of three to four miles around the industrial and housing sites in order to prevent the development of undesirable conditions on the fringe. Final recommendations on the composition, functions, and area of administration of the authority for the smelter township would be set out in the ordinance (paragraph 691) for the establishment of this authority.

247. It is recognised that efficient administration of the township itself, even of the extended area mentioned in the previous paragraph, would not be sufficient to prevent the development of undesirable social conditions in those existing communities which lie just outside the perimeter of the area suggested for municipal administration. It is recommended, therefore, that the administration of the existing towns and villages in the surrounding area should be strengthened and that the Gold Coast Government, in association with the local authorities, should accept a measure of responsibility for the maintenance of standards and the general development of essential works in these communities. These responsibilities would be supplementary to the public health duties envisaged in the draft Bill for the Volta River Authority, which would extend over the area in question. Dr. Koenigsberger has made the further suggestion that a regional plan embracing a considerable area which would include the smelter township and the surrounding villages should be prepared as soon as a decision to proceed with the Project was taken. He has suggested a number of preliminary steps that would be necessary for such a plan to be formulated. The proposal is discussed in detail in Chapter 8 of Appendix XII.

Financial Implications

248. The financial implications of building the smelter township, in particular the allocation of responsibility for capital expenditure between the smelter company and the Gold Coast Government, are discussed in paragraphs 480 and 481.

249. Although it will be seen that much attention has already been devoted to the study of the smelter township and its associated problems, a considerable amount of detailed elaboration would be required if a decision, in principle, was taken to go ahead with the Project. For example the problem of determining rents for houses would need to be settled without delay; again, there might be considerable scope for economies in building costs as a result of further research.

Impact of Industry on Local Communities

250. The Commission has always been particularly sensitive to the basic problem caused by the impact of a modern Western industry on an African society at a time of rapid political and social transition. A large number of difficult questions would necessarily arise from this development, but foresight and sympathetic understanding could do much to solve them. Undoubtedly the Gold Coast Government, the Volta River Authority and the smelter company would all co-operate in dealing with the problems (see also paragraph 222).

Permanent Township at Ajena

251. It is contemplated that the permanent community at Ajena would consist predominantly of the small operating force of the power station (which would not exceed 150 at maximum development), their dependants, and those people who would be essential for providing them with goods and services. In spite of its comparatively small size, this community has been the subject of special study in view of the significance to the Gold Coast of the dam and power station and the immediately surrounding area. The Commission therefore engaged Mr. Thomas Scott, an architect with extensive West African experience, to make a preliminary investigation of the site, layout, type and quality of housing and approximate cost of the Ajena permanent township. His report is summarised in Appendix XII and the following paragraphs indicate the main conclusions.

252. The site for the permanent housing was originally selected by the consulting engineers, and was confirmed by Mr. Scott as the most suitable. It is considered an excellent site for a permanent township, which would have a magnificent view over the new lake and power station, and would be within easy walking distance of the latter. The only drawback is that the site is near the area in which blasting operations would be carried out during construction of the dam so that it would not be practicable to build the township until construction of the dam was nearly completed. This presents no difficulty in the phasing of the Project, but prevents the achievement

[2] Dr. Koenigsberger has stressed the need to promote a constructive communal spirit, and has recommended the early delegation of appropriate responsibilities to neighbourhood units, and the adoption of an agreed timetable for the establishment of representative municipal government (Appendix XII, Chapter 8).

of the very small saving that could be obtained if the permanent housing could be built sufficiently early to house a number of construction workers.

253. The sociological objective of the permanent community would be the establishment of a small and contented group of reliable and efficient men whose primary responsibility would be the operation and maintenance of the dam and power installation, the regulation of the water, and the administration of certain public health measures. This settlement would thus be entirely different in character from the rural communities in the neighbourhood and, in view of the special responsibilities of the workers who would live there, it is desirable that it should remain so. It should not be merged with a village settlement of normal character.

254. It is possible that in the years to come after the creation of the lake, a new port would be required at its southern extremity. The port would, however, probably be some distance from the power station and would need to be planned independently from the Ajena community.

255. The township is planned on the basis of full provision for families and allowance is made for sufficient markets and shops, for recreation facilities and for a small town centre; provision is also made for a catering resthouse. There are certain services, however, which could not be economically provided for so small a community, and it is assumed that use would be made of facilities in neighbouring communities, such as the smelter township, and that special transport would be provided for the Ajena population. It is proposed that the township would have a piped water supply and piped sewerage system.

256. The design and layout proposed by Mr. Scott take full advantage of the natural surroundings. Trees and shrubs should be planted at the earliest opportunity, plans having been made in advance for the maintenance of a nursery for this purpose. This is also referred to in Appendix V which deals with landscaping.

257. Among the technical recommendations relating to housing, special emphasis is laid on the need for protection against termites and on the importance of correct orientation of the housing in relation to the prevailing breeze. The financial questions arising from the construction of the township are dealt with in Chapter 20 where it is assumed, for estimating purposes, that the Volta River Authority would be responsible for the cost of all accommodation required for its own employees, but not for other houses.

Temporary Township at Ajena

258. In planning the temporary township to accommodate the construction force for the dam and power installation, the first objective was to provide sufficient accommodation for families as a pre-requisite of economic construction. If no provision were made for families there is no doubt that, whatever measures of control were adopted, the dependants of workers would tend to group themselves as near as possible to the housing for construction workers with the result that a sociological and medical problem of the first magnitude would be created.

259. Another important consideration for this community is that there would be no permanent use at the site for the housing provided during the construction phase. The problem, therefore, is to meet the requirements for the construction force and families at the minimum cost. It should be noted that the temporary township at Ajena would form one of the first items in the construction timetable, and it would be essential to have plans sufficiently advanced for an early start to be made as soon as possible after a decision was taken to go ahead with the Project.

260. With these considerations in mind the Commission initiated a special investigation by the firm of Architects' Co-Partnership, in association with Dr. Koenigsberger, who were set the task of following up the earlier enquiries into the design and cost of the temporary township, and of achieving the maximum economy consistent with the basic policy in regard to families recommended by the Commission (paragraphs 177 and 181). Their terms of reference were more flexible than those given originally to the consulting engineers.

261. The only possible site of any reasonable area within practicable distance of the construction site is hilly and restricted. This physical condition imposes a pattern of fairly concentrated housing development. The construction timetable, which demands that a substantial proportion of the total temporary housing requirements should be met within twelve months from the start of construction, imposes a second condition, namely that some form of prefabrication should be employed.

262. The report made by Architects' Co-Partnership to the Commission will be circulated separately to the Governments and the aluminium companies as soon as printing has been completed; the most important conclusions can be summarised as follows:

(*a*) The inquiries confirmed decisively the two basic limitations, i.e. there is only one practical site for this temporary township, and the time factor makes it inevitable that prefabricated buildings should be used.

(*b*) Recognising the vital necessity for reducing to a minimum the possibility of any delay in constructing the Project, it is considered essential that houses should be supplied from a reliable overseas source, which could guarantee delivery dates to provide accommodation for up to 3,000 of the workers (with the appropriate proportion of families) of the total of 5,000 required for the dam and power installation.

(*c*) This general principle, however, would not exclude the full utilisation of the local potential in the Gold Coast for producing prefabricated components. Indeed, prefabricated floors for all houses should be constructed locally, and complete buildings for at least 1,500 workers with dependants should also be made in the Gold Coast. If experience demonstrated quickly that more than this number could be constructed locally at an economic price and with a satisfactory rate of delivery than the overseas figure could be reduced proportionately.

(*d*) The requirements of temporary and permanent housing for the smelter township near Kpong should be considered carefully in relation to the proven performance of Gold Coast firms in providing housing for the temporary township at Ajena. The greater demand might well lead to the possibility of reducing local costs.

(*e*) It would be desirable to erect as soon as possible a small number of prefabricated dwellings of the type eventually selected in order to gain experience in erection, etc. Such a small pilot project might serve to house staff who would be required very early in the Project, e.g. health and sanitation experts, and those required for the resettlement and compensation operation (paragraph 332).

(*f*) Arrangements should be made for the stock-piling in advance of an adequate supply of essential fittings, etc. Experience in the erection of prefabricated houses on a large scale has frequently indicated that considerable delays have been caused through a shortage of particular fittings. This advance stock-piling could possibly be arranged by the Volta River Authority, and transferred to the contractor for the township as soon as he was established.

263. The result of this special inquiry, in which Architects' Co-Partnership and Dr. Koenigsberger received the full co-operation of the consulting engineers and the Gold Coast Government, led to a reduction of £850,000 compared with the original estimate. This was achieved in part by modifying some of the original standards and making provision for the families of 50% of the labour force. The Commission desires to record its appreciation of the valuable work carried out by Architects' Co-Partnership and Dr. Koenigsberger.

Chapter 12

CONCLUSION AS TO TECHNICAL ASPECTS AND HUMAN FACTORS

264. The Commission considers that the Volta River Project can be regarded as technically sound, and that it could be carried out successfully, assuming that a contractor or consortium of contractors of proven experience and efficiency was employed on the hydro-electric project, that the aluminium companies efficiently developed the mines and constructed the smelter, that the Gold Coast Government provided the necessary railways and roads at the right time, and, most important of all, that throughout all aspects of construction the basic problem of human factors was handled successfully.

PART II

Effects of the Dam and the Lake

Chapter 13

EFFECTS OF THE DAM AND THE LAKE

Introduction

265. The construction of the dam at Ajena would have four main effects:

(*a*) An area of about 3,500 square miles[1] would be inundated;

(*b*) The pattern of flow of the river between the dam site and the sea would be changed;

(*c*) The new lake would create problems of health and sanitation;

(*d*) Agriculture, forests and fisheries would be affected in various ways.

266. In considering these problems, it is necessary to keep in mind the statement made by the Prime Minister of the Gold Coast in 1953 that, if the Project was carried out, the Government would ensure that no one was made worse off as a result of the creation of the lake.

Effects of the Project in the Area Subject to Inundation

267. The problems of compensation and resettlement which could arise in the lake area have always been recognised by all parties to the Project. The Commission carried out extensive investigations into the existing conditions in the area, and the extent and nature of the measures which would become necessary if the Project were to go ahead. The results are incorporated in Appendix VI and described in general terms in the next chapter of this report.

Effects of the Project on the Riparian Communities Living Downstream from the Dam

268. The Commission was unable to find any evidence, however, that the effects which the changed condition of the river would have on the riparian communities living along its lower reaches had been considered previously. Investigations were therefore initiated by the Commission and the results are recorded in Appendix VII. Chapter 15 describes these enquiries and gives the main conclusions.

Problems of Health and Sanitation Associated with the New Lake

269. Before the establishment of the Commission, an appreciable amount of investigation had been carried out into the problems of health and sanitation which could arise from the formation of the new lake. It was apparent, however, that a more detailed analysis would be required for each of the major individual diseases already existing in the area, and that detailed plans for a control organisation, together with estimates of cost, would have to be prepared. Chapter 16 summarises the results of the Commission's enquiries; Appendix VIII describes the problems in detail.

Agriculture, Forests and Fisheries

270. A general survey of the effects of the Project on agriculture, forests and fisheries is contained in Appendix IX. The salient features are summarised in Chapter 17 of this report. It was convenient to consider under this general heading the demands for food and firewood which the Project would make on the local economy.

Chapter 14

EFFECTS OF THE PROJECT IN THE AREA SUBJECT TO INUNDATION

A. INTRODUCTION

The Problem

271. The creation of a great lake extending over some 3,500 square miles would obviously create many problems. There are several examples in other parts of the world where a failure to handle claims for compensation fairly and efficiently, and to arrange practical resettlement policies, has led to political embarrassment and expensive economic consequences. Still more important, human beings have often suffered unnecessary hardship. The sociological changes

[1] The approximate area of Kent, Surrey and Sussex.

inevitably forced on them by changes in their physical environment have frequently been made worse by inadequate knowledge of the economic and social pattern of their lives, and of their rights and possessions, and by a lack of foresight in providing opportunities for them to create new homes and to obtain new sources of livelihood. Inefficient administration in resettlement and in the assessment and payment of compensation have frequently still further aggravated the situation.

272. This warning is given immediately for, although the parties to the Project gave some consideration in their earlier discussions to the problems of compensation and resettlement which might arise in the area of the new lake, the Commission feels their full implications need to be re-emphasised.

273. In the White Paper (Cmd. 8702) it was proposed that compensation up to a total of £3,000,000 would be borne by the Project, and that any excess up to a maximum of a further £1,000,000 would be shared equally between the Project and the Gold Coast Government. The maximum amount chargeable to the cost of power was thus limited to £3,500,000.

274. Later in this chapter the Commission estimates that the cost of compensation and resettlement would be about £4,000,000, and in the next chapter it is recommended that a further £500,000 should be accepted as a prospective liability for the effects on communities downstream from the dam. It must be emphasised, however, that these estimates are based on the assumption that, as soon as a decision was made to proceed with the Project, the Gold Coast Government would establish immediately an effective administrative organisation to deal with all the problems of compensation and resettlement, and with the changed conditions amongst the riparian communities. This administrative problem is directly related to the resources of administrative and technical manpower available to the Gold Coast Government which are considered in Chapter 28.

275. The economic implications of this problem can be illustrated by an example in another country, which was brought to the attention of the Commission, where the ultimate cost of compensation and resettlement was about eight times the original estimate.

Extent of the Problem

276. At present, almost 62,500 people inhabit the area which would be submerged by the new lake. Their lives would be changed; much of the land they now farm would be lost and most of them would lose their only homes. Compensation would have to be paid, and resettlement carried out where necessary. Certain public roads and buildings would be inundated, and need to be replaced. Fortunately, the greater part of the area is sparsely populated and there is relatively little cultivation. Moreover, most of the population have access to land outside the area on which they could resettle. With the possible exception of a small limestone deposit, no minerals of commercial significance are known to exist.

277. The manifold effects of the changed conditions demand the most careful consideration. An additional reason for such a detailed appreciation lies in the fact that, under the arrangements contemplated in the White Paper, the Gold Coast Government could, in certain circumstances, be with left an unspecified liability which might easily assume large proportions.

Inter-relationship of Communities

278. In considering the effect of the new lake on the present sociological pattern, it must be remembered that there is an affinity between certain elements of the population (e.g. the Tongu fishermen) who would be affected by the new conditions both above and below the dam. Again, a relationship would already exist in some cases, and would develop in others, between people who now live in the area and some of those who would assemble to form the labour forces at Ajena and Kpong (paragraph 247). These developments would almost certainly have important sociological effects which would require to be kept under constant and careful review both by the Gold Coast Government and the Volta River Authority.

The Lake

279. The Volta River Authority would aim at maintaining the level of the lake as near 276 feet above sea level as possible in order to generate maximum power. The level of the lake would usually rise and fall over a range of about fifteen feet annually; the lowest planned drawdown is to 252 feet. The design of the spillway permits some flexibility in operation, and this factor, taken in conjunction with the development of a flood warning system, should prevent the level of the lake from rising above 276 feet, save on exceptional occasions.

280. In conformity with its conservative policy, however, the Commission, on the technical advice of its consulting engineers, has recommended that 280 feet should be taken as the maximum level of the lake for the purpose of compensation and resettlement, although this level should be

reached only on a very rare occasion. The reasons for this decision are given in the Commission's report on the area subject to inundation, which is reproduced as Appendix VI. At the 280 ft. contour it is calculated that 3,435 square miles of land would be submerged.

B. METHOD OF ENQUIRY

Objectives

281. The main tasks of the Commission were:

(*a*) to ascertain the population and resources of the area which would be covered by the lake, and

(*b*) to estimate the value of the properties and other rights which would be lost, where they could be assessed in financial terms.

Information Available

282. Little information was available to the Commission when it began its investigations. A census had been carried out in 1948, and aerial photographs of the area had been taken in 1950 – 1951. Apart from these sources, the only available information, generally speaking, was contained in a few references to the area in a small number of technical reports compiled by Departments in the Gold Coast Government.

Collection of Information

283. The Commission's enquiries spread over almost every field of Government activity. At the outset of its work, the Prime Minister issued a directive to all Ministries and Departments that every assistance was to be given to the Commission. Help and advice was at all times forthcoming from every part of the Gold Coast Government, and is most gratefully acknowledged, particularly in relation to the surveys to which reference is now made.

Surveys

284. The following surveys were undertaken:

(*a*) counts of population in almost all villages which had been reported to contain more than twenty houses;

(*b*) a detailed survey of cocoa;

(*c*) a detailed survey of oil palms in the particular area where they were known to be important;

(*d*) sample counts of perennial crops apart from cocoa, such as coconuts, mangoes, oranges, pears and kola trees, in other selected sectors;

(*e*) an appreciation of the value of trees, particularly of teak and other trees of commercial value;

(*f*) a valuation of land, including its farming potential, and all rights pertaining to it, other than such appreciable incidences of perennial crops as had already been valued separately;

(*g*) fisheries in the area;

(*h*) public and private buildings, classified under separate headings recording the type of structure and condition;

(*i*) current building costs in a number of villages which would be inundated;

(*j*) schools in the area;

(*k*) churches, mosques and prayer houses;

(*l*) the more important local fetishes;

(*m*) roads and ferries which would be affected (together with plans for their replacement);

(*n*) known geological wealth of the area;

(*o*) common rights of economic value such as hunting, snail collecting and firewood supplies;

(*p*) heights fixed at certain key points.[1]

Date of Observations

285. Most of the information recorded in Appendix VI describes the situation in the area subject to inundation as it was in late 1954 and early 1955. Changes over the next few years should not materially alter the picture.

[1] The 280 ft. contour was not demarcated on the ground for it would have involved a distance of about 2,200 miles, and the cost and time involved could not be justified at this stage. If the scheme went ahead, however, the demarcation of the contour in certain sectors of the area would become a matter of urgency.

Precedents

286. Efforts were made to draw on experience in other countries with similar problems; several Governments made information available to the Commission. This assistance is acknowledged at the end of the report.

Approach to the Local Population

287. In making enquiries, the approach was a matter of importance. The attitude adopted by the Commission in its many contacts with the people concerned may be summarised as follows:

(*a*) there was no certainty that the Project would materialise although there appeared to be a prospect of that eventuality;

(*b*) it would be to the benefit of all concerned if the maximum information was available about the implications of such a development; and

(*c*) if the Project went ahead, what would be the reactions of the people as to the locality of their future habitation?

C. PRINCIPLES GOVERNING COMPENSATION

Basic Decisions

288. Early in its programme of work the Commission, in consultation with the Gold Coast Government, made (for the purpose of planning) two basic decisions:

(*a*) the maximum height of the lake should be taken as 280 feet;

(*b*) in order to obtain rights over the land which would be submerged, a policy of outright acquisition involving the immediate payment of compensation for all valuable rights which existed in the area on the operative date should be adopted.

The reasons for these decisions are explained in Chapter 2 of Appendix VI.

Loss of Public Rights

289. The creation of the lake would affect public rights in the following categories:

(*a*) roads;

(*b*) ferries;

(*c*) buildings of the Gold Coast Government;

(*d*) schools;

(*e*) local council buildings other than schools;

(*f*) places of religious worship.

Policy in Relation to Public Rights

290. The Commission recommends that a policy of replacing all public amenities should be adopted. To this general policy there might be two exceptions. Special action might need to be taken in relation to fetishes and burial grounds. This is dealt with in paragraphs 49 to 52 of Appendix VI.

Loss of Private Rights

291. Rights of a private nature which would be affected by the lake can conveniently be classified under the following heads:

(*a*) rights to the surface of land and to what grows naturally upon it;

(*b*) rights to minerals;

(*c*) rights to perennial crops;

(*d*) rights to seasonal crops, including the rights to prevent others from cultivating land previously farmed;

(*e*) rights to buildings;

(*f*) rights to waterways;

(*g*) rights of passage;

(*h*) rights of a common nature such as the right to collect snails and firewood, to hunt game and to fish.

Local Factors affecting Rights

292. Before entering into a more detailed analysis of these rights, two points should be emphasised. The first is that local conceptions in such matters do not always exactly coincide with the conceptions of the English law of real property. In the Gold Coast rights which in

English law would be deemed conflicting, are often held to exist over the same piece of land. Current legislation in the Gold Coast makes it quite clear that, in land matters, local custom shall prevail save where the parties have expressly provided that their transaction shall be governed by English law. The second point is that local land tenure does not exist as a precise legal code, but is rather a series of customs under constant process of evolution and modification in order to meet changes in local conceptions. Further, important differences in the approach to this matter occur in various parts of the area.

293. These circumstances made it desirable, on two separate grounds, that a detailed study should be made of land rights now existing in the lake area. Firstly, it would facilitate the smooth working of the payment of compensation; and secondly, it would ensure that a proper framework was provided in cases where whole villages as opposed to individuals had to resettle.

Classification of Private Rights

294. A detailed classification of private rights is given in Chapter 4 of Appendix VI. The most important (and complicated) right is that to the surface of the land and what grows upon it. All land in the Gold Coast is now considered to have a value, and permanent loss of land must be a subject of compensation. Rights to perennial crops such as cocoa would involve special payments of compensation. Mineral rights and common rights (e.g. firewood, hunting) are not of much significance and normally can be conveniently classed with the rights to the surface of the land. Rights to buildings should not present special problems in paying compensation, but this matter has a special reference to resettlement policy.

Principle on which Compensation for Loss of Private Rights should be based

295. The principle governing acquisition for public purposes is that of payment for the right affected at the current market rate which it would fetch if offered on the open market and the subject of a transaction between a willing buyer and a willing seller. This concept has formed the basis for all the valuations of private rights which have been recorded in this report and Appendix VI.

Disturbance Element

296. Another element which would have to be considered on its merits in relation to each type of compensation payable is that of disturbance. There are two aspects which require special attention. The first is the cost of transferring household goods etc. to new premises. In recent cases in the Gold Coast a figure of 20% of the compensation payable has frequently been added to cover this aspect, and appears to be a fair and reasonable award.

Cost of Rebuilding

297. The second aspect of disturbance is one which arises in the particular circumstances of the area subject to inundation. Housing is of poor standard, and market values are low. In these circumstances, it is plain that the real value of buildings to their occupants (i.e. their use value) is considerably greater than they could realise if they negotiated sales of the premises. The cost of building new ones of a similar standard and design would also be appreciably greater than the market value of the existing structures.

298. The total number of private buildings in the area is believed to be 18,594, and they have been valued individually to give a total of £175,940 for the purposes of compensation. Current costs of building in the area are estimated to be from 2½ to 3 times the assessed market value of the buildings. The Commission has therefore recommended that a further liability in respect of housing, calculated at twice the market value (i.e. £351,880) should be accepted as a charge on the Project in order to provide fair and equitable treatment. Payments from this source would not be made to individuals as part of the legal entitlement, but as part of the resettlement policy and used as an incentive to encourage individuals to move to the most suitable new localities. This aspect of resettlement is elaborated in paragraph 324.

Speculation

299. The Gold Coast Government issued a statement in November, 1954, that compensation for such acquisitions as were found necessary in the event of a decision to proceed with the Project would be paid upon the open market value obtaining at the date of the announcement, or at such other date as might be considered appropriate. This, the Government pointed out, was to prevent any speculation in local values with the object of raising extra charges against the Project.

D. DESCRIPTION OF THE AREA SUBJECT TO INUNDATION

Division of the Area

300. In order to facilitate its analyses, the Commission divided the land which would be submerged by the lake into nine geographical areas. They were:

A1	Kwahu Area	Colony Eastern Region
A2	South Afram Area	,, ,, ,,
A3	Akwamu Area	,, ,, ,,
B1	Ewe-Guang Area	Trans-Volta-Togoland Region
B2	Buem-Akan Area	,, ,, ,, ,,
B3	Pai Area	,, ,, ,, ,,
B4	Krachi Area	,, ,, ,, ,,
C	Volta River Confederacy Area	Ashanti Region
D	Gonja Area	Northern Territories Region

They are shown on the map[2] facing this page. The letters denote the Administrative Regions in which each of the nine Areas is situated. Boundaries between the Areas have purposely been drawn in arbitrary fashion since in some instances they are in dispute.

301. Existing roads and forest reserves are shown on the map as well as new roads which might be constructed and possible areas for resettlement. The general pattern of the lake can be clearly observed. It follows the present course of the Volta from north to south. On the right bank, three deep inlets occur and cause major barriers to communications. On the left, there is only one major tributary, the Oti, which enters the lake from the north-east. Along the south side of the Afram arm of the lake, for forty to fifty miles, is found the only comparatively densely populated area. This is concentrated in a narrow belt in which cocoa is grown.

Ecology

302. The entire area is classed as in the savannah-woodland zone of vegetation. More details are given in Chapter 5 of Appendix VI.

Population

303. Of the estimated 62,500 people in the area, it is thought about 40,000 live there permanently, another 10,000 have dwellings in the area but also have homes in other parts of the country, and about 12,500 are " strangers " in temporary residence (i.e. people who normally live outside the area but are at present living there temporarily). Two large stranger populations are the Konkombas, who are industrious yam farmers, and the Tongus who fish all along the river.

Occupations and Incomes

304. About 90% of the adult inhabitants look to agriculture as their main source of income. About 10% obtain money from fishing. Most of the larger villages have a few tradesmen. Most adult incomes probably lie between £20 and £40 a year.

Housing

305. The pattern and standard of housing varies appreciably, frequently reflecting the different tribes who now live in the area. Further details and some photographs of typical dwellings are given in Chapters 5 and 6 of Appendix VI.

Land Tenure

306. There are important differences in respect of land tenure between several of the nine geographical areas and they would, of course, have to be taken into account when assessing and paying compensation.

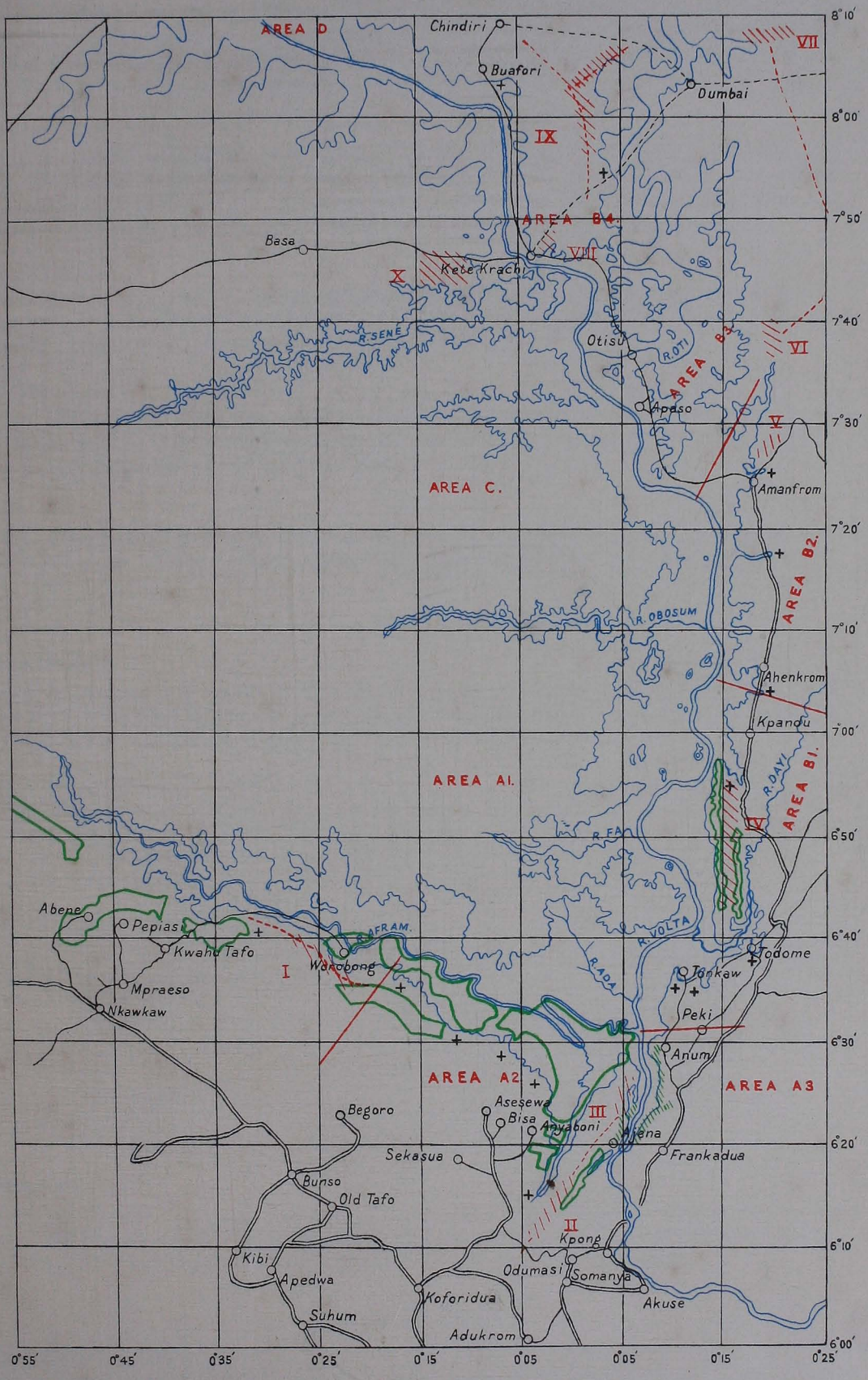
Existing Road Communications

307. The general effect of the new lake on existing roads has been referred to briefly in paragraph 122, and is considered in detail in Appendix X. If the Project was carried out, and the Gold Coast Government implemented the relevant parts of its development plans, there would be little appreciable effect on the national road system. A detailed analysis of the effects of the lake on roads is contained in Chapters 5, 6 and 7 of Appendix VI. Approximately 143 miles of roads would be flooded and about 160 miles would need to be built as replacement.

[2] The map does not show the whole of the Gonja Area. This can be seen on the map facing paragraph 296 of Appendix VI.

VOLTA RIVER PROJECT

APPROXIMATE ETHNIC BOUNDARIES AND AREAS IN WHICH SETTLEMENTS WILL POSSIBLY TAKE PLACE



SCALE 1: 1,000.000

Lake Area	~~~	Indication of New Shelter Belts	////
Instrument Heights Taken	+	Forest Reserves	□
Existing Main Roads	——	Sectors in which sample counts were taken of other Perennial Crops.	□
Existing Subsidiary Roads	– – –		
New Roads	– – –		
Possible Areas for New Settlements	\\\\		

Vehicular and Passenger Ferries

308. Certain of the ferries which at present operate in the area would be affected by the Project, and replacements or alternative services would be required. The biggest change would occur at Yeji where the present ferry traverses about 440 yards; if the lake formed, a new vehicular ferry would be needed to make a crossing of about five miles.

Forests

309. Generally speaking, the trees now growing in the lake area have little or no commercial value. The exceptions are four forest reserves which cover about 146 square miles. Two of these are potential sources of firewood for people who would work at the dam and smelter sites, and as much timber as possible should be removed in advance of flooding (paragraph 425).

Perennial Crops

310. The most important crop in the area is cocoa. There are about 6,000 acres at present under cultivation, but the Gold Coast Department of Agriculture reports that many of the trees would be unlikely to remain in good bearing condition.

Food Crops

311. Of the total area of 3,435 square miles, some 75 square miles (or about 50,000 acres) may at any time be under cultivation with crops such as maize, manioc, guinea corn, and rice. Yams are cultivated extensively in certain parts of the area.

Schools

312. There are at present 39 schools in the area which would be submerged. Only one of these is above the ordinary village primary standard and a number are temporary structures.

E. COMPENSATION

Detailed Analysis

313. In Chapter 6 of Appendix VI a detailed analysis is made of the compensation which would have to be paid for the loss of private rights and the cost of replacing public amenities in each of the nine geographical areas. The results can be summarised as follows.

Compensation for Loss of Public Rights

314. The total cost is estimated at £428,580 and is made up of:

(*a*) Replacement of public buildings—£89,080
(*b*) Replacement of roads and bridges—£326,500
(*c*) Miscellaneous (an airstrip, teak, etc.)—£13,000.

Compensation for Loss of Private Rights

315. It has been estimated that compensation for the loss of private rights would require the payment of £2,045,208 composed of:

(*a*) Private buildings	£ 175,940
(*b*) Disturbance element (20%)	£ 35,188
(*c*) Land	£1,113,680
(*d*) Cocoa	£ 496,400
(*e*) Other perennial crops	£ 210,000
(*f*) Clay deposits	£ 6,000
(*g*) Fishing rights	£ 8,000

Administration

316. In Chapter 7 of Appendix VI a detailed plan of operations for assessing and paying compensation is set out. The main implications of this plan in terms of staff and cost (salaries, provision of offices, transport, etc.) are summarised in Section G of this chapter.

F. RESETTLEMENT

Possible Lines of Approach

317. There are several basic approaches which might be adopted for dealing with resettlement. The fundamental issue is whether the policy should be " to resettle " or " to be resettled"; in other words whether the inhabitants would be expected to resettle themselves or whether a

public obligation would be accepted to undertake that operation. The former course would have the advantages of retaining communal initiative and encouraging people to help themselves instead of looking to Government for assistance in all matters. If the latter course was adopted, it is apparent that no matter what particular limitations or provisions might be made in the initial stages, constant pressure would inevitably be directed towards increasing the scope of operations, with consequent increased financial commitments.

318. The Commission recommends that the best policy for the Volta Project would be:

(*a*) the communities concerned should be expected to resettle themselves;

(*b*) the responsibility inherent in the Project should be in general limited to the payment of compensation for the loss of rights;

(*c*) in certain circumstances, assistance in the shape either of material aid or technical advice should be made available to the communities concerned to supplement the compensation payable for their loss.

The reasons for advocating this policy, and a discussion of alternative policies, are contained in Chapter 8 of Appendix VI.

Basic Philosophy

319. The basic philosophy in resettlement should be self-help, but this should not exclude the introduction of certain incentives to the people concerned to move into those areas which would be most suitable for the new villages, and the provision of technical advice and material aid where appropriate.

Conditions for Resettlement

320. An outstanding characteristic of the lake area is the community spirit. The great majority of the indigenous population lives in villages founded on kinship and it can safely be assumed that these people would wish to repeat the existing pattern of their villages if they were forced to move. The sites selected for the new villages would need to provide certain basic facilities. The most important would be the availability of land adequate in extent and quality so that the people could farm, and access to a suitable source of water. Simple village layouts should be provided. Communal buildings (e.g. a school, a few market sheds) would be needed and roads to link the new villages to the existing network. In Chapter 8 of Appendix VI a forecast is given of the approximate number and size of new villages which would be required.

Provision of Land, etc. for Resettlement

321. The Gold Coast Government has already started to investigate the suitability for agricultural development of areas in which resettlement might be expected, and it is hoped that this work would be completed by the time a decision was taken about the Project. The provision of other necessary facilities of which examples were given in the preceding paragraph should not be difficult

Land Available

322. An analysis is given in Chapter 8 of Appendix VI of the likely availability of land for resettlement, and attention is drawn to a small number of instances where the Gold Coast Government might have to intervene in order to ensure that adequate land was, in fact, made available.

Aids to Housing[3]

323. Several suggestions are made in the same chapter of Appendix VI as to aids and incentives which should encourage people to rebuild adequate new houses in the chosen localities. Examples are (a) courses in simple building construction; (b) the provision of simple building plans; (c) advice on construction problems during the actual process of building; and (d) the provision of hand-operated block-making machines.

Financial Incentive

324. Individuals who were willing to rebuild new homes on the sites selected by the Gold Coast Government for resettlement would be eligible for payments from the fund of £351,880 to which reference has been made in paragraph 298. Payments would normally take the form of issues of standard building materials under the control of the official organisation referred to in paragraph 328. It is thought that these arrangements might provide a very strong incentive in attracting people to build themselves new homes of a reasonable standard in the selected areas.

[3] As a general policy, the approach to housing should conform to that adopted by the Gold Coast Government for the country as a whole.

Kete Krachi

325. Special considerations arise in the resiting of the town of Kete Krachi, which is an important township and the centre of a very large area. The town would therefore need to be replanned with particular care. Provision for the replacement of public and private buildings has been made under the compensation head, but appreciable work would be involved in the survey and demarcation of the new township. The cost of this would be a charge to resettlement. A considerable amount of preliminary work in relation to the planning for the future Kete Krachi has already been completed.

The Tongu Fishing Communities

326. Reference has already been made, and will be made again later in this report, to the need for safeguarding the interests of the Tongu fishing communities both above and below the dam site. They would suffer considerable disruption during the construction phase, and later on they would have an important role to play in the development of the lake as a valuable fishery. (See also paragraph 348).

Cost of Resettlement

327. In addition to the fund of £351,880 (paragraph 298) it is estimated that another £150,000 would be needed to meet the cost of various measures under the general head of resettlement, i.e. to provide land for communities where it was not possible for them to obtain sites for resettlement, to give indirect assistance in rebuilding homes, to meet payments for fetishes, and to meet the cost of replanning Kete Krachi, etc.

Resettlement Organisation

328. A small number of officials would be required to assist the population of the inundated area in the task of resettlement. Provision for them is made in the organisation which the Commission has advised the Gold Coast Government to establish in order to deal with the problem of resettlement and compensation; the size and costs are summarised below.

G. ADMINISTRATIVE ASPECT OF COMPENSATION AND RESETTLEMENT

Chief Resettlement Officer and Staff

329. Compensation and resettlement should be carried out as a single operation, and the organisation should be placed under the control of a very capable and experienced Chief Resettlement Officer, who should be drawn from the senior ranks of the administrative service of the Gold Coast Government.

330. Details of staff required to deal with compensation and resettlement are shown at the end of Chapters 7 and 8 of Appendix VI. In addition to possessing the necessary technical qualifications, all officers employed on the work of compensation and resettlement should be in first class physical condition, and of suitable temperament.

331. Compensation would necessitate the employment (for periods ranging from 18 months to 3 years) of about a dozen surveyors and about twenty land officers, together with junior staff, eight relatively senior officials for the payment of compensation, and three auditors. Accommodation and transport would also have to be provided. The entire operation should be completed in four years and the total cost of administration is estimated at £700,000.

332. Resettlement would necessitate the employment of about ten officers and a proportionate number of junior staff. Transport and accommodation would also be necessary. It is estimated that this operation would last for four years and would cost £250,000. The cost of administration is caused primarily by the extent and complexity of the proposed operations, the physical characteristics of the area, and the fact that effective administration would be essential to hold the estimated total cost of compensation and resettlement to £4,000,000.

The Riparian Communities

333. The organisation dealing with compensation and resettlement should also deal with the problems which would arise amongst the riparian communities living downstream from the dam; they are described in Chapter 15 of this report and in Appendix VII.

Burden on the Gold Coast Government

334. If a decision was taken to proceed with the Project, it is apparent that the size and complexity of the compensation and resettlement operation would throw a large additional burden on the administrative and technical resources of the Gold Coast Government. This

particular difficulty was emphasised to the Gold Coast Government by the Commission in June, 1955, when transmitting the draft of its report on the problems in the are asubject to inundation and is directly related to the resources of staff available to the Government, a problem which is discussed in Section B of Chapter 28.

Cost

335. The estimated cost of the compensation and resettlement operation can be summarised as follows:

(*a*) Compensation:	payments	£2,473,788
	administration	£ 700,000
(*b*) Resettlement:	cost	£ 501,880
	administration	£ 250,000
		£3,925,668
Say £4,000,000.		

Liability

336. Under the arrangements previously agreed (see paragraph 273) this would leave the Gold Coast Government with a liability of £500,000. The Government has informed the Commission that it considers, in the light of the information now available, that this should be considered as a proper charge on the Project. An important reason for its attitude is the fact that the area subject to inundation is now considerably larger than anticipated originally, thus providing more power which would be of direct benefit to the Project as a whole. The matter will need to be resolved during negotiations about the future of the Project (see also paragraph 471). It will be observed in paragraph 382 that a parallel problem exists in meeting the estimated cost (£500,000) of measures which might need to be taken amongst the riparian communities.

Chapter 15

EFFECTS ON THE RIPARIAN COMMUNITIES LIVING DOWNSTREAM FROM THE DAM

A. INTRODUCTION

337. The alteration in the present pattern of flow in the Volta which would be brought about by the Project would have an appreciable effect in the areas which lie on both sides of the river below the dam site. At present the flow of the river is seasonal, and the annual flood (the peak is about September-October) sets the pattern of human activities in the river reaches between the dam site and the estuary. In this area numerous creeks near the main river course are flooded to a greater or less extent according to the size of the flood. Agricultural yields may derive some stimulus from the flood and many creeks are important sources of fish.

Present Pattern of the River Flow

338. The present flow of the river varies from below 1,000 cusecs in the driest months of the year to a peak which may be from 125,000 to 390,000 cusecs during the months of September and October.

Changes in the River Flow

339. The changes in the flow of the Lower Volta introduced by the Project would develop in two distinct phases. The first would take place about five years after construction had started in 1957 and would last for about two years (1962 to 1964) while the lake was filling. During this period a relatively low flow would need to be maintained in the river in order to ensure drinking water supplies for the riparian communities.

340. The second phase would begin with the commencement of power production (about 1964) and an appreciably larger but relatively steady flow would be established. During the first two stages of aluminium production, there would still be some flooding on the lower reaches of the river although not with the same intensity or as often as under present circumstances. When the final stage of aluminium production had been reached, there would be fewer floods and they would take place only after unusually heavy rains. Normally the river would then maintain throughout the year a steady flow of about 38,000 cusecs. The constancy of this flow would only

be varied as a result of seasonal additions from the rainfall in the Lower Volta and occasional discharge from the spillway.

341. It was clear that there would be major changes in conditions during the first phase when the lake was filling, and the consulting engineers were requested to carry out appropriate surveys of the river, and to make recommendations as to the rate at which the flow should be maintained to avoid salt penetration. They have indicated in their Engineering Report that it would be desirable to provide capacity so that up to 5,000 cusecs could be released.

342. The development of aluminium production in distinct stages is a fortunate feature of the Project. There would be considerable flexibility available for controlling the flow of the river in the early stages, and valuable experience could be gained in ensuring on the one hand that the well-being of the riparian communities was safeguarded, and that, on the other, water—and hence power and money—was not wasted.

Need for Investigation

343. The Commission considered it essential for surveys to be made of the present economy of the Lower Volta, and to make an assessment of the changes which might be introduced by the altered river conditions. It is estimated that approximately 54,000 persons at present depend to some degree on the Lower Volta for their livelihood, and, if the present high flood was to be eliminated or if its occurrence was even to be curtailed considerably, the consequent effects would need to be considered carefully by the Gold Coast Government. The Commission therefore thought it particularly important to place on record as much information as possible about the present position in all areas which could be affected by the Project.

Surveys

344. The object of the Commission was to obtain in the time available as much information as possible about the area concerned, and in particular about the influence that existing river conditions exerted on the local economy. For this purpose an intensive study was instituted within a limited area, and a wider survey was undertaken into conditions along the whole length of the Lower Volta. Only one full season was available in which to carry out investigations, but a very considerable amount of information was obtained and this has provided a foundation for certain broad recommendations for further action.

345. These surveys involved work covering several hundred square miles for—largely because of the bad communications which exist throughout the area—relatively little information had previously been recorded about local conditions, and extensive ground surveys were therefore essential. The more general enquiry included: the present physical characteristics of the river; the riparian agriculture; fishing in all its forms; and the influence of the Volta on present conditions governing the two major lagoons, Songaw and Keta, which flank the estuary. The more intensive survey included checks on production and consumption in the vicinity of Battor, a village in the middle reaches (see map facing page 56). The consulting engineers also carried out several technical enquiries for the Commission.

Claims for Compensation

346. The collection of this information would be an essential step in preparing to deal with the claims for compensation which would undoubtedly arise where cases of direct financial loss resulting from the changes in the flow of the river could be established. Failure to obtain this data could create a situation in which the Gold Coast Government and the Volta River Authority were later faced with a large number of claims for compensation for alleged loss—not all of which might be justified, but which might be very difficult to refute. (On a more positive approach, the information gained from the surveys could provide a sound foundation for plans for the future development of the area.)

Responsibility for Dealing with the Problems

347. The Preparatory Commission has been informed that the Gold Coast Government would assume administrative responsibility for dealing with the problems affecting the riparian communities; it is hoped that the information collected by the Commission might be of value to those who would ultimately have to deal with these matters.

The Inter-relationship of the Riparian Communities with Other Communities

348. As mentioned in paragraph 278, there is an affinity between the down-river communities and the groups of fishermen who now operate in the upper reaches of the Volta which would be covered by the new lake. This factor would need to be taken into consideration when planning action to mitigate the disadvantageous effects of the changed conditions both above and below

the dam site; the period of unsettlement would be eased as fishing continued to be a prominent occupation in the Lower Volta and as fishing in the new lake became established.

B. PRESENT FEATURES

The River

349. The map facing this page shows the salient points along the river which are referred to in this chapter. The dam site at Ajena is 13 miles above the rapids at Kpong which lie 6 miles upstream from Akuse (the smelter would be situated about 5 miles away from this point). The distance from Akuse to the sea is 54 miles. In the dry season the river from Akuse to the estuary is relatively shallow and difficult for small craft to navigate. The rate of flow falls below 1,000 cusecs; but when the floods come—the peak is normally in September or October—the river rises very rapidly. The range of the flood over the last 19 years has varied from 125,000 cusecs to 390,000 cusecs. It can be said that variability is the chief characteristic of the Volta River, and this provides the background to the lives of the riparian communities who live along its lower reaches.

350. The banks of the river are usually steep and lofty except in the estuary. In the lower reaches, sandy soil is the chief characteristic. As to vegetation, tall grasses predominate; virtually no riverine forest remains. There are few trees. The most important feature of the Lower Volta is a series of water channels lying behind the banks of the river, known locally as creeks. The channels vary in respect of the time and the manner in which they receive water from the river. They are important as fishing grounds, and in some places provide a source of fresh water to local communities.

Sociological Aspects

351. The population of about 54,000 people is composed of several tribes with different customs. The influence of the family remains strong. Land tenure, as usual in the Gold Coast, is complicated and concepts vary with changing local circumstances. Boundaries are uncertain and, as a result, land litigation about ownership is frequent when rights of property, such as the creek fisheries, become valuable. All this emphasizes that it would be necessary to handle with great care the problems which would arise as a result of the changed regime of the river, if unsatisfactory economic, social and political effects were to be avoided.

352. Preliminary studies indicate that the soils in the riparian area are not very fertile. However, only in a few localities is there a pressure of population on food production. The incidence of migration is high; the main reason for this appears to be the comparative stagnation of the local economy. The men mainly farm and fish; the women do not trade to the same extent as in other parts of the Gold Coast. In addition to ordinary household duties, a considerable number of them engage in the special form of oyster or clam fishing which is a characteristic of the Lower Volta. The standard of education and health is about the same as the rest of the rural parts of the Gold Coast, although there may be a little more malaria. The standard of housing is somewhat lower than the average for the southern part of the country. Water supplies from the Volta are good, but there has always been a problem in the vicinity of the estuary owing to the predominance of salt throughout most of the year.

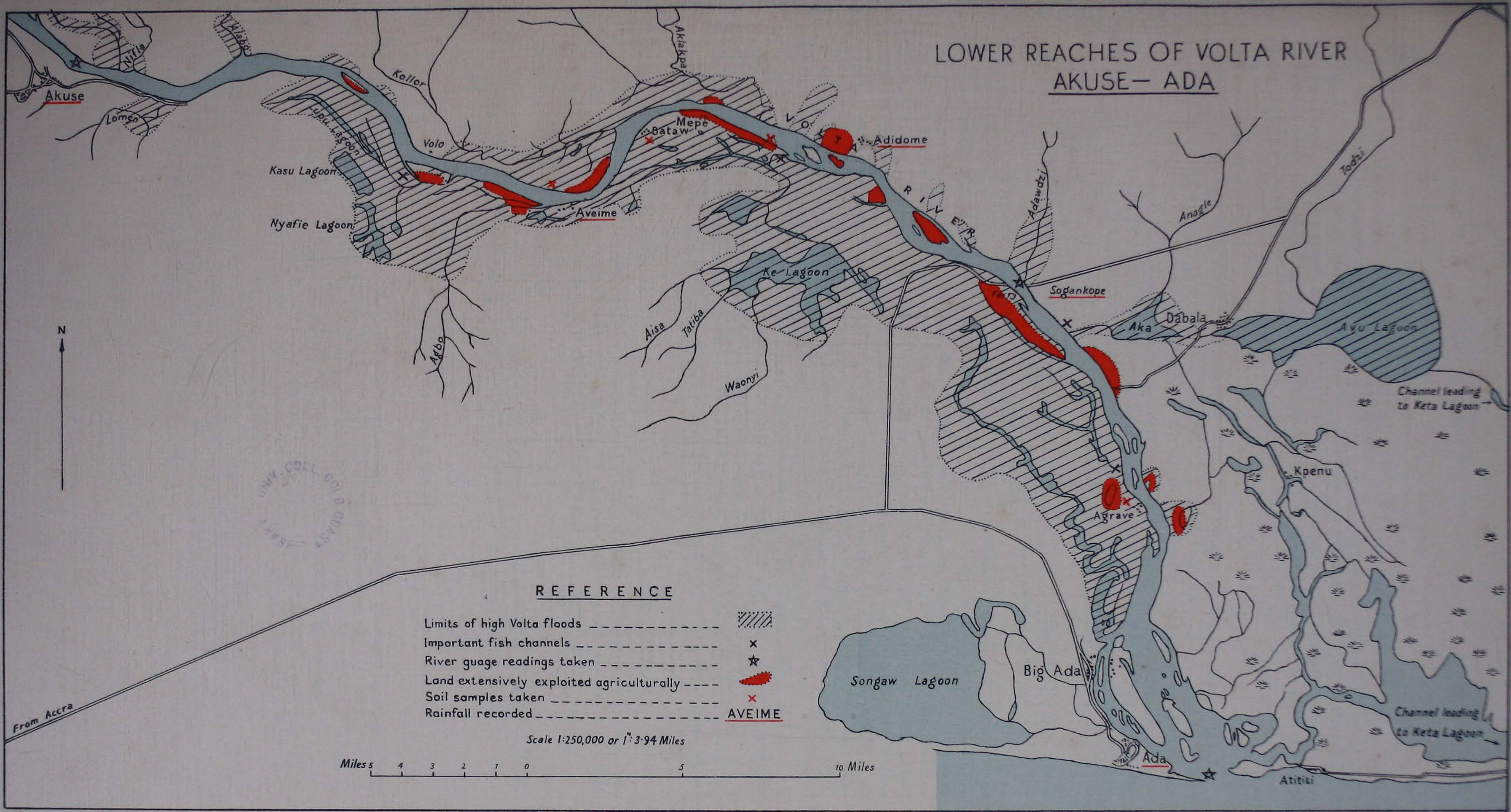
Economic Aspects

353. Bad communications have been a major factor in making the economy of the area static if not stagnant. There are several river markets between Ada in the estuary and Akuse. The main pursuits of the area are agriculture and fishing. The most important crops are cassava and groundnuts, but maize, sweet potatoes, and sugar cane are also produced. There are a few cattle. At a broad estimate, the total value of agricultural production is about £160,000 a year.

354. The fishing industry is very important and presents a complex problem. There are three main groups of fisheries:

(*a*) in the main stream;
(*b*) in the creeks; and
(*c*) the oyster fishing by women.

These are analysed in detail in Appendix VII. Of the three groups it is the creek fisheries which would be most affected by the construction of the dam; catches are believed to be worth about £65,000 a year, and between one-third and two-thirds might be lost. Fishing in the main stream is probably worth between £17,000 and £25,000 a year; the oyster fishing is worth not less than £25,000 per annum. " Pledging " is a common practice amongst the owners of the creeks; many of them are thus deprived of their fishing rights, but receive instead relatively small rentals.


LOWER REACHES OF VOLTA RIVER
AKUSE— ADA
Akuse
Nifla
Aklabo
Kollor
Aklakpa
Lomen
Volo
Kasu Lagoon
Nyafie Lagoon
Aveime
Bataw
Mepe
Adidome
VOLTA RIVER
Adawdzi
Anagle
Todzi
Sogankope
Aka
Dabala
Avu Lagoon
Ke-Lagoon
Aisa
Tatiba
Waonyi
Agbo
N
Kpenu
Agrave
Channel leading to Keta Lagoon
Big Ada
Songaw Lagoon
Ada
Atititi
Channel leading to Keta Lagoon
From Accra
REFERENCE
Limits of high Volta floods
Important fish channels
River guage readings taken
Land extensively exploited agriculturally
Soil samples taken
Rainfall recorded
AVEIME
Scale 1:250,000 or 1": 3·94 Miles
Miles 5 4 3 2 1 0 5 10 Miles

C. THE TERRITORIAL SURVEY

Pattern

355. A detailed survey of the river from the dam site to the sea is given in Chapter 4 of Appendix VII. For the purposes of survey this stretch of the river was divided into three sectors; the upper extended from Akuse to Battor, the central sector embraced the stretch from Battor to Sogankope, and the lower sector covered the reach between Sogankope and the sea. The lagoons at Keta and Songaw were considered separately. The map facing page 56 shows the area covered by the survey.

Basic Needs in the Future

356. Two fundamental requirements would arise if the Project were to be undertaken:

(*a*) It would be essential to preserve the present *quality* of the river water, and to protect it from any danger of contamination as a result of effluents escaping from the smelter. The aluminium companies have given an undertaking that the necessary measures to prevent this would be introduced, and an appropriate clause would be included in the Master Agreement (paragraph 669). Care would also need to be taken that the insecticides used as part of the health and sanitation programme (paragraph 400) did not affect the purity of the river water.

(*b*) The *quantity* of water flowing downstream would need to be maintained at a flow which preserved the present pattern of life amongst the riparian communities, and, in particular, safeguarded their supplies of drinking water.

357. These requirements need to be considered under three spearate conditions. First, during the lake filling period, provision would be made by means of a regulating valve at the dam to enable up to 5,000 cusecs of water to be released downstream whenever necessary. At present the river drops to less than 1,000 cusecs in the dry season, but many of the effects of this low flow are compensated by the annual flood. It would be necessary to ensure that up to 5,000 cusecs could be released for whatever period of time was required in order to prevent undue penetration of salt water. The most damaging effect of salt penetration would be to drinking water, with secondary effects on fishing and agriculture. If the only essential requirement was the provision of drinking water for a relatively short period, it might be cheaper to arrange for fresh water to be conveyed to the communities rather than releasing it from the lake.

358. The second period would elapse between the time after the lake had filled and the ultimate development to full power. During this period, the spillway which has been designed to give flexibility in operation, would give considerable discretion in releasing water.

359. The third condition would arise at full production of power. The river would then have a relatively stable flow at about 38,000 cusecs. A small flood might occur on the average about one year in ten.

Installation of Flood-warning System

360. The consulting engineers have recommended that a flood-warning system should be installed. This service combined with the method of spillway control should mean that the future risk of exceptional flood would certainly be less than under present conditions.

Background to the Territorial Survey

361. It is these controlling factors—the three different stages of river flow and the necessity for safeguarding the water—which provide the background for the territorial survey in the three sectors of the river.

D. MAIN CONCLUSIONS OF THE TERRITORIAL SURVEY

Upper Sector

362. In the upper sector it is considered there would be no danger of major changes so long as the river water was not polluted. Clam fishing should be good during the lake filling period, but during the years preceding the closing of the dam, studies should be carried out as to the habits of the species. It should be possible to move the clam beds to satisfactory new sites.

363. As to agriculture, there would probably be little effect in the short term; over an appreciable period of time there might be some question of soil fertility being reduced. Under these conditions small claims for compensation might arise.

364. The fishing creeks form the most important aspect of this sector. 174 individual channels and ponds were identified during the Commission's surveys. Some of them would be lost, but it is thought that production in a number of the more valuable creeks might be maintained, or even improved, by deepening the existing channels.

Central Sector

365. Any effects on agriculture should be slight, and visible only several years after the new conditions had developed.

366. The Commission identified 150 individual fishing creeks and ponds in this sector. The total production of fish would undoubtedly suffer. The extent of the loss would depend on the possibility of improving an important channel which already exists. The effects on this channel of various river levels are still being studied. If they continue to show promise, further detailed investigations should be carried out by qualified engineers, if a decision is taken to proceed with the Project.

Lower Sector

367. The consulting engineers have expressed the opinion that after completion of the dam salt would no longer penetrate beyond the Volta estuary. This would help agriculture, and also make the Volta suitable for drinking throughout the year in an area where hardship is now frequently experienced.

368. 70 individual fishing creeks and ponds were located; about half of these would undoubtedly be lost as a result of constructing the dam. Claims for compensation would arise here.

Keta and Songaw Lagoons

369. The Keta Lagoon lies about 20 miles to the east of the river mouth and is important for its production of onions (from an area of 800 acres a crop worth £250,000 per annum is obtained) and also as a source of salt. About 6,000 tons of salt are at present produced in a good year, and it is believed that this could be increased to 22,500 tons by the direct introduction of sea water. After a careful investigation it is considered that neither onion growing nor salt production in the Keta Lagoon should be adversely affected. Possibilities for improving production are under consideration by the Gold Coast Government.

370. The Songaw Lagoon lies eight miles west of Ada. It is important mainly as a source of salt production. The total amount of salt produced annually has varied between 500 and 10,000 tons. The consulting engineers believe that in order to achieve maximum production, sea water should be brought in either through a sluice gate in the bar or pumped over it. This improvement would be even more necessary if the Volta Project was undertaken, since the already high loss by evaporation at Songaw would be aggravated by the absence of the flood water from the river.

Keta Sea Fishing

371. There is a valuable afafa fishing industry about ten to thirty miles east of the estuary. A considerable amount of investigation has been made into the possible effects of the changed flow of the river on this industry, but it is very difficult to predict in advance what the ultimate results might be. This is a problem which would need to receive careful and constant study if the Project was undertaken.

Erosion of the Coast

372. For many years a process of accretion and erosion has been taking place east of the river mouth. The Gold Coast Government is watching this carefully. The consulting engineers consider that the Volta Project would not materially affect the existing process.

E. GENERAL CONCLUSIONS AND RECOMMENDATIONS

Agriculture

373. The Commission considers that the reduction or even total elimination of the annual flood would not be followed by any immediately apparent changes in agricultural production. In the extreme condition of no further floods taking place, and no fertilizers being applied to the soil, yields would undoubtedly decline over a number of years. It should be remembered, however, that improved control of the river could provide better conditions for planned agricultural development.

374. The Commission has recommended to the Gold Coast Government that a small agricultural staff should be appointed immediately to work in the area under review. Its main task would be to obtain more information about actual conditions in this area and, in particular, to study the influence of the annual flood on the surrounding country. The flow of the river would not be changed until 1962 at the earliest, but no time should be lost in starting to obtain additional information about current local conditions.

375. The primary objective of any action taken by the Gold Coast Government should be to alleviate any disadvantageous effects arising from the new river regime by introducing changes beneficial to the farming communities as a whole rather than paying compensation to individuals. Some specific cases of individual loss would probably arise, however, and they should be met from the general fund recommended in paragraph 381.

Fishing

376. It is much more difficult to forecast the effects of the changed flow of the river on fishing. The oyster industry would probably not suffer, but additional studies should be carried out before the dam was closed. Fishing in the shallow creeks and ponds would undoubtedly suffer. The Commission has recommended to the Gold Coast Government that a small staff should be appointed forthwith in order to obtain more information about actual conditions before the flow of the river is changed. Again, it is considered that some of the losses might be compensated by taking measures designed to assist the community as a whole rather than individuals. In Appendix VII, which gives a detailed analysis of this problem, it is recommended that £350,000 would be a prudent estimate to provide for such measures. It should form part of the general fund recommended in paragraph 381.

Keta and Songaw Lagoons

377. In general, the construction of the dam should not affect adversely production from Keta Lagoon, but a supply of sea water into Songaw Lagoon would need to be introduced. It would be for the Gold Coast Government to decide whether certain additional improvements should also be carried out.

Health

378. Health conditions amongst the riparian communities should not be affected as a result of the changed conditions of the river. A more stable flow of the river would not be favourable to the breeding of tsetse and *S. damnosum* (see Chapter 16). The incidence of malaria is already high. The annual flood may impede the breeding of mosquitoes to some extent, but observation indicates that it does not last long enough, nor is it always sufficiently extensive, to have a major effect. The plans of the Gold Coast Government to erect a new hospital either at Adidome or Sogankope should improve present conditions, and the hospital at the smelter township would also provide additional facilities.

Water

379. The quality of future water supplies should be assured by the smelter company preventing effluents escaping into the river, and by the exercise of proper care in the application of insecticides as part of the control measures carried out to preserve health and sanitation. Adequate quantities of water should be provided during the filling period by means of the regulating valve with a capacity of 5,000 cusecs; after the lake had filled the generation of power would automatically ensure an ample supply of water.

Communications

380. Greater control over the river after the dam had been constructed should assist the development of water transport, and a modest expenditure by the Gold Coast Government on two or three secondary roads as part of the programme on which it has already embarked successfully would bring a marked improvement in the present relatively bad communications in the area. The development of roads around the smelter area would also provide additional facilities, and the general result of these improved communications should be to increase economic activity amongst the riparian communities.

Financial Implications

381. The Commission has recommended that £500,000 should be accepted as the amount which might prove to be required in order to mitigate the effects which could follow from the construction of the dam, and to meet proven claims for compensation resulting from the changed conditions. Of this, £350,000 is estimated as a possible liability in respect of fishing in creeks and ponds. The balance would be available to meet the cost (about £20,000) of staff to make further investigations into fishing and agriculture between the present time and 1962 (the earliest date for claims, which might continue to arise until as late as 1970), to meet claims for loss of agriculture or fisheries, to make general improvements instead of paying individual compensation, and to meet possible costs for widening channels or developing other facilities.

Liability

382. The Gold Coast Government considers that this sum of £500,000 should be a charge on the Project; the matter would need to be resolved by negotiation when the future of the Project was considered (see also paragraph 471).

Chapter 16

PROBLEMS OF HEALTH AND SANITATION ASSOCIATED WITH THE FORMATION OF THE NEW LAKE

A. INTRODUCTION AND GENERAL CONCLUSION

Introduction

383. The great importance of the problems of health and sanitation which would arise from the formation of the new lake has been fully recognised by all concerned with the Volta Project. The Preparatory Commission, at the start of its work, made arrangements to advance and elaborate the earlier investigations into these problems in which Professor Lewis Berner of the University of Florida had played a leading part.

384. The Commission wished to ensure that a very careful survey was made into the effects which the new lake might have on the health of people who would live in its neighbourhood and, indeed, on the health of the country as a whole. In addition to defining the problems, the Commission wanted to draw up a comprehensive plan for controlling the various diseases and to assess its full administrative and financial implications. As well as this, it was desired to analyse with special care the health problems which might arise in the temporary township at Ajena and in the permanent township near Kpong. The principle followed was to ensure that the Project would not cause any deterioration in the health of the people affected by the scheme.

385. With the agreement of the two Governments, the Commission invited the late Dr. Andrew Topping, C.M.G., T.D., M.D., M.A., Ch.B., D.P.H., F.R.S.Ed., F.R.C.P., then Dean of the London School of Hygiene and Tropical Medicine, and Professor George Macdonald, C.M.G., M.D., Ch.B., M.R.C.P., D.P.H., D.T.M., Director of the Ross Institute of Tropical Hygiene at the same school, to visit the Gold Coast and report on the problems of lakeside health and on those associated with the health of the labour forces. The latter problems are dealt with in Chapters 9 and 10 of this report and in Chapter 10 of Appendix XII.

386. Dr. Topping and Professor Macdonald were assisted in their work by the Gold Coast Ministry of Health, by officers of the West African Medical Research Council and the Nigerian Malaria Service, and by the United States Public Health Service. The Commission owes much to all these officials, particularly to Dr. Topping and Professor Macdonald, and appropriate acknowledgements are made in Chapter 44. The results of the investigations into the problems of lakeside health and sanitation are recorded in Appendix VIII. The salient points in that appendix are summarised in this chapter and they are given in some detail because of their importance to the people of the Gold Coast.

General Conclusion

387. It is desirable to state immediately the general conclusion reached by the distinguished experts and specialists who have investigated these problems of health and sanitation. It is this:

> "..... The creation of the new lake would bring with it many health problems. Some of these can be envisaged at once and there would doubtless be others not now foreseen. However, the state of medical knowledge is such that it is extremely improbable that any problem would arise which could not be readily overcome, provided that a proper combination of knowledge was brought to bear on it."

B. PRESENT CONDITION OF HEALTH IN THE AREA SUBJECT TO INUNDATION

Lack of Information

388. At present, there is insufficient knowledge about the state of health of the inhabitants in the area subject to inundation, and its vicinity, to provide a basis for any subsequent statement that the lake had not caused any deterioration in their health. One of the first duties of

the medical organisation within the Volta River Authority, therefore, would be to establish a datum line of the standard of health normally enjoyed.

Specific Diseases

389. The main diseases which now exist in the area and the proposed methods of control are described in detail in Chapter 2 of Appendix VIII. The essential features are as follows.

Malaria

390. The present incidence of malaria in the area is considered to approximate to that in the rest of the Gold Coast. It is probable that the creation of the lake might encourage the breeding of *Anopheles gambiae* and *A. funestus*. Some degree of clearance of marginal and emergent vegetation might be desirable (and would in any case be necessary in connection with the prevention of trypanosomiasis) and the primary method of control, subject to confirmation in the light of trials now being carried out in Nigeria, would be by the use of residual insecticides.

Trypanosomiasis

391. The tsetse fly is numerous in the area which would be covered by the lake, but the disease, trypanosomiasis (" sleeping sickness "), is relatively rare. The reasons for this are not clearly understood and caution must therefore be exercised in forecasting events, but it would be unjustifiable to predict an important increase in the disease due to the multiplication of lakeside breeding places for the fly. The foreseeable risk is associated with the possible development of the lake as a means of transport down which " sleeve " epidemics might be propagated (primarily from the northern parts of the Gold Coast and adjacent French territories where the disease exists on a serious scale), in a manner similar to their extension along the main routes of land communication.

392. There is incontrovertible evidence from all parts of West Africa that outbreaks of trypanosomiasis are eminently controllable, and a combined surveillance and control mechanism is perfectly capable of detecting an outbreak in its very early stages and bringing it to a rapid end. The means used would be largely drug treatment and prophylaxis. Some selective bush clearance would also be necessary at points where lake ports developed, and the declaration of certain Forest Reserves from which people would be excluded (as far as practicable) would also be of assistance. Detailed recommendations are made in Appendix VIII.

Onchocerciasis

393. For understandable reasons there has been more public concern in the Gold Coast about the possibility of the Project increasing the incidence of onchocerciasis (known locally as " river blindness ") than any other disease. It is therefore dealt with here at length. In this particular case it can be emphasised again that the methods of control proposed in Appendix VIII should not only prevent any increase in onchocerciasis as a result of the development of the Project, but, in fact, make a material contribution to the improvement of the health of the people throughout the lake area and below it.

394. Onchocerciasis already exists in a considerable degree in many parts of the lower Volta valley and particularly in the ten miles above the projected dam and along the river below it down to the lower end of the Kpong rapids. The incidence is severe; 68% of the total population of Atimpoka immediately above the Senchi rapids are infected, including 92% of the adult males. Dr. M. H. Hughes, M.A., D.M., Dip.Batt., D.T.M.& H., has also demonstrated that 26% of people become infected within 2 years of exposure, 65% of people become infected within 4 years, and 87% within 6 years. Ocular lesions (" river blindness ") do not occur with this frequency or rapidity, but evidence associating these with infection is sufficient to make it imperative to regard the disease as of the greatest importance. Under no circumstances should work on the Project be permitted to increase the incidence, and labourers temporarily employed should not be exposed to any material degree of risk.

395. The influence of the lake would undoubtedly be to reduce or even eliminate totally the breeding of *Simulium damnosum* (the fly responsible for transmitting the disease), within the area inundated. It is beyond doubt that in this area the incidence of the disease would thus be reduced. No special measures to deal with it are therefore indicated. Considerable advantage would be gained by the local elimination of the disease and also by the resultant cutting off of the focus between Ajena and Kpong from the main source of the disease in the north, thereby making it possible to envisage its ultimate complete elimination from the Ajena/Kpong area.

396. Construction work itself is not likely to exacerbate the breeding of *S. damnosum*, but it would undoubtedly bring large numbers of people into contact with it who might otherwise escape. Special control measures to protect this population would therefore be necessary. It has

been suggested that the most appropriate measure would be by periodical examination of the people concerned and the routine treatment of those found infected, but it seems much preferable to choose the complete control of *S. damnosum* in the construction area even though it is considerably more expensive.

397. The spillway could act as a *S. damnosum* breeding place unless it was so designed that at all rates of overflow there was a uniform fast current down the surface of the spillway. It is thought that a minimum velocity of 7.5 feet per second would be adequate, and the design for the spillway ensures that this would be comfortably exceeded; the suitability of this velocity should in the meantime be the subject of entomological study. Although the spillway should be designed to achieve as rapid a flow as is possible, it is hoped that the process of chemical eradication of *S. damnosum* would prevent infestation of the spillway; should it occur despite these precautions it is now well established that effective chemical control could be maintained.

398. The cut in the Senchi rapids should lead to a marked reduction in the *S. damnosum* breeding in that stretch of the river, although it would of course leave the breeding below the rapids and in the neighbourhood of Kpong as intense as it is now; however, there might be some diminution later as a result of the cut in the Kpong rapids. The influence of controlling the river flow so as to produce a generally uniform rate cannot be precisely foretold but it may be expected that it would result in a material reduction in breeding. Although the introduction of construction labour forces into the area would increase the numbers subject to exposure, the general influence of the Project would be to produce an ultimate reduction in the incidence of the disease and provide an opportunity for the local elimination of an extremely important pest.

399. The proposed methods of control are detailed in Appendix VIII and two separate techniques are described. The first is the application of insecticides to the water with the object of killing the larva in its aquatic stages. The second is the aerial application of insecticides covering all breeding places along the banks of the river and on islands with the object of killing the adult flies resting there.

400. The variation in the flow of the Volta makes further research necessary before it could be decided whether larvicidal control would be completely successful, and this is being pursued by the British Empire Society for the Blind (which has been kept informed of the work of the Commission and its advisers in this field), by the Ministry of Health and Department of Fisheries in the Gold Coast Government, and the Department of Zoology in the University College of the Gold Coast. During this research, particular attention is being paid to the necessity for ensuring that the application of insecticides would not have harmful effects on water used for drinking purposes in the lower reaches of the river and the important fishing industry below the dam (paragraph 356).

401. The aerial application of insecticides to vegetation would not, of course, be affected by the state of the river. The economics of helicopters and fixed-wing aircraft have been examined. Helicopters appear to be the more suitable and though more expensive if used only for this work, might also be employed for other purposes (paragraph 114). Aerial application would be more costly than larvicidal control, and it is recommended that the simpler dry-weather method should be tried for a year. If it did not succeed, the aerial technique should be introduced immediately. It should be remembered that this second technique would not only control *S. damnosum*, but it would also provide a general insect control in the neighbourhood of Ajena. The estimates of cost provide for the more expensive technique.

Bilharziasis

402. This disease already exists in the Gold Coast and there is little doubt that the lake would become infested. It could thus become a source of disease to people actually entering the water in commonly frequented places though its effects would not extend beyond the margin. A detailed programme of control has been prepared.

403. It would be most important to site the new villages required for resettlement at some distance from the shores of the lake. The provision of fresh water and proper sanitary facilities would reduce the need for access to the lake and reduce the dangers of disease. The programme of control would provide for the constant surveillance of the lake in order to detect infestation, snail control by means of molluscicides, and constant clearance of vegetation in recognised places of access. Facilities for medical treatment should be provided as necessary.

404. Molluscicides are, in general, toxic to fish, and the effect of various concentrations and of different methods of application is being studied carefully from this point of view; experiments are also being made with the propagation of a small local fish which is an active predator of snails. If successful, this technique might provide an alternative to chemical molluscicides.

405. The general programme of educating the public about bilharziasis will, of course, be continued by the Gold Coast Government.

Other Diseases

406. There is no reason to forecast a possible exacerbation of any other conditions. Most other conditions which could conceivably be increased by the creation of the lake such as *bancroftian filariasis*, yellow fever, and dengue would, in any case, be adequately controlled by the proposed malaria control scheme. There is the possibility that the alteration of water levels and the consequent change in the nature of wells could induce a higher incidence of guinea worm than is now present, but this could be avoided by the recommendations which have already been made for the provision of adequate safe water in the new villages which would be created. Despite this assurance there would have to be constant surveillance and the Medical Survey Team working under the Lakeside Health Section (paragraph 411) should be capable of recognising the increase of any disease of importance.

Resettlement of People Living in the Lake Area

407. Reference is made in Appendix VIII to the precautions which would need to be taken to preserve the health of the people after moving to new villages. While it would be very undesirable for unrestricted settlement to take place too close to the lake margin, it is recognised that fishermen and farmers wishing to cultivate the exposed land around the lake would naturally wish to live as close as possible to their place of work. The health of such communities would require supervision from the Medical Survey Team. These facts have been taken into account in preparing the plans for resettlement.

C. METHOD OF APPROACH AND ORGANISATION

Two Stages

408. Risk of disease has been envisaged in two distinct phases. The first—when the risk would be greatest—has been described as the " dynamic stage," and would extend from the time when approval was given to proceed with the Project until (say) two years after the smelter was in production. A second stage of routine control and maintenance would then commence.

Allocation of Responsibility

409. During the initial dynamic stage, when the principal risks would apply, arrangements would be made with the Gold Coast Government and other authorities for the Health and Safety Division of the Volta River Authority to execute or supervise all measures for the maintenance of health in the areas immediately affected. When that stage had passed, responsibility for different aspects of health work would be assumed by the Gold Coast Government, the aluminium companies and the Authority in accordance with the logical division of responsibility. The responsibilities and duties of the Authority in this connection are contained in the draft Bill at Appendix XVI.

410. The problems fall into two natural groups; those following the creation of the lake and other measures of water management, and those following the aggregation of labour and the development of townships. The organisation for dealing with the latter problems is described in Chapter 10 of Appendix XII. It is only necessary here to consider the arrangements for surveying and controlling lakeside health.

Organisation

411. In order to do this it is recommended that within the Health and Safety Division of the Volta River Authority there should be a Lakeside Health Section. Its functions should be the continuous study and appreciation of the health state of the population, and of the factors incidental to water management which might influence it in the neighbourhood of the lake and the water controlled below it, and the control of the special hazards which water management might create.

412. Originally, a survey unit should be established containing several workers, an epidemiologist, aquatic biologist, entomologist, botanist, malacologist and chemist, though ultimately on the analogy of the Tennessee Valley Scheme the unit might be reduced in size as the implications of water development became better understood. These workers should be free to study their problems, to survey, and to advise on control, without having executive functions in this last respect, such work being undertaken by field officers. In addition, within the Lakeside Health Section, there would, of course, be executive control teams to deal with specific diseases.

Costs

413. The organisation required to carry out the various techniques and measures of control is detailed in Chapter 3 of Appendix VIII, together with estimates of cost. The vital factor in

achieving success would be the appointment of certain key personnel immediately a decision was taken to proceed with the Project, and it would also be essential to ensure that the important position of the director of the Health and Safety Division within the Volta River Authority was recognised and safeguarded. (This has been done in the draft Bill reproduced as Appendix XVI.)

414. A timetable for carrying out health measures has been drawn up, and estimated capital and operating costs for all aspects of the proposed control measures have been prepared. It is estimated that the total cost of the Lakeside Health Section would be approximately £1,116,000 (excluding interest) during the construction phase of the Project, and about £135,000 a year thereafter. The estimates have been examined by Cooper Brothers & Co. who have accepted them as reasonable on the basis of the technical recommendations proposed.

D. ACCEPTANCE BY THE GOVERNMENTS AND ALUMINIUM COMPANIES

415. The two Governments and the aluminium companies have accepted the recommendations and proposals made to deal with the problems of health and sanitation associated with the formation of the new lake. The cost of the control measures would be borne by the Project.

CHAPTER 17

AGRICULTURE, FORESTS AND FISHERIES

Introduction

416. Although the effects of the Project on the agriculture, forests and fisheries in the area subject to inundation, and on the general economy of the riparian communities living downstream from the dam, were surveyed in detail as part of the Commission's general consideration of the problems of compensation and resettlement, it was recognised that the scheme, if undertaken, would have wider repercussions on the agricultural sector of the national economy. An appreciation was therefore made of the relationship of the Project to agriculture, forests and fisheries in the Gold Coast.

417. The primary responsibility for dealing with the many problems which would arise in these fields would rest, of course, with the Gold Coast Government and the Commission's survey (which is reproduced as Appendix IX) was therefore deliberately carried out on general lines except where specific matters (e.g. supplies of food and firewood, land clearance) were directly related to the Project, and therefore required more detailed investigation.

418. Agriculture today dominates the economy of the Gold Coast and will almost certainly continue to do so for many years to come. The growing of cocoa is of vital importance to the country, and, although the successful development of the Volta Project could be of great assistance to the Gold Coast Government in reducing the present dangerous dependence on this one major export (see paragraph 542) as well as bringing other advantages, it is apparent that the greatest emphasis must continue to be placed on the further expansion and improvement of agricultural production.

419. The Project would clearly cause some losses in the agricultural sector, but it should also provide great opportunities for increasing the growth of the fishing industry (thus helping to reduce the national deficiency in proteins) and for developing certain types of agriculture.

Effects of the Project

420. There are five main areas in the Gold Coast where agriculture, forests, and fisheries would be affected in varying degrees as a result of the introduction of the Project:

(*a*) the area subject to inundation;
(*b*) the area occupied by the riparian communities living downstream from the dam;
(*c*) the dam site at Ajena and the smelter site at Kpong;
(*d*) the new mines in the Aya/Yenāhin area;
(*e*) the new port at Tema.

421. The effects of the Project in the first two areas have already been described in Chapter 14 and Chapter 15. In the case of the former it can be said that a large part of the 3,000 square miles of land which would be permanently inundated is relatively poor and unexploited; and the loss would be offset in a large measure by the possibilities for growing crops around the margin of the lake and of developing a fishing industry in it. A total of about 6,000 acres of cocoa would be lost, but much of this is in poor condition and many of the soils are marginal. Considerable stands of oil palms in one sector form the only other crop of economic significance.

422. In the second area, the riparian communities living downstream from the dam should suffer very little loss in their farming, but there would be some damage to fishing since various creeks and ponds would no longer receive replenishment from the annual flood. Production from the Keta and Songaw Lagoons should not be seriously affected, but provision would have to be made for the introduction of sea water into Songaw.

Supplies of Local Foodstuffs

423. As to the other three areas, the effect of the Project should be to stimulate agriculture in the districts surrounding the mines, the dam and the smelter, and the demands for food from the new populations should be met without difficulty. The further development of the Government's present programme of feeder roads in the Krobo area (where the smelter would be built) would undoubtedly encourage agricultural production, and the Commission has recommended that the Government should place particular emphasis on the development of this part of the Gold Coast, for the Krobos are renowned for their industry as farmers. At Tema there is little prospect of food requirements being met locally, but they should be capable of satisfaction from other sources which at present supply Accra. Increased production by the Krobos could undoubtedly play an important part in meeting these demands, as well as those of the smelter township.

Reserve Supplies and Availability of Meat and Fish

424. A reference is made in Appendix IX to arrangements for providing alternative sources of food, and to additional steps which could be taken to increase the supplies of meat and fish required for the high protein diet recommended for the labour forces during construction (paragraph 204).

Firewood

425. An appreciable supply of firewood would be required for the labour forces at the dam and smelter sites, both during the construction and operating phases of the Project. The four forest reserves referred to in paragraph 309 would be inundated by the new lake, and recommendations are made in Appendix IX for the extraction of wood from two of them in advance of flooding. Once more, the further extension of the Government's programme for the development of feeder roads would be an essential factor in this process.

426. After the lake had formed, two areas covering 172 square miles north-west of the present junction of the Volta and Afram Rivers would become virtually isolated. This land is covered with savannah and small strips of riverine forest. It is recommended that the areas should be turned into forest reservations and ultimately used to meet the long-term requirements of the smelter township.

427. The staff recommended (paragraph 330) for dealing with compensation and resettlement in the inundated area includes two forestry officers who could organise the utilisation of the existing forest reserves as well as the introduction of new reserves. These officers could also give attention to the provision of shade and fruit trees in the new resettlement villages.

Erosion and Conservation

428. It is not anticipated that serious problems would arise either in the field of erosion or of conservation, but these matters are considered in Appendix IX, together with a recommendation that consultation with the French Authorities should be maintained as part of a general policy of facilitating conservation throughout the watershed area, of which 59% lies outside the Gold Coast. The existing legislation in the Gold Coast gives the Government adequate power to take whatever steps might be necessary to preserve and reclaim land, to protect sources of water, and to facilitate conservation.

Clearance of Vegetation

429. There would be several advantages if widespread clearing could be undertaken before flooding commenced. In any case, a restricted amount of clearance would be essential for reasons of health and sanitation and to facilitate inland navigation. These needs are discussed in Appendices IX and X. Practical and economic considerations rule out the possibility of complete clearance. There are about 50 square miles of riverine forest in the area subject to inundation and a sample count in one square mile showed 133,666 trees and saplings, about 2,000 ranging from 6 ft. to over 10 ft. in girth. The rest of the area can be broadly classified as savannah woodland, and a sample count there indicated an incidence of just under 100,000 trees and saplings in a square mile—one-third of which were from 1 ft. to 5 ft. in girth.

430. The Commission carried out an experiment in clearance, and also obtained information from other authorities about their experience in using various methods for removing the growth, so as to judge relative effectiveness and to ascertain costs. Detailed reference to this is made in Appendix IX, and it is apparent that the cost of clearing the entire area subject to inundation would be economically prohibitive. At a later stage, however, some part of the lake margin might be cleared in order to assist agricultural production.

Major Opportunities for Increased Food Production

431. There would be three major opportunities for increasing the local production of food as a result of the introduction of the Project. The first would be an opportunity for agricultural development along the margins of the lake—some 2,000 miles in length—but it would take time to find the necessary farmers and, where necessary, to acquaint them with new techniques: the preservation of their health would also require careful consideration. The second opportunity would exist in developing large scale fisheries in the new lake, and the third possibility would arise in the field of irrigation.

Fisheries in the New Lake

432. The Commission was fortunate enough to have the advice of Dr. E. B. Worthington, M.A., Ph.D., lately Secretary-General to the Scientific Council for Africa South of the Sahara, about the fishery potential of the new lake. At a conservative estimate, it is considered that the lake might produce 18,000 tons of fish a year—an amount equivalent to the present total catch off the sea coast. In 1954, the Gold Coast imported 10,800 tons of tinned and smoked fish at a cost of about £2 million.

433. Of course, it would take time to develop this great potential. A large number of additional fishermen would be required, new techniques would have to be introduced, and a considerable organisation for handling and marketing the catch would need to be built up. Health would need to be safeguarded as well. There can be no doubt, however, that a new and appreciable source of wealth for the people of the Gold Coast would be created.

Irrigation

434. A description is given in Appendix IX of the experiments which the Gold Coast Government is already making with a view to irrigating the plains of Accra, which extend over some 1,500 square miles. This area lacks water and as a result is sparsely populated. So far 100 acres have been brought under irrigation and various trials are being carried out. If successful, the Government would consider extending the experiments to about 18,000 acres. Ultimately 200,000 or 300,000 acres might be covered, but that is of course a very long-term objective and entirely dependent on the success of the earlier investigations.

435. Cost would not be the only factor in developing irrigated farming. Additional manpower would be required, and it would be necessary to ensure that the farmers would be willing to adapt themselves to entirely new methods. All this suggests that the basic problem should be approached with great care and particular consideration paid to the human element.

Fertilisers

436. It has been suggested that fertilisers should be produced in the Gold Coast by using part of the power from Ajena reserved for local use (paragraph 85). The suggestion raises many technical and economic issues and the Gold Coast Government is now making preliminary enquiries into the proposal.

Chapter 18

CONCLUSIONS AS TO THE EFFECTS OF THE DAM AND THE LAKE

437. The Commission considers that the local effects of the dam and lake could be dealt with satisfactorily, assuming that the Gold Coast Government arranged for the immediate establishment of an effective organisation to deal with compensation and resettlement in the area subject to inundation, and with the effects of the changed river conditions on the riparian communities; and assuming that the Volta River Authority implemented the plans and recommendations made in this report for dealing with the problems of health and sanitation.

PART III

Financial and Economic Aspects

Chapter 19

FINANCIAL AND ECONOMIC ASPECTS: INTRODUCTION

438. The Commission's study of the financial and economic aspects of the Project represented the second stage of its work. Particular care was taken in analysing the various problems in this field for it was appreciated that any of them might influence decisively the scheme's prospects of successful development. The results of the Commission's enquiries are contained in Appendix XIII; the most important features are summarised in this part of the report.

439. The first requirement was to establish realistic estimates for the five component parts of the Project, and for those capital works which the Gold Coast Government would need to carry out simultaneously. Chapter 20 describes the method of approach to these estimates and the fundamental assumptions on which they were prepared, and sets out a summary of the estimates themselves, with some explanatory notes.

440. The annual charges arising from the Project are dealt with in Chapter 21 which also shows the estimated cost of power at the various stages of development. The determination of railway freight rates and certain other factors influencing the cost of aluminium production are discussed in the same chapter.

441. Chapter 22 reviews the estimates in the light of general experience in recent years with major construction projects in the Gold Coast and in other countries. It indicates that estimates have often been substantially exceeded in the event, and in view of this the Commission recommends that an allowance of 40% to 50% should be added to the estimates of capital cost when considering the provision of finance for the Project.

442. External factors, such as rises in world prices, which might influence the cost of the scheme are considered in Section A of Chapter 23, and their probable effects on its economics are examined.

443. Various internal Gold Coast factors which might influence the cost of the Project, such as policy in regard to cocoa payments and wages, are reviewed in Section B of Chapter 23, and their probable effects considered. The possibility of the Project itself creating an inflationary trend in the Gold Coast economy is also discussed in this chapter.

444. The wider impact which the scheme might have on the Gold Coast economy is reviewed in Chapter 24. Attention is drawn to the more important effects, but a detailed quantitative assessment is not made since the Gold Coast Government has been advised independently on this aspect by Professor W. Arthur Lewis, Ph.D., B.Com., M.A., L.H.D., Stanley Jevons Professor of Political Economy at Manchester University.

445. Certain general economic considerations are discussed in Chapter 25, and the following chapter summarises the Commission's conclusions as to the financial and economic aspects of the Project.

446. Elsewhere in this Report an appropriate acknowledgement is made of the most valuable assistance given to the Commission in dealing with these problems by officials in the British and Gold Coast Governments, the consulting engineers, Cooper Brothers & Co., Aluminium Laboratories, and Professor W. Arthur Lewis.

Chapter 20

CAPITAL COST OF THE PROJECT

Method of Analysis

447. For the purpose of estimates the capital investment was considered under six main headings:

Jointly Financed

A. Dam and power installation and ancillary works;
B. All costs incurred in setting up the smelter and mines;

Gold Coast Government Financed

C. The new railways and improvements to existing railways required for the Project;
D. Other direct commitments arising from the Project;
E. Other possible investment arising from the Project;
F. Allied development expenditure (including the port of Tema).

448. A summary of these six estimates is given below in the following table:

SUMMARY OF ESTIMATES

	Initial Stage £m		*Intermediate Stage* £m		*Final Stage* £m	
Jointly Financed						
A. Dam and Power Installation		60.2		64.0		67.6
B. Smelter and Mines		43.1		57.9		91.2
Gold Coast Government Financed						
C. Railways	15.9		16.6		18.1	
D. Other Direct Commitments	2.5		2.8		5.0	
E. Other Possible Investment Arising from Project	1.5		4.2		10.0	
F. Allied Development Expenditure	39.4		39.4		39.4	
Total		59.3		63.0		72.5
TOTAL		162.6		184.9		231.3

Notes: (*a*) The estimates for the dam and power installation provide for 10% more electricity than the figures in the White Paper.

(*b*) The heading " Allied Development Expenditure " covers investment in port, town and road development which the Gold Coast Government has already decided to undertake for the general benefit of the country irrespective of the decision on the Volta Project. The expenditure would therefore form part of the normal development programme of the Gold Coast, but is included in the above table since all the works concerned would be essential for the operation of the Project.

(*c*) All figures are based on 30th September, 1955, prices, and make no allowance for rises during the construction period in wages or materials costs. The addition of an extra allowance is suggested later in this Report, and adjusted estimates appear in paragraph 520.

Responsibility for Preparing and Checking Estimates

449. For Estimate A the consulting engineers were responsible for the preparation of the figures for the power development works although certain other items were derived from different sources (e.g. the estimate of expenditure on health precautions in the lake area was obtained from the studies of Professor Macdonald and Dr. Topping). Estimate B was provided by Aluminium Laboratories. For Estimate C the consulting engineers assessed the cost of new railway construction, while the Gold Coast Government prepared the estimates for improvements to existing lines and for the cost of locomotives and rolling stock. Estimates D, E and F are based on figures provided by the Gold Coast Government.

450. Estimates A, B, and C would clearly be of decisive importance to the economics of the Project and were therefore prepared with particular care. To supplement the work of the consulting engineers, the Commission retained the services of Cooper Brothers & Co. for the scrutiny of the power and railway estimates. Aluminium Laboratories also made an independent study of the power estimates (which was fully discussed with the consulting engineers and Cooper Brothers & Co.) in addition to their preparation of estimates for the smelter and mines which was done in much more detail than would be their normal practice so many years before actual construction.

The Work of Cooper Brothers & Co.

451. The report of Cooper Brothers & Co. is reproduced in full as Appendix XIV, and the following letter indicates that the firm was in general agreement with the method of investigation adopted by the Commission, and endorses the power and railway estimates:

COOPER BROTHERS & CO.
CHARTERED ACCOUNTANTS
14 GEORGE STREET, MANSION HOUSE, LONDON, E.C.4.

2nd November 1955.

" Special Commissioner,
Volta River Project Preparatory Commission,
Accra.

Dear Sir,

VOLTA RIVER PROJECT

In your letter of 5th August, 1954, you requested us to examine and report on the estimates of costs in respect of both capital and operating charges of the hydro-electric

project and of the capital charges relating to the new railways. The final estimates have recently been completed by Sir William Halcrow & Partners and our report thereon will be sent to you to-day.

2. You will see from the conclusion of our report that, accepting the technical foundation of the estimates as sound, we consider that the estimates examined by us have been properly compiled and fairly represent the probable cost of the capital and operating charges of the hydro-electric project and the capital charges relating to the new railways on the basis of prices, wages and other costs ruling at 30th September, 1955. They do not include any amount in respect of inflation which may occur after that date, a study of which is contained in your report on the financial and economic aspects of the scheme.

3. As you are aware we were associated with the Volta River Project before the appointment of the Preparatory Commission, having been asked by Sir Wilfrid Eady in 1951 to advise the United Kingdom Treasury on the scheme. We have therefore followed the work of the Preparatory Commission with much interest. We have been impressed by the wide range of the Commission's investigations and the detailed planning of all phases of the scheme. The work of the Commission, its enquiries, plans and recommendations are now set out in a series of reports dealing in detail with all aspects of the scheme.

4. The Commission has directed particular attention to human factors and a basic policy making provision for the preservation of the family life and contentment of all employed on the scheme has been adopted. The Commission has also recommended the maximum use of modern mechanised methods during construction. This will reduce the labour force required for construction and will simplify the attendant problems of housing, feeding, health and other difficulties which might be expected in the rapid assembly of a large population in an undeveloped area.

5. The various stages of the scheme have now been phased, as far as is practicable, to follow the construction of services which are complementary to them, such as the port at Tema and the new roads and railway.

6. We have not examined the estimates made by the aluminium companies of the capital expenditure by the proposed smelter company or their estimates of the ability of the smelter company to earn adequate profits. We understand that the United Kingdom and Gold Coast Governments take the view, which we think is reasonable, that the willingness of the aluminium companies to make a large investment in the proposed smelter company is a sufficient assurance that the aluminium scheme will be profitable.

7. In the light of our association with the scheme before the appointment of the Commission and our knowledge of the work of the Commission, we have formed the opinion that the scheme has now been carefully planned, and, on the assumption that the proposed smelter company will be able to earn adequate profits (paragraph 6), is economically sound.

We are,
Dear Sir,
Yours truly,
Cooper Brothers & Co."

Work of Aluminium Laboratories on Power Estimate

452. Aluminium Laboratories, in their examination of the estimates for the dam and power installation, prepared independent figures which were in very close agreement with those of the consulting engineers. Aluminium Laboratories obtained different costs for certain individual items which are dealt with later in this chapter, but the net result of their independent calculations was a total estimate about £700,000 less than that of the consulting engineers. The main differences between Aluminium Laboratories and the consulting engineers are fully discussed in the report of Cooper Brothers & Co. (Appendix XIV, paragraphs 48 to 51), who conclude that, apart from three items where the differences virtually cancel each other " there is a convincing measure of agreement between Aluminium Laboratories and Sir William Halcrow & Partners."

General Approach to the Estimates

453. Throughout the investigations the Commission and all concerned with the Project were resolved that estimates of cost should be prepared on a conservative basis, consistent with the general approach to the Project described in paragraph 17. Fortunately very few problems arose in the consideration of construction works and ancillary services where final decisions as to design or financial responsibility could not be taken. In any case, they should not be difficult to resolve

during negotiations between the parties. If it was not possible to determine the choice between alternative courses of action or methods of treatment then the more costly alternative was assumed for estimating purposes.

Basic Assumptions for Estimating

454. For the purpose of planning it was assumed that construction for the first stage of the Project would start in 1957 and conclude in 1964. The estimates in this chapter and Chapter 21 are based on costs as at 30th September, 1955. (Chapter 22 considers possible price movements after this date.) They are also based on the site investigations and plans as they stood on the same date. Site investigations have not been carried forward to the same degree for each component of the Project. For example, the dam and power installation has been surveyed in very considerable detail, but for the railways and the mines and smelter (where there would be time to complete surveys after a decision had been taken to go ahead with the Project) the estimates are not based on detailed bills of quantities. On the other hand, for many items in Estimate F, such as the port of Tema, the actual contract price is known and is subject to variation only for specific reasons listed in the contract.

455. The estimates would not be further refined until a decision was reached to go ahead with the Project, when tenders could be obtained, and survey work completed for those items which would follow later in the construction programme. The estimates are based on much more detailed surveys than the earlier figures published in November, 1952, when it was recognised that " the risk of exceeding the estimates even by a substantial margin is not one which could be removed from a scheme of this kind."[1] Although the estimates have now been prepared, checked and rechecked, some qualification of this sort must still stand, and an examination of factors which might lead to significant variation is included in later chapters. The estimates tabulated in this chapter represent the cost of the Project, allowing an appropriate contingency margin, if prices and wages were to remain at their present level and if progress in construction were reasonably smooth. The result of a more cautious assessment of the future course of events appears in Chapter 22.

Margin for Contingencies

456. It might be thought that the intensive investigation of the scheme which has now been made would justify some reduction of contingency margins below the conventional figures. The Commission considers, however, that no reduction would be prudent in view of the size, complexity and duration of the Project, and the inevitable difficulties of launching a major construction scheme in a country where no development of comparable size has previously been undertaken. The estimates therefore include throughout a contingency element rather above the normal; and for certain items, including those for which completion of surveys has been deferred until a decision to go ahead with the scheme, a special addition to the contingency margin has been made.

The Estimates

457. The estimates, which are summarized in paragraph 448, are set out in full with detailed comment in Chapter 2 of Appendix XIII. The following paragraphs draw attention to the more important aspects, and contain brief tables of the main items in each estimate.

ESTIMATE A: DAM AND POWER INSTALLATION

	Initial Stage £ *million*
Preliminary Surveys	1.3
Roads	0.4
Dam and Power Station	26.6
Temporary Housing	4.9
Permanent Housing	0.3
Compensation and Resettlement	3.5
Volta River Authority	1.5
Lakeside Health Maintenance	1.1
Other Health Expenditure	0.1
Transmission Lines, Switchgear and Metering	1.1
Contingencies and Engineering	6.8
Interest	12.6
TOTAL	60.2

Notes: (*a*) The cost of extension to the final stage would be £7.4 million, representing almost entirely the additional cost of the power station, making a total of £67.6 million.
(*b*) The amount of power which the consulting engineers now estimate would be available from this installation is about 10% greater than that originally anticipated.

[1] Para. 23 of Appendix II of the White Paper (Cmd. 8702).

Preliminary Surveys

458. £1.3 millions included for preliminary surveys largely represents expenditure already incurred in successive stages of investigation into the power installation, by West African Aluminium Limited in the first place, then by the Gold Coast Government, and finally by the Preparatory Commission on behalf of the two Governments. It has been agreed that these costs would be chargeable to the power scheme. The bulk of the expenditure under this heading relates to the cost of engineering investigations.

Main Works

459. The most important item in the estimates is the very large sum required for the main works (£26.6 million for the initial stage) of the dam and power station. The assessment of the work involved in excavation and rock and earth movement is a major factor here, and affects also many other items in the estimate which would depend on the size of the labour force and the duration of construction. The estimate is built up on a conservative basis of machine performance and workers' productivity, not assuming anything beyond proved achievement in the Gold Coast wherever comparison is possible. The figures in question have been subjected to an exhaustive examination by Cooper Brothers & Co. which is described in paragraphs 22 to 38 of their report (Appendix XIV). Aluminium Laboratories have also given special consideration to this item and, while in broad agreement with the estimates for the dam and power installation as a whole (paragraph 452), would have taken a higher unit cost for rock excavation, this being in part offset by a lower rate for contingencies.

460. The estimate for the indoor power station is based on the design submitted by Mr. G. A. Jellicoe (paragraph 71). The indoor station would be more costly than an outdoor type, and the estimates for the first stage are about £330,000 higher (including contingencies, engineering and interest). Each of the two later stages would require an additional £50,000.

461. The estimates for the main works include £500,000 for bonus payments to the contractor on satisfactory compliance with an agreed timetable. This is to ensure that an adequate incentive would be given to the contractor in view of the very heavy interest charges that would accrue if there were any delay in completion after substantial investment had already been made. Interest charges would accumulate not only on the dam and power installation, but also on the other component parts of the scheme which could not become remunerative until power was available. Aluminium Laboratories, while recognizing the vital importance of completion according to timetable, would not themselves have included such a bonus in the estimates. The detailed arrangements for the payment of any bonus would be discussed between the parties and incorporated in the contract for construction (paragraph 696).

462. The estimate also includes £50,000 for special insurance that would cover the Volta River Authority against the risk of loss caused by delay due to exceptional flooding. The risks of damage to plant and equipment through flooding would be covered by the contractor in the normal way. It would be for the parties to the scheme to decide whether to take out special insurance against the risk of delay from such causes or to stand the risk themselves.

Temporary Township at Ajena

463. The cost of the temporary township that would accommodate the construction labour force, together with a substantial proportion of families, and provide hospitals and schools for the community, was estimated at £4.9 millions[2] (excluding engineering, contingencies and interest) by the consulting engineers. This estimate was based on certain recommendations about housing standards that emerged from discussions in the Gold Coast during 1954 and 1955. The temporary township would thus account for about 12% of the total of Estimate A for the first stage. The main reasons for the high cost are the duration of the construction period, which leads to the necessity of the recommended policy in regard to families (see Chapter 8); the timetable of construction, which requires a high degree of prefabrication (which is relatively costly) in order to provide housing in time for the rapidly increasing labour force; the general desire for satisfactory housing standards; and the difficult nature of the only possible site within reasonable distance of the construction area.

464. The aluminium companies have expressed reservations on the estimate for the temporary township, and the estimate of Aluminium Laboratories assumes that the cost could be reduced substantially.

465. In view of the high cost of the temporary township the Commission has considered a number of possible economies by the use of joint sites for construction forces (for the dam and power installation and for the smelter) or for construction forces in the earlier phase and operating

2 This includes about £400,000 for recurrent costs of health and education services, and £800,000 for recurrent costs of electricity, water, etc. The capital expenditure would be £3.7 million.

staff in the later phase; or by the use of certain joint facilities such as hospitals. However, such economies are ruled out by the physical nature of the sites, or by the timetable of construction which causes the periods of maximum employment on the construction of the dam and of the smelter to overlap. The temporary township has therefore to be planned as a largely self-contained unit. The net cost could, however, possibly be reduced by the collection of receipts such as rent from construction workers and the residual values of buildings and equipment. It would be the recommended policy to collect rents and to obtain the maximum residual value for all assets relating to the township. At the same time experience indicates that it would be unwise to reckon on too optimistic assumptions concerning receipts from the above sources; in accordance with the Commission's generally conservative policy, no credit is assumed in the estimates.

466. In agreement with the two Governments and the aluminium companies, the Commission in 1955 initiated further investigations into the temporary township by the firm of Architects' Co-Partnership in association with Dr. O. H. Koenigsberger (see paragraphs 260 to 263). The main objective of this investigation was to achieve a substantial economy in the cost of the township without departing from the basic policy of providing facilities for family life.

467. The financial results of this investigation showed that the original estimate of the consulting engineers (£4.9 millions) could be reduced by approximately £850,000. This saving could be achieved principally as a result of some modification to standards of accommodation, by different methods of construction and by a more compact town layout.

468. This further investigation showed that the original estimate could not be reduced in other ways without virtually abandoning the policy for families advocated by the Commission. This is discussed further in paragraphs 552 to 556.

Permanent Township at Ajena

469. The estimates include £340,000 for the permanent community that would be required at Ajena for the power-station operating staff. The planning of this township was the subject of independent study by Mr. Thomas Scott (paragraph 65) and the estimate is in accordance with his recommendations.

Compensation and Resettlement

470. The provision of £3,500,000 in the estimates is in accordance with the 1952 proposals under which this sum would be the maximum charge on the power project. The reports on the area subject to inundation and on the riparian communities downstream from the dam (Appendices VI and VII) estimate the cost of compensation and allied measures at approximately £4,000,000 for the former area and £500,000 for the latter. Of the estimated total of £4,500,000 the sum of £3,500,000 has been included here for the power project. The £1,000,000 representing the excess of estimated compensation over the maximum previously agreed as chargeable to the power project, has been assumed to be borne by the Gold Coast Government unless agreement otherwise is negotiated between the parties, and is included in Estimate D.

471. The Gold Coast Government has expressed the view (paragraph 382) that the cost of compensation, etc., below the dam (estimated at £500,000 of the total £4,500,000) should be chargeable to the power project over and above the £3,500,000 formerly agreed as the maximum. The Government has pointed out that the disturbance to the riparian communities downstream of the dam was not specifically considered in the course of the 1952 discussions, and that a fresh issue is therefore raised. In addition, the Gold Coast Government has suggested (paragraph 336) that the information now available justifies reconsideration of the earlier understanding as applying to compensation above the dam also, especially since the increased lake area would provide the 10% addition to the power potential. These questions will need to be resolved in negotiation.

Volta River Authority

472. A sum of £1,116,000 is included in the estimates for the cost of measures necessary during the construction phase to prevent any deterioration in health in the areas affected by the scheme. The estimate is based on the recommendations of Professor Macdonald and Dr. Topping concerning the problems of health and sanitation arising from the formation of the new lake, and was included in the examination of the estimates by Cooper Brothers & Co. and endorsed by that firm.

473. In addition, a sum of £1,500,000 is included for the administrative and other costs (excluding medical) of the Volta River Authority during the construction period. This sum includes an allowance for the essential staff who might be appointed to the Preparatory Commission in the period before the Authority could be formally constituted (see paragraph 652).

Transmission Lines from Ajena to the Smelter

474. The high voltage transmission lines are estimated to cost £538,000; it has been assumed that the shortest practicable route would be followed except in its approach to the Adomi bridge where there is a diversion in order to comply with the general landscaping scheme as envisaged by Mr. Jellicoe (paragraph 75). The extra cost of this diversion, about £34,000 in the first stage and a further £6,000 in the intermediate stage (including contingencies, engineering and interest), is included in the estimates. No further expenditure would arise at the final stage.

Switchgear and Metering

475. Final technical arrangements have not yet been settled for the sub-station at the smelter end of the transmission lines from Ajena. The sum of £542,000 included in the estimate for switchgear and metering conforms with the arrangement by which the Authority would own the equipment necessary for allocating current as between the smelter company on the one hand and other Gold Coast consumers on the other. The aluminium companies would prefer an alternative arrangement which they estimate would cost £60,000 less.

Interest

476. The estimates include £12,600,000 for accumulated interest up to 31st December, 1964. In agreement with the two Governments a rate of 5% per annum has been taken for planning purposes, but is not intended as an indication of the actual terms on which money would be advanced, which would have to be negotiated between the parties. Differences in the rate of interest would have an appreciable effect on the total construction cost as the following table shows:

EFFECT OF DIFFERENT INTEREST RATES ON COST OF DAM AND POWER INSTALLATION

First Stage of Development (80,000 Tons)

Interest Rate	*3%*	*4%*	*5%*	*6%*
	£m	£m	£m	£m
Cost excluding interest	47·7	47·7	47·7	47·7
Interest	7·1	9·8	12·5	15·5
Total including interest	54·8	57·5	60·2	63·2

Rates of interest would make an even greater proportional difference to the unit cost of power, as will be seen in paragraph 510.

ESTIMATE B: CAPITAL COST INCURRED IN SETTING UP THE SMELTER AND MINES

Scope of the Estimate

477. This estimate covers expenditure which the smelter company would incur on the bauxite mines and village; the smelter and ancillary facilities; the township to be built near the smelter; and certain installations at Tema which are envisaged as the responsibility of the smelter company. The costs have been computed by Aluminium Laboratories on the same general assumptions as the other estimates for the Project. The estimate is summarised below, and attention is drawn in the following paragraphs to certain items of special interest.

ESTIMATE B: SMELTER AND MINES

	Initial Stage £m	*Extension to Final Stage* £m	*Total at Final Stage* £m
Bauxite Mines and Village	2.8	0.7	3·5
Smelter and Ancillary Facilities	32.7	38.3	71.0
Smelter Township	6.2	8.5	14.7
Installations at Tema	1.4	0.6	2.0
TOTAL	43.1	48.1	91.2

Housing for Construction Force

478. It is proposed that the majority of construction workers would be housed in the permanent township described in the next paragraph, which would be built sufficiently early for that purpose and would provide a proportion of family accommodation. The permanent township, however, would not be large enough to house the whole of the construction force, and the alu-

minium companies have based their estimates on the assumption that the remainder would be accommodated in temporary dormitories with cubicles. Some doubt has been expressed in the Gold Coast about the general acceptability of dormitory accommodation, and Aluminium Limited have stated that they would be prepared to review the proposal if housing in dormitories should prove clearly unacceptable.

Permanent Township

479. The estimates for the permanent township correspond with the plans advanced on behalf of the aluminium companies by the town planning consultants, Mayer and Whittlesey, and considered generally acceptable by the Gold Coast Government (Chapter 11). The exact details of housing standards would be settled during negotiation as has been noted in paragraph 244.

480. The estimates for the permanent township include all items which are visualized as the responsibility of the smelter company. During discussion of the problems of the smelter township, it was generally agreed that it should be planned to include an appreciable proportion of workers other than those employed in the aluminium industry in order to avoid the recognized disadvantages associated with the formation of a " company town " (paragraph 240). The financial consequence of this agreement was that the companies accepted responsibility, for planning purposes, for the cost of all houses for the employees of the smelter company, and initial financial responsibility for all services for the township (the intention would be for the services ultimately to be transferred on agreed terms to the local authority for the smelter township).[3]

481. The Gold Coast Government has agreed for planning purposes to accept the ultimate financial responsibility for those houses in the township which would be used to accommodate people other than employees of the smelter company, although the Government's intention would be to allow the maximum participation in the development of non-company housing by private finance or non-Government corporations. Estimate B includes the smelter company's share of township costs in accordance with the above agreement, and the potential liability of the Gold Coast Government is allowed for under Estimate E.

Installations at Tema

482. The estimate for the smelter company's installations at Tema includes £125,000 for facilities for receiving and holding oil at the port during the first stage of aluminium production. The remaining £1,250,000 covers miscellaneous handling and storage equipment for special cargoes such as petroleum coke imports and aluminium exports. The Gold Coast Government and the companies have agreed to explore the possibility that the Government would make berthing capacity and storage areas available for the exclusive use of the industry on suitable terms, and that the smelter company would itself instal and operate the port equipment which it regarded as best fitted for the aluminium industry. The companies' estimate for port equipment is included here accordingly.

ESTIMATE C: CAPITAL COST OF THE RAILWAYS

Scope of the Estimate

483. This estimate includes provision for all new railway construction required for the Project (as described in Chapter 5) including the tunnel on the line between Koforidua and the smelter; for necessary improvements to existing lines and ancillary facilities; and for locomotives and rolling stock. It is summarized below.

ESTIMATE C: RAILWAYS

	Initial Stage £m	*Extension to Final Stage* £m	*Total at Final Stage* £m
New railways	10.5	—	10.5
Improvements to existing railways	3.1	—	3.1
Locomotives, rolling stock, etc.[4]	2.3	2.2	4.5
TOTAL	15.9	2.2	18.1

484. The basic assumptions about wages and productivity are the same as those adopted for the dam and power installation (paragraph 459). The provision of housing, medical services, etc. would be on a more modest scale, however, in view of the mobile nature of railway construction, and the consequence that few families would be expected to settle near construction sites. Conditions would, of course, need to be sufficiently attractive to maintain stability and productivity of the working force and to safeguard their health.

[3] Certain variations in the proposals for financing public utilities have been discussed, and the detailed arrangements would be settled in negotiation.

[4] See footnote to para. 99.

485. The estimates for improvement of existing facilities provide for the reinforcement of the present line from Kumasi to Koforidua, the most important item being the replacement of the existing 60 lb. rail by 80 lb. rail. This replacement would be essential if the heavy traffic of the Project were to be successfully carried in addition to present traffic.

486. It should be noted that major sections of new railway construction have been successfully carried out in the Gold Coast during the past two years. The consulting engineers, with the assistance of Cooper Brothers & Co. and of the Gold Coast Railways and their technical consultants, were thus able to study the actual costs of building the new railways from Achiasi to Kotoku, from Tema to Shai, and from Accra to Tema. These lines provide examples which should be a good guide to the construction of the Volta Project railways.

Choice of Routes for New Lines

487. The routes on which the estimates of £10.5 million for the new lines are based—with one exception—are those which on technical grounds would appear to be the most economic. For example, three routes were surveyed between Koforidua and the smelter, and the Engineering Report gives the reasons why the recommended route (with the 2-mile tunnel) is expected to be the cheapest in spite of its higher capital cost. The only exception is the route followed in the immediate surroundings of Kumasi, where a link by-passing the town to the south has been used in the estimate instead of a more direct approach further north and passing nearer the centre of the town. The northern route, however, would raise objections from the town-planning point of view, and while the decision would be for the Gold Coast Government to take, the Commission has based the estimate on the more costly alternative; the additional capital expenditure thus incurred is estimated at about £500,000, and the additional annual operating costs at £60,000.

Interest

488. Interest has been computed at 5% per annum, as for the dam and power installation. In order to minimize the total interest charges, the installation of permanent way would not be undertaken immediately after completion of earthworks but would be deferred until later. Interest has been assumed to accumulate up to the end of 1964 except for those lines which would be brought into general use at an earlier date.

Locomotives and Rolling Stock

489. The estimate for locomotives and rolling stock amounts to just over £4 million, of which rather over half relates to the movement of bauxite from mines to smelter, and the remainder to the movement of the aluminium industry's imports and exports between Tema and the smelter. The estimates for the latter traffic assume that no economies could be achieved by the design of a wagon that could carry petroleum coke inwards and aluminium ingot outwards; if a suitable wagon could be produced as the Commission has suggested, the estimates might be reduced.

ESTIMATE D: GOLD COAST GOVERNMENT: OTHER DIRECT COMMITMENTS ARISING FROM THE PROJECT

Scope of the Estimate

490. Of the three estimates of Gold Coast expenditure arranged under the headings D, E, and F, this is the only one that can properly be regarded as relating solely to the Project. The second and third headings each have wider implications, and expenditure under those headings would be undertaken on general grounds of national policy. Estimate D includes only items of direct expenditure to which the Gold Coast Government would be unavoidably committed if the Project went ahead.

ESTIMATE D: OTHER DIRECT COMMITMENTS

	Initial Stage	*Extension to Final Stage*	*Total at Final Stage*
	£m	£m	£m
1. Compensation and resettlement (excess over £3. 5m)	1.0	—	1.0
2. General expenditure on establishment of new communities	1.5	2.5	4.0
TOTAL	2.5	2.5	5.0

491. The amount for compensation and resettlement is included on the basis of the earlier arrangements under which the maximum liability of the power project would be £3.5 million. If the review of this arrangement (paragraph 471) were to lead to an increase in the agreed charge to power, the amount in this estimate would be correspondingly reduced.

492. The general expenditure for the new communities represents the cost of providing in the new townships, both temporary and permanent, those services which are normally the responsibility of the central Government, such as the installation of postal services, and the provision of accommodation for police.

493. Allowance is also included for expenditure on maintaining and improving the standards in the existing communities adjacent to the smelter area which would necessarily be affected by the Project, and which could in turn prejudice conditions in the smelter township (paragraph 247).

494. It is not possible to make precise estimates of the expenditure under these various commitments; in particular, an accurate assessment of the cost of necessary measures in the area surrounding the smelter could not be undertaken until the Gold Coast Government had completed the survey of the area, which has been recommended by the Commission.

ESTIMATE E: GOLD COAST GOVERNMENT: OTHER POSSIBLE INVESTMENT ARISING FROM THE PROJECT

Scope of the Estimate

495. The Project would provide the Gold Coast Government with certain obligations and opportunities to maintain or improve standards, and to develop the economy. Investment under this heading would be undertaken as a rule only if the Government was satisfied that the results would justify the outlay.

496. An approximate assessment was made of the potential commitment on those items which would be immediately foreseeable. Much larger figures would be involved if decisions were taken by the Government to proceed with large-scale irrigation works, the development of the hydroelectric scheme at Bui, or the construction of an extensive electricity transmission system.

ESTIMATE E: OTHER POSSIBLE INVESTMENT

	Initial Stage	*Extension to Final Stage*	*Total at Final Stage*
	£m	£m	£m
Fisheries, inland navigation, etc.	0.5	5.0	5.5
Permanent housing (mainly at smelter)	1.0	3.5	4.5
TOTAL	1.5	8.5	10.0

497. The creation of the lake, and the change in the water regime below the dam, would provide the Government with opportunities to develop a number of possible activities in the fields of agriculture, fishing, and navigation, as indicated in Appendices IX and X. The possible commitment in respect of permanent housing arises primarily at the smelter township where its amount would depend on the extent to which private persons and bodies and non-Government corporations financed the building of those houses that would not be occupied by smelter company employees. If the Government's policy were successful (paragraph 481), the above estimate might be considerably reduced.

ESTIMATE F: GOLD COAST GOVERNMENT: ALLIED DEVELOPMENT EXPENDITURE

Scope of the Estimate

498. This heading comprises substantial expenditure, to which the Gold Coast Government is already committed, on the development of a port and a new township at Tema, and on the construction of certain roads (see Chapter 4). These commitments have been accepted by the Government as part of the normal development of the country irrespective of the decision on the Project. The works would, however, be essential for the execution of the scheme, and the expenditure is included here, and in the summary of estimates at the beginning of the chapter, in order to present a full picture of the possible financial commitment of the Government arising from the Project and associated development works, and in order to record accurately the extent to which the Government would contribute towards the success of the Project.

ESTIMATE F: ALLIED DEVELOPMENT EXPENDITURE

	£ million
Port of Tema	
First stage (including preliminary works and port equipment)	14.9
Second stage	4.0
Tema township	11.1
Roads and bridges	9.4
TOTAL	39.4

GENERAL COMMENTS ON ESTIMATES

Subjects for Further Consideration or Negotiation

499. It may be useful to list the main factors affecting the estimates which have not yet been resolved completely. It does not appear to the Commission that they should be unduly difficult to settle, and some of them may well compensate each other. The financial implications of the differing approaches to items (*a*) to (*h*) are small in relation to the estimated cost of the Project and would not affect its economic feasibility:

(*a*) the precise standard of temporary housing to be provided for construction workers at Ajena;
(*b*) the precise standard of permanent housing in the smelter township;
(*c*) the architectural and landscaping treatment of the power station and the transmission lines;
(*d*) the technical arrangements at the Kpong sub-station;
(*e*) the apportionment of the cost of compensation and resettlement (£1 million is included as a charge to the Gold Coast Government in the present estimates);
(*f*) the arrangements for compensation water;
(*g*) the choice of the approach route for the bauxite railway to Kumasi from Aya;
(*h*) possible economies in rolling stock by the design of a wagon for both imports and exports of the smelter;
(*i*) the terms on which money would be advanced for financing construction (paragraph 476).

Comparison with the White Paper Figures

500. The following table compares the estimates now presented with those which appeared in the 1952 White Paper:

Smelter Capacity	*80,000 tons*		*120,000 tons*		*210,000 tons*	
	1952	1955	1952	1955	1952	1955
	£m	£m	£m	£m	£m	£m
1. Power Project (*a*)	45.5	60.2	49.5	64.0	54.0	67.6
2. Smelter and Mines	29.0	43.1	39.0	57.9	64.0	91.2
3. Gold Coast Government Public Works (*b*)	26.0	59.3	26.0	63.0	26.0	72.5
4. Total (*c*)	100.5	162.6	114.5	184.9	144.0	231.3

Notes: (*a*) The 1955 estimates for item 1 provide for 10% greater power than the 1952 figures.
(*b*) The 1952 and 1955 estimates for item 3 do not cover identical fields, as explained in paragraph 502. The figures for item 3 of the Table cannot therefore be exactly compared in the same way as those for items 1 and 2. This is reflected in the total figures.
(*c*) If the amounts in Estimate F are excluded from the total costs (on the grounds that they form part of the national development programme to which the Gold Coast is already committed) the totals for the three stages become £123 m., £146 m., and £192 m. respectively.

Reasons for Increases in Estimates for Power Project and Smelter

501. The estimates have increased since 1952 mainly because the further investigations since then have shown that the full implications of the Project were not in all respects foreseen at that time. For example:

(*a*) full account has now been taken of the commitment in housing the labour forces and providing health and other services for them;
(*b*) the cost of overcoming the lakeside health problems has now been calculated (in 1952, the enquiries necessary for making this assessment had not been carried out);
(*c*) a few new elements, such as port equipment at Tema to be provided by the smelter company, are now included;
(*d*) the estimate for the power installation now provides for generating capacity 10% greater than originally planned;
(*e*) rises in prices of plant, machinery and materials are other contributory factors.

The increases for the power project have been offset to some extent by the deletion of the additional " safety margin " of 15% included in the 1952 estimates (White Paper, Appendix II, paragraph 22; the White Paper is reproduced as Appendix I). The further surveys and the more

detailed work on engineering design carried out since 1952 have removed the main reason for the original inclusion of this additional margin. The provision of an allowance in all the estimates so as to take account of future rises in cost and of other factors is discussed in Chapter 22.

Comparison of Gold Coast Government Estimates for Port, Roads, Rail, etc.

502. As stated in note (*b*) to the table in paragraph 500, the two estimates under this heading are not comparable. The 1952 estimate covered the new railways, some roads, and the port and township of Tema. The 1955 estimates include in addition expenditure on new trunk roads, some housing at the smelter township, and certain other items not foreseen in 1952. Even the estimates for the railways and the port of Tema are not strictly comparable, since the 1952 figures excluded any allowance for locomotives and rolling stock, for improvements to the Kumasi-Koforidua line, or for the second stage of the port of Tema.

503. The estimates for the new lines, for which £5 million was included in the 1952 figures, now stand at £10.5 million; this increase is partly due to the fact that in 1952 there had been no recent experience of constructing railway lines in the Gold Coast, and actual costs in the past two years have proved to be substantially higher than forecast. Moreover, the detailed surveys have shown that certain of the routes for the new railways lie in very difficult country.

Provision of Finance

504. The provision of the necessary finance for the power project and smelter is a matter on which the parties would wish to negotiate within the general framework of the earlier discussions recorded in the White Paper. No attempt is made here to set out the sources from which the funds corresponding to the new estimates would be forthcoming, nor the total finance that might be required from each party. Special mention of the financial resources of the Gold Coast Government in relation to the possible extent of its participation in the Project is made in paragraph 534.

Chapter 21

ANNUAL CHARGES ARISING FROM THE PROJECT

Cost of Power

505. Estimates were made by the consulting engineers and endorsed by Cooper Brothers & Co.[1] of the unit cost of electricity delivered at the smelter from the dam and power installation. These estimates are based on the figures of capital cost discussed in the previous chapter and on an assessment of the annual cost of operation including the expenses which would be incurred in the maintenance of health around the lakeside (estimated by Professor Macdonald and Dr. Topping at £135,000 a year).

506. Allowance is made for the amortisation of capital and the renewal of assets. Briefly the intention is that at the end of 80 years from the beginning of operation all loans should have been repaid, and all physical assets should have been renewed or appropriate amounts should be available in renewals funds. (See Annex B to Appendix XIII).

507. It is assumed for the purpose of determining the cost of power that all available firm power would be used, and that it would be sold at the same price both to the smelter company and to the organisation supplying other consumers. In fact, a formula is under consideration which would take into account such elements as the load factor, so that the smelter company (following usual practice) would pay a lower price per unit than other consumers using electricity less continuously. Another formula is being worked out for the payment for irrigation water, but no credit to the Authority from this source is assumed.

508. On the assumptions set out above the cost of power at the substation would be as follows:

	Pence per Unit
First Stage	0.378
Intermediate Stage	0.245
Final Stage	0.199

The above figures are based on prices as at 30th September, 1955, and on an interest rate of 5%. The effect of possible increases in the general price level and certain other factors is discussed in later chapters. It should be noted that the cost of power diminishes very substantially with increasing aluminium production, the cost at the final stage being little more than half the cost at the initial stage. The reason is that the bulk of the capital expenditure on the dam and power installation would be incurred in the construction of the dam before any power at all could be

[1] See Appendix XIV, paragraphs 59 and 60.

generated. The additional expenditure for expansion of power production would be small in proportion to the initial outlay, and would consist almost entirely of the cost of additional turbines and generators and the extension of the power station.

Evaporation

509. The assessment of the amount of firm power that could be generated at full development is subject to a number of uncertainties; chief among these is the amount of evaporation to be expected from the reservoir. This has been discussed in paragraphs 59 to 64. The estimated cost of 0.199d. per unit at full development would be increased to 0.205d. by an annual evaporation of 60″ and to 0.211d. by 65″.

Interest Rates

510. Any change in interest rates would have a marked effect on the price at which power could be generated. As stated in the previous chapter, a rate of 5% has been taken for planning purposes. The following table also illustrates the effect of rates of 3%, 4% and 6%:

COST OF POWER IN PENCE PER UNIT: VARIATION WITH RATE OF INTEREST

Rate of Interest	3%	4%	5%	6%
Cost at First Stage	0.257	0.314	0.378	0.451
Cost at Intermediate Stage	0.169	0.205	0.245	0.291
Cost at Final Stage (assuming 55″ evaporation)	0.139	0.166	0.199	0.235
Cost at Final Stage (assuming 65″ evaporation)	0.147	0.177	0.211	0.249

Railway Freight Rates

511. The earlier discussions between the parties gave a clear indication of the method of computing the charge for power, but did not give any guidance as to the calculation of railway freight rates. It has been assumed, therefore, that the charges for railway transport would be settled on a normal commercial basis in accordance with the policy followed by the Gold Coast Government in the customary settlement of charges for public utilities. The aim of the Government is to cover all costs and to show a modest profit. The Gold Coast Government has put forward to the aluminium companies proposals for railway freights which put this policy into effect, and which neither subsidize the smelter company on the one hand by moving its traffic below cost nor seek on the other hand to make an abnormal rate of profit from the company. The principles followed by the Gold Coast Government in the proposals for freight rates are set out in Annex C to Appendix XIII.

512. As in the case of the dam and power installation, the great bulk of capital expenditure on railways would have to be incurred for the initial stage of the Project. Railway freight costs, in the same way as power costs, would therefore diminish very sharply with increasing production. The rate per ton-mile at full development would be substantially less than the corresponding rate at the initial stage. The Gold Coast Government has proposed that the rates should be periodically reviewed to take account of changing costs and of other factors including the extent to which other traffic might make use of the new railways. It would be essential, if full economic advantage was to be obtained from the relative proximity of the bauxite deposits to the smelter, that maximum aluminium production should be attained relatively quickly; and freight rates would be substantially more favourable if other traffic made use of the new lines.

513. The detailed terms for the carriage of the aluminium industry traffic by Gold Coast Railways remain to be settled and it is envisaged that they would be incorporated in a long-term agreement (paragraph 694).

Port Dues

514. The charges for the use of the port of Tema by the aluminium industry traffic are likewise a matter for negotiation between the Government and the companies and would probably form the basis of a long-term agreement (paragraph 695). The arrangements for allocating a berth or berths at Tema for the exclusive use of the aluminium industry (see paragraphs 105 and 482) would need to be settled before the long-term agreement could be

drawn up. It is not likely that the cost expressed in terms of aluminium production would be as significant as the cost of power and railway freight.

Mines and Smelter

515. All the charges mentioned in this Chapter enter into the cost of aluminium production, as do also those charges arising directly from the operation of the mines and smelter themselves. The assessment of these charges is the responsibility of the aluminium companies, and with the agreement of the two Governments the Commission has not investigated them. They would include the capital charges of the mines and smelter, the cost of the labour required to operate them, and the cost of the imports of materials used in the operation. These factors are discussed in general terms in Chapter 25.

Minerals Duty

516. One element in the operating costs, minerals duty on bauxite, although not likely to constitute a major item in the total, has been specially considered with a view to eliminating a possible uncertainty. The present Gold Coast Law on the subject, the Minerals Duty Ordinance, 1952, establishes a formula which can be applied to a commodity of which the selling price is known. The bauxite for the Project, however, would not be sold, but used for processing by the same company which produced it. The Gold Coast Government has a formula under consideration which would be a matter for negotiation with the aluminium companies.

Chapter 22

REVIEW OF ESTIMATES IN THE LIGHT OF GENERAL EXPERIENCE

Introduction

517. The previous two chapters set out estimates based on present engineering specifications and on the level of wages and prices as at 30th September, 1955. Bearing in mind that the assumed date for completion of construction of the first stage is in 1964, the Commission has reviewed the estimates in the light of general experience in recent large-scale construction where, for a variety of causes, estimates have often been substantially exceeded in the event by actual costs.

Review of Projects in Other Countries and the Gold Coast

518. With the object of assessing the extent to which estimates have commonly been exceeded, the Commission obtained information about a number of recent construction projects in the Gold Coast and elsewhere in the world, covering several countries and a variety of types of enterprise. It became clear from this study that over the past six or seven years it has been the rule rather than the exception for estimates to be exceeded by 40% to 100%. A number of causes have contributed to this state of affairs. Annual rises in world prices, and in local wages in the countries of construction, have been a major factor. Other causes have included inadequate estimating in the first instance through pressure of time, or lack of planning staff, or through incomplete appreciation of the full implications of housing and ancillary facilities. Additional factors have included difficulties in the control of expenditure through lack of supervisory staff; and delays caused by unforeseen physical conditions, by strikes, or by inadequate port facilities and other means of communications.

Additional Allowance

519. The detailed study which has been made of the Volta Project should eliminate certain of the factors which have inflated the cost of other schemes. At the same time, the Commission considers that it would be unrealistic to assume that none of them would operate. Obviously the Project could not be insulated from the effect of external factors such as rises in world prices, nor could internal influences be ruled out. The competitive economics of the Project would not necessarily be endangered by changes in external factors—this question is discussed in Section A of Chapter 23—but, for the purposes of providing finance, the Commission believes that the parties, in reviewing the estimates, should consider an additional allowance. This would be of particular importance to the Gold Coast Government. The parties would no doubt form their own judgments on the extent of such an allowance. The Commission has naturally not attempted to forecast world economic trends, but has concluded from the studies mentioned in this chapter

that an allowance of the order of 40% to 50% above present estimates would not be out of line with general experience. This conclusion assumes that world prices in the immediate future would be no more unstable than in the last decade; any more violent change in world economic conditions would necessitate a review of the figure. The conclusion assumes also a reasonable degree of economic stability in the Gold Coast. The relation between Gold Coast and external economic trends is discussed further in Chapter 23, Section B.

520. Applying (for purposes of illustration) an allowance of 45% to the expenditure on the power project, the smelter and mines, and the railways (apart from the relatively small sums already spent on preliminary surveys), the estimates in paragraph 448 would be increased to the following figures:

ESTIMATES WITH 45% ADDED

Smelter Capacity	*80,000 tons stage*	*120,000 tons stage*	*210,000 tons stage*
	£m	£m	£m
Jointly Financed			
A. Power Project	87	92	97
B. Smelter and Mines	62	84	132
Gold Coast Government Financed			
C. Railways	23	24	26
Gold Coast Government Financed			
D. Other Direct Commitments	2	3	5
E. Other Possible Investment Arising from Project	2	4	10
F. Allied Development Expenditure	39	39	39
TOTAL	215	246	309

Note: The Gold Coast items below the line are repeated from paragraph 448 without any addition. Certain of the expenditure under headings D, E, and F does not fall within the category of construction works, and much of the construction expenditure within these headings is already incurred or about to be incurred under existing contracts.

521. It should be emphasised that the above table is intended mainly as a guide to the parties who would have to provide the finance for the Project. The Commission believes it would be unrealistic for the parties to commit themselves to the scheme and to consider the pattern of investment in it without taking into account the possible need for a substantial safety allowance; the figure of 40% to 50% represents the Commission's judgment of an appropriate range. If the later stages were unduly prolonged, the allowance would need to be reviewed.

Effect on Cost of Power

522. The effect of adding 45% to the unit costs of power quoted earlier in this chapter would be to increase the figure for the final stage to 0.289 pence taking an interest rate of 5% and evaporation at 55″. The effect on the full table (paragraph 510) would be as follows:

COST OF POWER IN PENCE PER UNIT (WITH 45% ADDED)

Rate of Interest	3%	4%	5%	6%
Cost at First Stage	0.373	0.455	0.548	0.653
Cost at Intermediate Stage	0.245	0.297	0.356	0.422
Cost at Final Stage (evaporation 55″)	0.202	0.241	0.289	0.341
Cost at Final Stage (evaporation 65″)	0.213	0.257	0.306	0.361

CHAPTER 23

EXTERNAL AND INTERNAL ECONOMIC FACTORS AFFECTING THE PROJECT

A. EXTERNAL ECONOMIC FACTORS

World Price Levels

523. The main reasons in recent years for the estimates of construction projects being exceeded have been the influence of rising world prices and, in particular, rises in prices for capital

equipment. General movements in world prices would inevitably be reflected in the price of imports for the Project, and would probably also affect Gold Coast costs. Assuming world price movements to be upwards, the immediate effect would be to increase the monetary cost of the scheme as distinct from its cost in real resources. This, however, would not jeopardize the financial prospects of the Project which would remain unaffected provided the price of aluminium rose proportionately.

524. Experience in recent years has made rising prices appear almost inevitable. It should be recalled, however, that there have been, and could again be, periods of falling world prices which would have the reverse effect.

World Construction Activity

525. The price of capital equipment depends partly on the level of construction activity throughout the world. Such activity has been maintained at a very high level in recent years, and on present indications an even higher rate of development is by no means unlikely. Another result of increased construction activity, apart from its effect on prices, might be to lengthen delivery periods, with consequent delays in the completion of the Project. Delays of this sort can be very costly, especially in terms of interest charges.

526. The general level of construction activity might also influence the cost of the Project by diminishing the extent of competition for the contracts for the major construction works with resulting increases in contractors' tenders. It appears likely, however, that there should be enough competition to prevent inflation in the contract price on this account, although the size of the Volta Project would limit the number of contractors in the field to those who had substantial resources.

Interest Rates

527. The general level of interest rates would be one of the most important external factors affecting the cost of the Project as is clear from paragraph 476. Although the actual terms on which the Governments would advance money for the scheme remain to be negotiated, there is little doubt that the terms would be competitive with those on which funds could be raised for any other new power scheme that might be undertaken at the same time. Any loans which might be advanced by the International Bank for Reconstruction and Development might well be on terms different from those of the two Governments, and that element would no doubt be considered by the parties to the scheme together with other factors affecting the possible participation by the Bank.

B. INTERNAL ECONOMIC FACTORS

Wages and Prices

528. The most obvious internal factor affecting construction cost is the level of remuneration earned by workers during the construction phase. Increases in wages or indirect benefits unless offset by increases in productivity, would naturally raise the total cost of the Project and would affect its economic prospects unless they happened to be parallelled by compensating increases in prices in the outside world.

529. Movements of Gold Coast wages have been linked by many observers with the policy in regard to cocoa payments. Attention has frequently been drawn to the effect produced by changes in the price paid to farmers for cocoa on the general level of local food prices, which in turn must affect local wages. Gold Coast wages and prices have been remarkably stable over the period 1952-55 and it is generally agreed that a major factor in promoting this stability has been the Government's policy for cocoa payments. Over the same period Gold Coast workers have displayed restraint and responsibility in wage matters, and have reaped the benefit of a stable cost of living.[1]

530. The world price of cocoa is naturally outside the control of the Gold Coast Government, but the Government has very considerable power to influence the domestic effects of variation by fiscal measures. The detailed application of the Government's policy is a matter on which opinions can vary, but attention must be drawn to the contrast between the economic stability in the Gold Coast and the state of affairs in many other countries in which the prices of primary products have fluctuated violently over the past few years.

531. It would be of great importance to the Project that Government and workers should continue with policies of prudence and restraint. The economics of the scheme would be

[1] In March, 1956, (while this report was being printed) the Gold Coast Government announced that all Government employees would receive temporary allowances of up to 15% from 1st April, pending a general wage review. This is the first general wage increase since 1952.

prejudiced if radical departures from this policy were to produce increases in Gold Coast wages and prices which were substantially in excess of price movements in the outside world.

532. The greater the restraint that the Government and the people could exercise over the next ten years, the greater would be the prospects for the success of the Project.[2] It should be noted that the vulnerability of the Project to local wage movements is linked to the size of the labour force. The recommendation to use a high degree of mechanisation to keep the construction force to a minimum should reduce the effect of this possible danger. Mechanisation would naturally make the Project vulnerable to increased prices of imported machinery, but rises in cost from that cause would be felt throughout the world and should not therefore prejudice the competitive position of the scheme to the same extent.

Gold Coast Currency

533. Another internal factor which could affect the economic success of the Project is the future of the Gold Coast currency. If unforeseen events should impart any instability to the currency, then the Volta Project would be endangered—as would all other schemes involving foreign investment in the Gold Coast. At present there is reason to believe that the Gold Coast will maintain a sound currency commanding international confidence; the country has a favourable balance of payments and the Government is well aware of the importance of preserving world-wide support when the Gold Coast replaces the present West African issue by its own national currency.

Financial Resources of the Gold Coast

534. Assuming that the pattern of investment remained as set out in the White Paper, that the Gold Coast investment in the dam and power installation remained at £8 million, and that prices remained at their level of 30th September, 1955, it would be necessary for the British Government and the aluminium companies each to contribute a substantial proportion of the total. The Gold Coast Government would be left to find approximately £70 million for the first stage of development. The Gold Coast Government has in recent years followed a most prudent financial policy, having made a capital provision of £75 million for development over the past five years without recourse to outside borrowing; the present strength of the Government's finance is fully displayed in Annexes N to Q of Appendix XIII. By the time construction might begin, the Government should have available in funds set aside for the purpose at least three-quarters of the required £70 million in addition to other sums set aside for general development. If the recent financial policies were continued, and if future development plans were suitably balanced and framed in relation to the needs of the Project (see Section A of Chapter 28), the Gold Coast Government should be able to find the required funds. The provision of the allowance of 40% to 50% suggested in the previous chapter would add appreciably to the capital to be provided by the Gold Coast Government; this factor is being borne in mind by the Government in its financial planning.

Strain on the Gold Coast Economy

535. The Commission undertook a detailed investigation of the possible strain which might be imposed on the Gold Coast economy by the Volta Project, with a view to assessing whether inflationary pressures might be set up, which could in turn affect the cost of the Project. A presentation of the Commission's investigations and findings on this subject is set out in Appendix XIII and the following paragraphs summarize the main conclusions.

536. The capital investment in the Project over the eight years of construction would be well over £100 million (excluding interest), but over two-thirds of this would be external in character, representing imported plant, equipment and materials.

537. In considering the resources required for the internal expenditure on the Project, the Commission concluded that the main strain likely to arise would be on the administrative, technical and supervisory staff of the Gold Coast Government. It has already been found that the planning work of the Commission has made serious calls on the time of senior officials, and it is clear that if the Project went ahead the Government would require to give constant attention (in consultation with the Volta River Authority and the aluminium companies) to many vital questions of policy that would arise during construction; in addition, important responsibilities such as railway construction would fall within the direct control of the Gold Coast Government. The importance to the scheme of the administrative and technical capacity of the Gold Coast Government is discussed in Section B of Chapter 28, where reference is made to the Govern-

[2] A special difficulty facing the Gold Coast Government in adhering to its policy of wage restraint should be noted. In order to attract staff from overseas, it is necessary to offer salaries appreciably higher than those operative in the country of recruitment. Moreover, salaries in those countries have virtually all increased more rapidly than in the Gold Coast, thus making it all the more difficult for the Gold Coast Government to pursue its internal policy of wage restraint.

ment's assurance that the needs of the Project would be fully taken into account in the formulation of the next Development Plan in order to avoid the creation of excessive demands on Government staff, and other essential resources.

538. On this vital assumption, it appears likely that no serious inflationary pressure would be built up in the Gold Coast by the Project, provided that the Government continued with its general financial policies of prudence and restraint. A reassuring feature is that the internal element of expenditure would rise only slowly from £4.3 million in 1957 to just over £7 million in 1961, and that the expenditure in 1957 would be on work such as the port of Tema and new trunk roads which are already under construction; thus the Project itself would generate no sudden major increase in internal spending power. An additional safeguard against inflationary pressures would be the successful promotion by the Government of an active policy to foster agricultural development so that increased food supplies could be available to absorb some of the increased income generated by the Project which would be spent on local products. The importance of agricultural progress as an essential support to any programme of industrialization was emphasized by Professor W. Arthur Lewis in his 1953 Report on Industrialization and the Gold Coast.

Local Inflationary Pressures

539. In addition to the study of possible strains on the economy as a whole, the Commission also examined the nature of pressures which might be set up in particular sectors of the economy or in particular areas of the country. The possible pressure on communication facilities and labour resources have already been discussed in Chapters 4 and 9. In addition, there would be a potential danger in the immediate locality of construction sites that local price increases would be generated as a result of the concentration of spending power. This danger, however, should be largely overcome by:

(*a*) measures to ensure adequate supplies of food and services for the construction forces;
(*b*) the provision of efficient distribution and retail agencies in the new communities, supplemented by the supply of limited categories of essential commodities from official stores at reasonable prices;
(*c*) the provision of accommodation and amenities for families;
(*d*) the encouragement of various forms of saving by the construction forces.

540. If the above measures were taken in good time, there is every reason to suppose that local inflationary effects could be kept within reasonable bounds. The first three of the above measures have already been recommended in Chapters 8 to 10, and the fourth should be achieved by appropriate action by employers with the co-operation of the Gold Coast Government.

Chapter 24

ADDITIONAL EFFECTS OF THE PROJECT ON THE GOLD COAST ECONOMY

541. Section B of Chapter 23 has examined one aspect of the Volta Project in relation to the Gold Coast economy, namely the strains which its construction might impose on the economy. The Project would of course affect the economic life of the Gold Coast in many other ways, certain of which have already been discussed in Chapters 14, 15 and 17. It has not been the Commission's task to advise the Gold Coast Government on the balance of advantage and disadvantage to the country in embarking on the Project. That is a judgment which the Government itself would make, just as the other parties would themselves assess what they would stand to gain or lose by participation in the scheme. The Gold Coast, however, would be affected in greater degree and complexity than the other parties because the Project would take shape within the country, and would be large in relation to the national economy. The Gold Coast Government therefore asked Professor W. Arthur Lewis to advise on the special position of the Gold Coast in relation to the Project, and the Commission worked closely with him and provided him with full information. While the assessment of possible advantages and disadvantages is not within the Commission's field, it may be useful to indicate here those factors which have emerged from the Commission's studies as relevant to such an assessment.

542. Although the Project would make its greatest impact on the immediate localities affected by its operations, its economic effects would extend to all parts of the country. A most important gain that would follow from the eventual establishment of a profitable aluminium

industry would be its contribution towards the diversification of the national economy. The new industry would be a major employer of labour, a very large earner of overseas currency from the export of aluminium, and—if profitable—a substantial contributor towards Government taxation revenue, since at present rates of tax the Government would obtain (including its share of equity dividends as envisaged in the 1951 – 54 discussions) about one half of the company's profits. These factors would lessen the country's excessive dependence on cocoa, a feature which is universally regarded as the most dangerous weakness of the Gold Coast economy.

543. The country would gain also by the creation of great new physical assets such as the dam and power station, the lake, the smelter, and the new townships—particularly the smelter township which would ultimately house some 50,000 people in dwellings of higher standard than those in other Gold Coast towns today.

544. The Project would offer opportunities for the development of commerce and industry through the availability of electric power to Gold Coast consumers, by the construction of the new railways, through the possibilities of improved communications and water supplies provided by the new lake, and the facilities offered by the new townships.

545. As to food production, the Project would create opportunities for the development of a new major fishing industry in the lake, and of agriculture along some of its margin. There would be the possibility of a large-scale irrigation scheme if the present pilot experiment yields satisfactory results. The loss to food production caused by the flooding of some 3,500 square miles, of which only about 200 square miles is now used productively, would be small in comparison.

546. Another gain would be the acquisition of new skills by the workers engaged in the operation of the Project, and also by many of the construction force whose skill would later be valuable on other development work.

547. In financial terms, the Gold Coast Government would obtain a secure return (including the repayment of capital) from its investment in public utilities, including a profit on the investment in railways and port if rates were determined in accordance with normal principles. The return from taxation and from the equity investment would depend on the profitability of the smelter and could be substantial. Much (though not all) of the expenditure listed in Estimate D would also be remunerative, e.g. investment in telephone facilities for the new communities.

548. The numerous economic gains described in this Chapter are mainly long-term, as must be expected with any scheme as large and complex as the Volta Project. In the course of construction of the scheme, there would be rephasing of certain other development works, in accordance with the Government's assurance (paragraph 576). The assessment of these factors, and of the social and other non-economic factors, in relation to the major advantage of diversification and the other substantial benefits to the economy, is a matter for the Gold Coast Government.

Chapter 25

GENERAL ECONOMIC CONSIDERATIONS

Introduction

549. Before assessing the economic prospects of the Project it is proper to emphasize that the technical investigations described in Part I of the Report have been directed towards obtaining the most economic result. For example, the plans of the dam and power installation proposed by the consulting engineers have been designed to produce the final requirement of power at minimum cost. The design and siting of the alumina plant and smelter, and the method of working the bauxite deposits, have been selected by the aluminium companies in the light of their extensive experience with a view to establishing the most efficient and economic pattern of aluminium production in the Gold Coast. Railways have been chosen as the form of transport in preference to other possibilities for reasons given in Chapter 4, and endorsed by the Gold Coast Government, the aluminium companies, and an independent expert on transport.

Factors influencing Estimates

550. Several factors which cannot be resolved in advance of negotiations have been mentioned in the preceding chapters. A number of these, while important in themselves and in their financial implications, would be unlikely to exercise a decisive influence on the economics

of the Project. Three factors which could be decisive are delays during construction, policy for employment and living conditions of the labour forces, and economic stability in the Gold Coast.

Delays during Construction

551. Paragraph 89 has mentioned that heavy additional burdens of interest and other charges would accrue if the construction period were prolonged. If any component part of the Project were delayed, there would be a risk of rendering unremunerative for a period the whole investment in the scheme. If the period of delay were unduly prolonged, the Project could become uneconomic. All parties therefore recognize the paramount importance of completing the various works in accordance with the planned timetable. This would depend essentially on the quality of contractors and of supervision. It would also be directly related to the administrative and technical strength of the Gold Coast Government, and, in particular, its ability to provide essential services (new railways, roads, etc.) at the required time. An additional safeguard is contained in the powers contemplated for the Volta River Authority to co-ordinate construction works and to undertake tasks at the request of and on behalf of the Gold Coast Government (paragraph 640).

Policy for Employment and Living Conditions of the Labour Forces

552. The policies recommended by the Commission for the labour forces are set out in Chapters 8 to 11, and consist essentially of the provision of reasonable accommodation and amenities for workers as well as facilities for their families, within the economic limitations referred to in paragraph 171. The advantages of such policies are widely recognised in the operating phase of an industry, particularly of an industry such as aluminium production employing a high proportion of skilled workers. The economic advantage of provision for families in the construction phase may be less widely recognized, but in the Commission's view it would show a clear gain for the dam and power installation where the bulk of the construction force would be required over a period of five years or more.

553. There is naturally an additional initial outlay in providing the houses and other facilities for families, the extra charge being broadly estimated at £1.5 million for Ajena. However, the cost of failing to provide for families, expressed in terms of high labour turnover, and of discontinuity of skilled and supervisory work, would likewise be extremely high, although it is impossible to estimate a figure. The cost of passages alone, in the case of overseas staff, could well become a large item.

554. Experience in the Gold Coast, and in recent construction projects in many parts of the world, suggests that the cost of high turnover and discontinuity, if expressed in terms of poor productivity and delay, is remarkable. In the Gold Coast in particular, the importance of preserving individual relationships as a means of raising productivity and of consolidating racial understanding is also of the highest importance. These facts have been stated fully in Chapter 8, and their financial implications should not be under-estimated.

555. It is in any case unlikely that it would be possible to avoid some expenditure on family facilities, whatever initial policy was adopted. Experience in similar conditions elsewhere suggests that families would tend to group themselves around the site, and that measures of housing and sanitary protection would become essential to safeguard the health of the labour forces. Such measures are more costly if adopted after the event than if properly planned in advance.

556. The question of the extent of family provision is therefore one of degree rather than of kind, and the answer is not susceptible to precise evaluation. The Commission is of the opinion that any substantially lower standards than those which have been discussed could not be accepted without endangering the stability of the labour forces, particularly in view of the difficult nature of the housing site at Ajena. The exact point which gives optimum results in economic terms would be a matter for judgment. In the Commission's view, it would be imprudent for any party to assume that major reductions could be safely achieved from the estimated expenditure on housing and health services, except by technical improvements that would produce equally satisfactory buildings and services at lower cost; the achievement of such improvements was the objective of the investigation by Architects' Co-Partnership and Dr. Koenigsberger into the design and layout of the temporary township at Ajena.

Economic Stability in the Gold Coast

557. It has been pointed out in Section B of Chapter 23 that the maintenance of economic stability in the Gold Coast would be essential for the success of the scheme, and that if wages and prices in the Gold Coast were to rise appreciably faster than external wages and prices

(thus reversing the trend of recent years), then the economic prospects of the Project would be prejudiced.

Exchange Rates

558. The Commission has not attempted any examination of the probability or the effects of future changes in the dollar/sterling or other exchange rates. This would be a matter for the parties themselves to assess.

Special Factors affecting Investment of Aluminium Companies

559. In addition there are two factors affecting the investment of the aluminium companies —namely the relationship between the Gold Coast Government and the overseas investor, and the taxation policy of the Gold Coast Government.

Relationship between the Gold Coast Government and the Overseas Investor

560. A satisfactory relationship between the aluminium companies and the Gold Coast Government would be the best guarantee to the companies of the security of their investment, and to the Government that the smelter company would carry out its various obligations in the country. Judging from the Government's expressed policy on foreign investment (Chapter 29) and from the companies' record as employers in other countries, a satisfactory relationship should be capable of achievement. This is a question of major importance on which the parties would have to satisfy themselves, and there is no doubt that the investment of large sums by the British Government and the aluminium companies would mark an expression of confidence in the future stability of the Gold Coast.

Taxation

561. The rate of taxation would be an essential factor in determining the ultimate return on the investment of the aluminium companies. Company tax at nine shillings in the pound is relatively high in the Gold Coast at present, but relief is offered by the country's pioneer-industry legislation under which new industries are totally relieved of tax during their early years. It was agreed in 1952 that the smelter company would obtain the maximum benefit under this provision, and the draft Volta River Authority Bill (Appendix XVI) also provides that the Authority would be exempt from Gold Coast income tax, so that no tax would be reflected in the cost of power. An additional safeguard to the smelter company is a clause contemplated for the Master Agreement by which the Gold Coast Government would undertake not to impose any discriminatory taxation on the company (paragraph 671).

Economic Soundness of the Project as a Whole

562. It is assumed that the power project, the railways and the ports would be self-supporting. The charges made for these utilities would be elements ultimately brought to account in the economics of aluminium production—the crucial test of the Project as a whole.

563. For reasons which will be appreciated, the Commission is not in possession of estimates of cost for the internal operations of the smelter, nor of information that would enable a comparison to be established with other existing or potential schemes for aluminium production. The two Governments informed the Commission early in its work that in their view the best test of the commercial prospects of the smelter would be the willingness or otherwise of the companies to undertake the great capital investment involved on their part. Nevertheless, it is possible to make some general observations about the competitive economics of this particular Project.

564. The basic materials and techniques for the various processes in aluminium production are the same everywhere. The major variants are:

(*a*) the cost of power;
(*b*) the labour element (including supervisory staff);
(*c*) the freight element (which depends on the geographical relation between mines, alumina plant, smelter and markets).

Power

565. The estimated cost of power (paragraph 508) diminishes sharply with successive stages of production, and at final production the power appears fully competitive with any projected hydro-electric schemes for which figures have been quoted on a similar basis in recent years.

Freight

566. The estimated freight element likewise diminishes sharply with increasing aluminium production, and it would be only in the later stages that the full advantage of the proximity of

the bauxite to the smelter would be reaped. The rate of development of other traffic on the new lines would also have a marked effect on freight rates.

Labour

567. The potential advantage in this field depends on productivity of Gold Coast workers in relation to their wages, and above all on their capacity to fill technical and supervisory positions, thus enabling the company to reduce the high cost of maintaining overseas staff in such posts. There can be no doubt of the powerful economic incentive to replace overseas staff by local men as soon as the latter have gained experience and demonstrated their ability. As to some categories of skilled, semi-skilled, and unskilled workers employed in operating the smelter, there is reason to believe that performance by Gold Coast workers on wages of the present order might show relative advantages over the labour costs in Europe and North America, even allowing for the indirect labour costs incurred on housing and hospital and other services in the Gold Coast. The key to this subject is the rate at which supervisory costs (which are bound to be high initially) could be brought down to a level comparable with other schemes.

Chapter 26

FINANCIAL AND ECONOMIC ASPECTS: CONCLUSIONS

568. Three main conclusions emerge from the study of the economics of the Project. First, the Commission on the evidence available to it considers that the Project as conceived in the various technical reports is not capable of significant improvement from the economic point of view.

569. Second, the economics of the Project show a very marked improvement with increasing production. This is because the additional investment for both the power project and for the railways would be relatively small for the extension to the later stages in comparison with the heavy investment needed for initial production. It would therefore be of the greatest economic advantage if the Project could be advanced to maximum production as soon as possible. In considering the rate of expansion, the parties would naturally need to take other factors into account besides the effect on costs; in particular the aluminium companies would need to consider the great additional capital investment required on their part in relation to the state of the aluminium market at the time, and against the general background of operating in the Gold Coast as shown by experience in the early stages of production.

570. Third, the Project should be competitive in relation to other schemes, provided that:

(*a*) it was completed according to the timetable of construction;

(*b*) a sound policy was adopted in the employment and provision of living conditions for the labour forces;

(*c*) economic stability in the Gold Coast was maintained;

(*d*) the aluminium companies were satisfied that the internal cost of operating the smelter would be acceptable.

PART IV

Other Factors which could Influence the Project

Chapter 27

OTHER FACTORS WHICH COULD INFLUENCE THE PROJECT: INTRODUCTION

571. In addition to the purely technical and economic aspects of the Project there are other factors which could exert an important and, in some cases, decisive influence on its successful development. It may be convenient to consider these factors under two broad headings; first, those which most directly concern the Government of the Gold Coast, and second, those of a more general nature.

Factors involving the Government of the Gold Coast

572. The first of these is the future development policy of the Gold Coast. The importance of ensuring that the Gold Coast could provide the local resources and services required for the Project, and the willingness of the Government to make any necessary adjustments in its development plans, were emphasised during the earlier discussions, and have already been referred to in this report (paragraphs 192 and 537). Directly related to this factor is a second element of great importance, the resources of administrative and technical staff available to the Government. These inter-related problems are considered in Chapter 28.

573. The climate for overseas investment in the Gold Coast would obviously exercise a decisive influence on the future of the Project and reference to this is made in Chapter 29, together with some comments on nationalisation and expropriation.

574. Two other factors which could exert an influence on the Project are the future administration of that part of Togoland which is at present under United Kingdom Trusteeship, and the control of the headwaters of the Volta. Chapters 30 and 31 deal with these matters.

Other Factors

575. Two factors, of a more general nature, which could affect the success of the scheme are discussed in Chapters 32 and 33. The first of these is the world demand for aluminium, and the second is the generation of power from nuclear energy.

Chapter 28

RESOURCES AVAILABLE TO THE GOLD COAST GOVERNMENT

A. FUTURE DEVELOPMENT PLANS

Introduction

576. The need for ensuring that the resources of manpower, materials, and finance required for the Volta River Project were effectively co-ordinated with all other demands on those resources in the Gold Coast was fully recognised by the two Governments and aluminium companies during their earlier discussions. Accordingly, paragraph 18 of the White Paper (Cmd. 8702 of 1952) states ".....It is in particular important to make sure that.....the scheme once launched is not dislocated because of other claims on resources," and that " the Gold Coast Government have stated that they would be ready, whenever the occasion arose, to defer or rephase other parts of their development programme which seemed likely to conflict with the scheme in the demands on resources available of men, transport and materials."

577. It is of the greatest importance that everyone concerned with development plans in the Gold Coast and with the Volta Project should recognise the basic fact that a major shortage in any category of specialised manpower (e.g. supervisory staff and notably foremen) or of a particular material resource, such as housing, could, during the construction phase, seriously disorganise the next Development Plan and the Project. In the case of the latter, the financial and economic consequences could be exceedingly grave. All this underlines the necessity for a conservative approach in preparing the next Development Plan so as to ensure that it would not create shortages which could prejudice the Volta scheme.

Current Plan

578. The current Development Plan of the Gold Coast Government was commenced in 1951 and the Government has now decided that it should end on 30th June, 1956, to be followed by a year in which outstanding items would be completed and other essential works advanced. The Second Development Plan would thus start in 1957. If the Volta scheme was begun about the same time, an excellent opportunity would be provided to ensure that all demands on local resources were effectively co-ordinated. A suggestion is also receiving consideration from the Gold Coast Government that the Second Plan might extend for the same eight years as the construction phase of the Project; this would provide an even better opportunity for co-ordination.

579. In considering the new Development Plan it should be noted that the Gold Coast Government estimates that the rate of annual expenditure has recently been running at approximately £14 million. A great deal of development has been carried out within the framework of the first Plan, and limitations in execution can be attributed to two main causes—shortage of trained manpower, and alterations in the content of the Plan at intervals during its execution.

580. It would be prudent to pay particular attention to past performance when preparing the new Development Plan, and a conservative policy should be reinforced by an acceptance of the fact that the major political and other developments likely to occur in the Gold Coast over the next ten years or so will almost certainly impose very heavy burdens on the administrative and technical resources of the Government, quite apart from the demands which would arise from development work.

Probable Limits for Next Development Plan

581. In general terms, it can be said, as indicated above, that the present annual rate of expenditure on development is about £14 millions. Discussions with the Gold Coast Government suggest that two factors—shortage of certain supervisory and technical staff, and the general pressure of work falling on the various Ministries and Departments at this time of political transition—could in the future reduce the present rate of expenditure by about £3 millions annually. In order to carry out the Volta Project, it is estimated that capacity equal to about another £3 millions annually would be absorbed by the Gold Coast Government's construction of the necessary railways, port facilities and roads, etc. An appreciable rearrangement in the present pattern of development during the construction phase of the Project would thus be necessary, but the total amount of development in the country—which would naturally include the works involved in the Volta scheme—would almost certainly exceed the present rate, despite the staff difficulties to which reference has been made. This expansion would become possible since a major part of the Project would be financed by overseas investment and would be executed and supervised by the Volta River Authority and the aluminium companies.

582. Consideration of these important factors led the Preparatory Commission to suggest to the Gold Coast Government in June, 1955, that, in the event of the scheme going ahead, the next Development Plan (excluding works involved in the Volta Project) should be prepared on a more limited scale than the first, and that any subsequent increases in the Plan should be authorised only after it was apparent that the necessary resources of administrative and technical manpower were available in the Gold Coast to undertake such additional commitments, and that they could be carried out without prejudice to the Project.

The Next Development Plan

583. The Gold Coast Government is now completing the details of its next Development Plan which is being prepared taking fully into account the resources required for the Project. It will be appreciated that the Government has been faced with a basic difficulty in drawing up this Plan, for it is not yet known whether the Project will be undertaken or not. Accordingly, it is understood that the Plan is being prepared on a basis of priorities, making provision firstly for the resources and services required for the Volta scheme, and secondly for a development programme which could be adopted if the Project was deferred.

584. The Gold Coast Government has informed the Preparatory Commission that the new Plan is being arranged so that no unsatisfactory competition would arise between the requirements of manpower and materials for the Project and those needed for the new Plan. Furthermore, provision is being made in the Plan for absolute priority to be given to those works which form part of the scheme (e.g. railways and roads) and which would fall to the responsibility of the Gold Coast Government.

585. The Government has given a similar undertaking that the financing of the new Plan would be so arranged that the scale of expenditure, when taken into account with that estimated

for the Volta Project, should not place an undue burden on the country's financial resources nor lead to any danger of inflation.

586. It is assumed that the process of consultation between the Gold Coast Government and the Preparatory Commission will be continued and subsequently that it would be carried on with the Volta River Authority.

587. If the Project is undertaken, it is apparent that the total demands for manpower required by the Government and the scheme would have to be kept under close and constant study, so that if, unfortunately, shortages did appear in the various labour forces required for the Project, the Gold Coast Government could then comply with the undertaking given in the White Paper and modify its own development plans so that there would be no impediment to the smooth and timely execution of the scheme. This might involve the temporary deferment of certain other desirable works, but clearly the inconvenience caused by such adjustments would be less disadvantageous than the alternative of serious delay in the construction of the Volta Project—which would burden the scheme for eighty years with millions of pounds of extra interest charges and thus cause consequent loss of return to the Gold Coast Government and the aluminium companies.

588. The continuous survey of manpower demands could also help to ensure that the needs of commercial undertakings producing essential goods and services were protected, and that essential elements in the present economy (e.g. the cocoa and mining industries) were not disturbed (see also paragraph 197).

Detailed Consideration of the Next Development Plan

589. The Gold Coast Government hopes that details of its next Development Plan will be available early in 1956. As soon as the Plan has been completed it is assumed that all parties to the Project would review it with care, first to ensure that the demands for manpower (particularly skilled and supervisory) did not indicate a likely conflict with the requirements of the Project, and second to make certain that the necessary priority had been given to such major and essential items as the new railways and roads.

B. ADMINISTRATIVE AND TECHNICAL MANPOWER

590. It is obvious that the efficiency of the administrative and technical staffs of the Gold Coast Government would be of exceptional importance in carrying out the Volta Project. The present position is reviewed in this chapter, and the possible situation over the next ten years (covering the construction phase) would, no doubt, be considered carefully by the parties to the Project before reaching a decision whether it should be undertaken. In making this review, the parties would undoubtedly bear in mind the fact that in recent years the Gold Coast Government has had to contend with serious staff shortages.

Administrative Staff

591. An important constitutional change took place in the Gold Coast after the elections in June, 1954, and pensionable overseas officials in the Government were given the option of joining, on 31st July, 1955, the new Gold Coast Local Service or withdrawing on the payment of compensation for loss of career. At that date the pensionable overseas staff formed rather less than one-third of the total senior staff requirement.

592. About 82 per cent of them joined the new service, but they retained the right to resign (and receive compensation) on giving a minimum of four months' notice. During the further period up to 31st December, 1955, approximately 50 of these officials, representing about 8 per cent of the balance, applied to retire.

593. This loss in experienced manpower was offset, in part, by the promotion of African and overseas staff, and by recruitment from abroad on contract. During 1955, 18 administrative and just over fifty technical officers arrived in the Gold Coast on contract terms.

594. During the course of its work the Preparatory Commission has had an opportunity to observe the very heavy burden placed on all sections of the Gold Coast Government, and it would be prudent to assume that the general strain on the Government is likely to increase in the immediate future. It is desirable to re-emphasise the fact that the Government machine is likely to be under appreciable strain for a considerable number of years to come without the addition of a substantial development programme or the Volta Project.

595. As to the Project, it must be appreciated that if a decision was taken to proceed the strain on the machinery of Government would be increased not only by direct responsibilities (such as those associated with the construction of the new railways and port facilities, with local government in the areas of the new communities, problems of compensation and resettlement

in the inundated area, the adjustment of the economic and social life in the riparian communities, and a wide range of activities associated with agriculture and fisheries), but also by many pressures on Ministries and Departments indirectly affected.

596. Recognising the great effect on the Project which could be exercised by a weakness in the machinery of Government, particular care has been taken in proposing functions and powers for the Volta River Authority. This is dealt with in detail in Chapter 36. Provision has been made for the Authority to undertake on behalf of, and at the request of, the Gold Coast Government, functions directly related to the Project, if such arrangements would ease the burden placed on the Government's resources of administrative and technical manpower.

597. If the Project were to be started, and the Gold Coast Government then found that shortages of administrative and technical staff were making it impossible for the Government to carry out essential construction (such as railways) or administrative functions (such as those involved in resettlement and the payment of compensation) then the most practical arrangement would be to request the Volta River Authority to undertake such responsibilities. This possibility would have to be borne in mind by all the parties to the Project (particularly the Gold Coast Government) when reviewing the possible manpower situation over the next ten years, and the effects of such a transfer of responsibility should be considered in advance of a decision being taken to proceed with the Project.

Supervisory and Technical Manpower

598. At various places in this report, emphasis has been placed on the vital need for ensuring that all the manpower required for the Project should be available at the right time. In this chapter, the limitations imposed on the Gold Coast Government services and on the execution of its development plans have been stressed. It is appropriate, therefore, to call attention to the world wide shortages of certain types of supervisory and technical personnel[1] which are developing as a result of the constantly expanding economies in North America, and in many countries in Europe and Asia, as well as in Australasia and in other parts of Africa. Fortunately the demands for the Project are relatively very small, but the Gold Coast Government may well experience increasing difficulty in recruiting all the men it needs. (See also footnote to paragraph 532).

Chapter 29

OVERSEAS INVESTMENT IN THE GOLD COAST

A. POLICY FOR CAPITAL INVESTMENT

599. In a statement to the Legislative Assembly on 1st March, 1954, which is given in full at Appendix XV, the Prime Minister defined the policy of his Government towards capital investment. This policy can be summarised as follows:

(*a*) Africans should be trained to participate at all levels of employment;

(*b*) the Gold Coast Government would be willing to participate with foreign investors in developing enterprises which could be shown to be economically sound;

(*c*) it was expected that public utilities would continue to be owned and operated by the Gold Coast Government;

(*d*) with the exception of utilities, it was " the Government's considered view that foreign capital should be free to invest in any other form of new industrial enterprise. In other words, it is hoped to see new industries established which will in due course become fully self-supporting under fairly competitive conditions ";

(*e*) provision would be made for the repatriation of non-sterling funds;

(*f*) reference was made to the Government's policy in relation to nationalisation, which is dealt with in the second half of this chapter.

600. At the appropriate time, therefore, the Gold Coast Government would need to consider whether the pattern of investment proposed for the Volta River Project conformed with this policy.

601. The overseas investors for their part would, at the same time, need to decide whether the general climate for investment in the Gold Coast was sufficiently attractive to justify the exceptionally large and long-term investment of sterling and dollars in the Gold Coast. These are matters which could only be resolved by the parties financing the Project (see also paragraph 706).

[1] Cf. the serious shortage of engineers and scientists referred to in the first report of the U.K. Atomic Energy Authority published in November, 1955.

B. NATIONALISATION AND EXPROPRIATION

602. In the earlier discussions about the Project there was general recognition of the importance which the aluminium companies attached to private enterprise. This was one of the reasons for the companies agreeing to the arrangement by which 10% of the equity in the smelter company could be taken up by the Gold Coast Government for subsequent sale to private investors in the Gold Coast; and for up to another 10% to be taken up by private investors in the Gold Coast twenty-five years after the smelter had come into operation, depending on the extent to which the Government had disposed of the first 10%.

603. It is understandable that the aluminium companies should be concerned about the possibility of nationalisation and expropriation at some future date, especially as an agreement extending over eighty years is envisaged.

604. The Gold Coast Government appreciates this concern on the part of foreign investors, and the Prime Minister's statement on capital investment included the following passage:

> " The present Government has no plans for nationalising industry beyond the extent to which the public utilities are already nationalised, and it does not envisage any such proposals arising. Nevertheless, in order to ensure that if the nationalisation of a particular industry were to be considered essential by a successor Government in the national interest, there should be suitable means for guaranteeing fair compensation, the Government intends to request the United Kingdom Government to incorporate in the Constitution appropriate provision for this purpose following the precedents set in the Constitutions of the United States of America and of India. There should be no doubt left in the minds of foreign enterprises that the Gold Coast is prepared not only to encourage the entry and investment of foreign capital but also to ensure that the interest of investors will be adequately safeguarded."

605. The Prime Minister's undertaking was implemented in due course by the Gold Coast (Constitution) (Amendment) Order in Council, 1955, section 36A(1) of which reads:

> " No property, movable or immovable, shall be taken possession of or acquired compulsorily except by or under the provisions of a law which, of itself or when read with any other law in force in the Gold Coast—
>
> (*a*) requires the payment of adequate compensation therefor;
>
> (*b*) gives to any person claiming such compensation a right of access, for the determination of his rights (if any), including the amount of compensation, to the Supreme Court of the Gold Coast;
>
> (*c*) gives to any party to proceedings in the Supreme Court relating to such a claim the same rights of appeal as are accorded generally to parties to civil proceedings in that Court sitting as a court of original jurisdiction. . . ."

606. Reference is made in paragraphs 674 and 677 to special articles in the draft Master Agreement which are proposed to cover the possibility of nationalisation of the smelter company and the procedure for arbitration between the parties to the Project.

607. In paragraph 527, the possibility of negotiating a loan from the International Bank for Reconstruction and Development has been mentioned. If such a loan is considered in due course, the Commission suggests that it might be negotiated between the Bank and the Volta River Authority (guaranteed by the Gold Coast Government) on terms which linked the loan with the carrying out by the Gold Coast of its undertakings in the Master Agreement, thus providing an additional assurance to the other parties.

CHAPTER 30

FUTURE ADMINISTRATION OF TOGOLAND UNDER UNITED KINGDOM TRUSTEESHIP

Effects of Project

608. Togoland under United Kingdom Trusteeship covers an area of 13,040 square miles. The new lake, at the 280 ft. contour, would submerge approximately 975 square miles of this territory. The recommendations made by the Commission for compensation and resettlement (Chapter 14 and Appendix VI) include provision for all effects of the lake on this area.

Policy of the British Government

609. In 1954, the British Government announced that it would wish to surrender its trusteeship in Togoland once the Gold Coast had become independent.

Policy of the United Nations

610. The General Assembly of the United Nations on 17th December, 1955, adopted a resolution which, after making reference to various reports and including observations on opinions expressed by the Trusteeship Council and others, recommended that the Administering Authority of Togoland under British Administration, in pursuance of Article 76 (*b*) of the Charter of the United Nations, should take steps in consultation with a United Nations Plebiscite Commissioner to organise and conduct without delay, under the supervision of the United Nations, a plebiscite in respect of the Trust territory in order to ascertain the wishes of the majority of its inhabitants. The plebiscite is intended to indicate whether the people wish to unite their territory with an independent Gold Coast, or to separate Togoland under British Administration from the Gold Coast and continue it under Trusteeship pending the ultimate determination of its political future.

611. The General Assembly also decided to appoint a United Nations Plebiscite Commissioner who would exercise on behalf of the General Assembly the powers and functions of supervision defined by the Visiting Mission of the United Nations (which came to the Gold Coast in August, 1955) in its special report, and who would be assisted by observers and staff appointed by the Secretary-General.

Plebiscite

612. The resolution of the General Assembly indicated the method by which the plebiscite should be organised and conducted, and asked the Plebiscite Commissioner to submit a report on the organisation, conduct and results of the plebiscite to the Trusteeship Council for its consideration and for transmission in due course to the General Assembly. It is anticipated that the plebiscite would be carried out about May, 1956. There would be advantage if the results of the plebiscite could be known before a final decision about the Project was made.

Chapter 31

CONTROL OF HEADWATERS OF THE VOLTA

613. The catchment area directly related to the Volta Project is about 150,000 square miles. Of this, 61,500 square miles lies in the Gold Coast and Togoland under United Kingdom Trusteeship. The remainder is under the control of the French Authorities.

614. The Preparatory Commission and its consulting engineers have examined this problem carefully; the latter retained the services of an eminent authority on international water rights to advise them. In their Engineering Report, they state that the only work contemplated in the area under French control, the Sourou irrigation scheme, " would not vitally affect the Volta River Project." They recommend that an agreement on the subject of water rights between the French and Gold Coast Governments should be considered if a decision is taken to proceed with the Project. The British Government, which has been kept informed of the position by the Commission, has had informal discussions with the French Authorities about this matter.

Chapter 32

FUTURE OF ALUMINIUM

615. The White Paper (Cmd. 8702) included, in Appendix I, a survey of the growth of the aluminium industry with particular reference to the requirements of the United Kingdom. Figures of world production were given from 1920 to 1951. It was concluded that a continued rise in the world demand for aluminium could be expected. During the subsequent four years,

the trends indicated in the White Paper have been maintained. World production and consumption have continued to rise. The table below, which gives world production over the last ten years, indicates the pattern and rate of development:

WORLD PRODUCTION OF ALUMINIUM

(thousand tons)

Year	*U.S.A. and Canada*	*Europe (excluding U.K.)*	*Sterling Area*		*Rest of World*	*Total*	*Percentage of 1945 Total (1945=100)*
			U.K.	*Other*			
1945	635	79	31	2	20	767	100
1946	538	92	31	3	5	669	87
1947	777	125	28	3	4	937	122
1948	885	169	30	3	11	1,098	143
1949	869	182	30	4	23	1,108	145
1950	994	213	29	4	25	1,265	165
1951	1,166	321	27	4	36	1,554	202
1952	1,283	386	28	4	43	1,744	228
1953	1,605	411	31	4	48	2,099	274
1954	1,804	466	31	4	57	2,362	308
1955	1,920	500	24	8	73	2,525	329

Note: This excludes production in Yugoslavia, U.S.S.R. and satellite countries.

616. This table shows the spectacular increase in production during the past ten years. It will be observed that by far the greater part of the increase in world production has been in North America and Europe. At present, the United Kingdom is the only substantial producer in the Sterling Area, and although production in India is being expanded and a new plant in Tasmania started in December, 1955, the increase in Sterling supplies will be very modest.

617. Development of aluminium production continues in many parts of the world. The confidence with which producers are prepared to expand their plant is clear evidence of their assessment of future expansion of demand.

618. In the United Kingdom, the Aluminium Industry Council has reiterated the view that they expressed in 1952 that an annual average rate of increase of consumption of 5% is a conservative basis of assessment, assuming that the price of aluminium continues to be competitive with that of other materials.

619. The willingness of Aluminium Limited, representing as it does one of the largest producers, with world-wide connections, to participate in the Volta Project, would be in itself an assurance for the marketing of the output. The President of this company, in his address to stockholders at the Annual Meeting on 28th April, 1955, referred to "what appears to be an unrelenting demand for increasing quantities of primary aluminium."

Chapter 33

GENERATION OF POWER FROM NUCLEAR ENERGY

620. The Preparatory Commission has endeavoured to keep in general touch with developments in the field of the generation of power from nuclear energy. This particular problem has been raised by the Commission at various times in discussions with the two Governments and the aluminium companies.

621. Present evidence suggests that electricity from nuclear power plants may be able to compete relatively soon with thermal generation; but only the future will show whether costs could ultimately be reduced to compete with hydro-electric installations such as that proposed for the Volta River. If this did happen, an entirely new economic factor would appear in determining the location of aluminium smelters as of all other heavy power-using industries. Undoubtedly the two Governments and the aluminium companies would study the matter with special care before deciding whether the Project should be undertaken or not.

Chapter 34

OTHER FACTORS WHICH COULD INFLUENCE THE PROJECT: CONCLUSIONS

622. The Preparatory Commission considers that the other factors enumerated in this report which might influence the Volta Project should not affect it adversely, provided that the future development plans of the Gold Coast Government were effectively co-ordinated with the Project, and that the efficiency of the Gold Coast Government was not prejudiced by serious shortages of administrative or technical personnel; and provided that the climate for investment in the Gold Coast was attractive; and assuming that the level of future world demand for aluminium and future developments in the generation of power from nuclear energy did not make the Project uneconomic.

PART V

Administrative and Legal Framework

Chapter 35

ADMINISTRATIVE AND LEGAL FRAMEWORK

Administrative Framework

623. The broad administrative framework for the Volta Project would, of course, be provided by the Gold Coast Government. It would be the natural responsibility of the Government to preserve the political and economic stability which would be of vital importance to the success of the Project, particularly during the construction phase. The Government, as has been noted earlier in this report, would also have major responsibilities in providing certain resources and services essential for the execution of the scheme. In Section B of Chapter 28 reference has been made to the availability of administrative and technical personnel in the Gold Coast, for it is obvious that the ability of the Government to provide the necessary administrative framework for the Project would depend on adequate staffing.

624. It was generally agreed amongst the parties to the scheme in their earlier discussions that immediate responsibility for constructing the dam and power installation and for ensuring the effective co-ordination of the other component parts which would be essential to secure the success of the Project as a whole, should be entrusted to a Volta River Authority, which would be a public corporation set up by Gold Coast legislation. It has been stressed already in paragraph 597 that there would have to be a close administrative inter-relationship between the Gold Coast Government and the Authority. In the first half of the next chapter, a general account is given of the draft Bill for the Authority, including a description of the Authority, and in the second half certain observations are made about the administrative arrangements proposed.

Legal Framework

625. The legal framework to the scheme would be provided by the Ordinance constituting the Volta River Authority, and a Master Agreement embodying terms agreed amongst the parties for the construction and operation of the Project, supplemented by a Power Contract by which the Authority would sell power to the smelter company for eighty[1] years.

626. In addition, there would be several other legal documents:

(*a*) a Land Acquisition Ordinance;
(*b*) leases;
(*c*) a Local Government Ordinance;
(*d*) mortgages;
(*e*) a Railway Agreement;
(*f*) a Port Agreement;
(*g*) works contracts and accompanying documents.

627. The Master Agreement and Power Contract are dealt with in Chapters 37 and 38 respectively, and the other legal documents in Chapter 39.

Debate in Legislative Assembly of the Gold Coast

628. Reference is made in paragraph 706 to the debate which would ultimately be held in the Legislative Assembly of the Gold Coast to consider the Government's policy towards the Project. At that time, the terms of all the agreements described in the following chapters would be debated, and the Assembly could, if it thought fit, pass into law the relevant statutes.

Chapter 36

VOLTA RIVER AUTHORITY

A. THE DRAFT BILL

629. It was contemplated originally that the Preparatory Commission would be required only to participate in the determination of the constitution and powers of the Volta River Authority; but at the request of the Gold Coast Government the Commission itself assumed responsibility for preparing a draft Bill for consideration by the two Governments and the aluminium companies.

[1] In the White Paper (Cmd. 8702) a period of sixty years from the date at which power was first available was mentioned, reflecting the earlier discussions between the parties; but the period for amortising the loans was given as eighty years. To eliminate this apparent inconsistency, the Governments and companies agreed in 1955 that, for the purposes of planning, eighty years should be taken as the period of operation of the Power Contract also.

630. After consultations with the Gold Coast Government as to the constitution and powers of the Authority, the Commission prepared a draft Bill which was then referred to the two Governments and the aluminium companies. A draft was finally evolved which has been accepted for purposes of planning by both Governments and the aluminium companies; it is set out at Appendix XVI.

Constitution and General Objective during Construction Phase

631. The Authority would be constituted as a body corporate with the duty and power of managing its own affairs and making ends meet, subject to the usual Ministerial supervision provided for in a form suitable to this Project. The Bill follows the normal lines of public corporation legislation in other parts of the Commonwealth, and the powers of the Gold Coast Government in relation to the Authority conform with the usual pattern. In view of the fact that the Authority would be financed from several sources, provision is made for the association of all the parties with its functions. The draft Bill provides for a majority of the members of the Board being nominated by the Gold Coast Government; the British Government and the aluminium companies would each nominate one member to the Board.

632. Since the timely and economic construction of the dam and power installation would be fundamental to the success of the entire Project, the Commission has proposed an Authority with strong but defined powers, concentrated on the essential functions. During the construction phase, these would be the building of the hydro-electric scheme and the co-ordination of activities essential for the successful completion of all the other component parts. This policy was adopted so as to ensure that during the vital phase of construction, effort was not dispersed on other desirable but less essential activities.

Policy after Completion of Construction Phase

633. There is general agreement that after the construction phase had come to an end, the Authority should remain in existence, in order to discharge responsibilities in relation to the supervision of the power installation, control of water, health and sanitation, etc., and to the future development of power from the Volta system. (See also paragraph 649). Provision is made in the draft Bill, however, for certain of the Authority's functions to end with the construction phase, or in some cases a few years later.

634. It may well be that a time would come when the duties of the Authority should be modified so that it could undertake additional separate functions as part of the further development of the Volta Basin; but the Commission felt strongly that the first essential should be for the Authority to concentrate every effort on those activities which would do most to secure the production of cheap power.

Co-ordination

635. Provision has been made in the draft Master Agreement, supplemented by powers in the draft Bill, for a co-ordinating function, so that appropriate action could be taken by the Authority if one of the parties responsible for the construction of a particular component, or for other activities essential to the Project, failed to achieve the rate of progress necessary for the successful development of the scheme as a whole.

Health and Sanitation

636. From the outset it was recognised that the Authority should have strong and special powers in relation to health and sanitation. This was accepted by the Governments and aluminium companies as it would clearly be essential to preserve and protect the health of the various labour forces, and to ensure that the health of the people living near the new lake would not suffer as a result of its creation.

637. The Governments and aluminium companies have accepted, for purposes of planning, certain principles in relation to health and sanitation. (They are shown in Annex E of Appendix XII). These principles are reflected in the draft Bill, which places appropriate statutory duties on the Authority.

Land

638. The land needed by the Authority would be:

(*a*) that covered by the new lake and its margin up to a level of 280 feet, i.e. about 3,500 square miles, and

(*b*) that needed for the dam and power installation[1] and its permanent township at Ajena and possibly other small areas.

[1] A slightly larger area would be needed temporarily during the phase of construction.

This land would be acquired by the Gold Coast Government under a separate Ordinance and immediately leased to the Authority for 300 years by a simple lease.

639. In order to discharge its responsibilities in relation to health and sanitation, the Authority would, outside the areas which it would take on lease, have certain functions in two surrounding areas :

(*a*) a margin approximately one mile wide from the 280 ft. contour (surrounding area "A"); and

(*b*) an area several miles wide surrounding the area of the smelter and its township and extending on both sides of the river to the dam site and its immediate vicinity, (surrounding area " B "). This latter area is dealt with in the proposed Local Government Ordinance.

Permissive Functions

640. Powers have also been included in the draft Bill by which the Authority (with the approval of the Gold Coast Government) could undertake other activities which would promote the more efficient construction of the various works, or the carrying out of the Master Agreement. The object is that the Gold Coast Government could, if it wished, entrust the Authority with a particular task associated with the Project which would normally be the responsibility of the Government, e.g. payment of compensation. The primary reasons for doing this would be to give the Gold Coast Government flexibility in the discharge of its administrative responsibilities, and to facilitate and implement the Authority's task of co-ordination. It is impossible to prophesy what administrative and technical services will be available to the Gold Coast Government during the next ten years and while the Commission has naturally adhered to the basic principle that the Government should itself carry out functions proper to it, powers should exist in the Bill for the Authority itself to be entrusted by the Government with those functions if essential for the successful co-ordination and development of the Project, particularly during the construction phase (see also paragraph 596).

641. This provision is of exceptional importance because delay in constructing a particular component could lead to very costly delays in the completion of the Project as a whole. In all cases where the Authority undertook a particular task at the request of the Gold Coast Government, there would be payment in full by the Government.

Abstraction of Water

642. Provision has been made in the draft Bill for the abstraction of water from the lake for purposes of irrigation up to an agreed amount, and also for the regulation and limitation of abstraction from the lake and its tributaries for other purposes; but domestic supplies of water required for towns and villages in the Volta catchment area would not be subject to regulation or limitation.

Flood Warning and Compensation Water

643. The draft Bill directs the Authority to set up a flood warning system and take all possible steps against flooding. The Authority is also directed to make provision so that a stated quantity of water (up to 5,000 cusecs) could be released as necessary so as to prevent penetration of salt from the estuary during the filling period, and so that a continuous flow of at least 5,000 cusecs would be maintained during the operating phase.

Research

644. The Authority would have power to engage in research. In view of the financial implications of this function, however, provision would be made in the Power Contract for such work, if it was to be paid for out of the cost of power, to be carried out in agreement with the smelter company.

Financial Provisions

645. The draft of the Bill reflects the financial powers and responsibilities which have been agreed, for purposes of planning, between the two Governments and the aluminium companies. These are of a kind normally provided when setting up public utility corporations, e.g. borrowing powers, ensuring that receipts would be sufficient to meet outgoings, and the keeping of proper accounts. The statutory direction to make ends meet is supplemented by the detailed arrangements in the Power Contract.

Administration

646. It has been proposed that the administration of the Authority should be placed under the control of a board composed of a chairman, assisted by four members nominated by the Gold

Coast Government, and one each nominated by the British Government and the aluminium companies.

647. Having studied carefully the experience of multi-purpose projects in other countries, the Commission proposed that the chairman be made the chief executive of the Authority. The chairman should have direct access to the Prime Minister and work on the level of Ministers. Experience also indicates the desirability of not making a statutory appointment of a deputy chairman. There is general agreement that such an appointment could best be made as necessity arose after the chairman and other members of the Board of the Volta River Authority had worked together for some time.

648. Experience elsewhere also shows that the board should concentrate its work on questions of policy, and that members should not be appointed with functional responsibilities, e.g. financial, electrical and engineering. The Commission's survey of certain other projects indicated that where individual members of boards had been given specific functional responsibilities, confusion had almost invariably arisen and misunderstandings resulted between the members of the board and the senior officials responsible for the particular functions within the administrative framework of the Authority.

Volta Electricity Board

649. It has been proposed (paragraph 633) that the Volta River Authority should continue to exist throughout the operating phase, although certain functions, such as those dealing with co-ordination, would cease after the construction phase. The Gold Coast Government has agreed that this would be preferable to constituting a new statutory body, such as the Volta Electricity Board proposed in the White Paper, to take over from the Authority at the end of construction—particularly as any new body would need to exercise many of the responsibilities (such as those relating to lakeside health) that would have been previously discharged by the Authority. It is not contemplated that the Authority would be concerned with the distribution and sale of electric power; it would sell power in bulk, and retail distribution would be the responsibility of the Electricity Department in the Gold Coast.

B. THE BOARD AND STAFF FOR THE VOLTA RIVER AUTHORITY

650. The provision of the Board and certain members of the staff for the Volta River Authority would be a matter of great importance. These appointments could well exercise a decisive influence over the Project as a whole during the phase of construction.

651. It has been accepted that the chairman should be a man of exceptional qualities, and the members of the board would need to be selected with great care. Within the administrative framework of the Authority, the appointment of the chief engineer would require a man of outstanding capacity; the chief financial officer and the principal medical officer would also need to be men of proven ability and experience. So too would the senior official in charge of administration.

652. Experience with other projects suggests that there would be great advantage in appointing some key officials at an early stage, if possible immediately after a decision had been taken, in principle, to proceed with the Project and to invite tenders for the dam and power installation. (It is generally agreed that the risk at that stage of ultimately not receiving an acceptable tender would be very small.) The advantage of this arrangement would be that the officials would then be able to assume duties with the Volta River Authority on the day that it came into existence, and would already have had an opportunity to obtain a good knowledge of the Project. They could be attached to the Preparatory Commission until the Authority was established. It would be very desirable to appoint auditors to the Authority (who could also advise on accounting methods) at as early a stage as possible so that they could assist in the establishment of effective financial controls from the outset (see paragraph 697).[2]

653. The Commission has observed that the amount of large-scale development in the world has almost doubled during the last five years. It follows, therefore, that adequate salaries and conditions of service would need to be offered if men of the right type were to be attracted to these particular appointments.[2] The salaries involved would seem high by present Gold Coast standards, but, in fact, they would not be so when measured by current world rates. The salaries would only be justified if the services of men with the necessary qualification and experience could be secured. After the critical phase of construction had been completed, it should be possible to use the services of less highly qualified (and thus less highly paid) men for some of the key posts, with the exception of that of the principal medical officer.

[2] Failure to face this practical problem could lead to very unsatisfactory and expensive results. Chapter VII of the Report of the Damodar Valley Corporation Enquiry Committee, 1952/53, which deals with the delay of 2½ years in appointing a Chief Engineer to the Corporation, gives an example of this experience.

654. It can be assumed that the salary scales and conditions of service for a large proportion of the Authority's staff during both the construction and operating phases would follow closely those adopted by the Government for officials on contract. One important reservation to this general statement must be made. If the Government, as a result of its inability to recruit staff, found it necessary to ask the Authority to carry out a particular function which it had been assumed originally would be discharged by the Government itself, then it is virtually certain that the Authority would have to adopt salary scales and conditions of service better than those offered by the Government. This would be part of the price which would have to be paid in order to get the job done on time; and it may well be that the Government would consider that a short-term arrangement of this nature would have fewer repercussions on its salary structure than the direct recruitment of the necessary staff at increased rates of remuneration.

655. These practical considerations often have unpleasant results if they are not dealt with effectively and the economic consequences can be exceedingly expensive. The Volta Project would represent a great capital investment by the Gold Coast and British Governments and the aluminium companies. It should not be undertaken unless all those concerned with the scheme were prepared to pay salaries and offer conditions of employment which would secure the services of those men who could do most to ensure its successful construction.

Chapter 37

DRAFT MASTER AGREEMENT

656. The previous chapter has described the Bill which would set up the Volta River Authority. That Bill, however, would not immediately come into force and would not commit any party to go ahead with the Project. The instruments committing the parties would be the Master Agreement, the Power Contract, and the other contractual documents all of which would be signed on the same occasion. The Preparatory Commission in the later stages of its work established a framework for this agreement based on the 1951/1952 discussions, and in consultation with the two Governments and the aluminium companies developed a draft which would be taken as the working document for the purpose of negotiation. The following paragraphs describe the main features of the draft which would, of course, be amended as necessary in discussion between the parties.

Nature of the Master Agreement

657. It is contemplated that the parties to the agreement would include not only the two Governments and the aluminium companies, but also the Volta River Authority and the smelter company. The Authority would have been formally constituted shortly before the signing of the agreement so as to become a party to it. This arrangement would enable the Master Agreement to include the rights and obligations of the Authority and of the smelter company besides those of the main parties. It is not intended, however, to make the Master Agreement a single all-embracing document that would deal with all matters arising from the Project. It would contain the majority of main provisions, but separate documents would set out agreements on such important matters as the sale of power from the Authority to the smelter company, the terms on which aluminium industry traffic would be handled and carried by Gold Coast ports and railways, and the arrangements for acquiring land and for establishing the municipal authority for the smelter township.

658. The intention is to deal as fully as possible in the Master Agreement and the other documents with all matters which might arise in the construction and operating phases of the Project, so that the parties might know the full extent of their commitments, and so that there should be no chance of the main agreement being frustrated at some later stage by failure to agree on minor matters.

659. The duration of the Master Agreement is proposed as a period of eighty years from the end of the construction phase. Provision is not made for review or variation during this period although obviously the parties could initiate changes if they were to agree on the necessity for doing so. Provision is made for arbitration in the event of any disagreement, and arbitration machinery is proposed which should guarantee impartiality and which is believed to be acceptable to all parties.

Main Structure

660. The essential features of the agreement as at present foreseen are:

(*a*) a preamble setting out fully the intention of the parties;

(*b*) a section dealing with the initial and subsequent financing of the Project;

(*c*) provisions dealing with land;
(*d*) clauses setting out the responsibilities for construction and for co-ordination;
(*e*) a section describing the main responsibilities for operation, and setting out various conditions of operation;
(*f*) the provision governing the sale of aluminium by the smelter company;
(*g*) a number of reciprocal undertakings by the various parties; and
(*h*) an arbitration clause.

Financial Provisions

661. These provisions would specify the detailed arrangements for financing the Project in accordance with the proposals set out in the White Paper or such modified arrangements as might be negotiated. There would be provisions to deal with the financing of the Volta River Authority by the Gold Coast and British Governments which would provide or guarantee the capital for the dam and power installation. The Master Agreement would specify the terms of the loans by the Governments, and the amounts, or some formula for determining the amounts. The mortgages providing the Governments with security for their loans would be scheduled as separate documents to the Master Agreement. The relevant articles would be drawn so as to provide for possible participation by the International Bank for Reconstruction and Development in the financing of the dam and power installation, if that should be agreed by the parties and negotiated with the Bank.

662. Other provisions under this heading would deal with the financing of the smelter company to ensure that it was provided with sufficient capital for the construction of the mines, smelter, townships, and ancillary facilities. The Master Agreement would specify the initial provision of capital by the aluminium companies, the loans which the British Government would make, and the arrangements for the issue of equity shares. Conditions would be established for the participation by the Gold Coast Government in the equity of the smelter company, for the subsequent transfer of Government shares to individual African investors in the Gold Coast, and for a later issue of equity to this class of investor depending on the extent to which the earlier issue had been transferred to private holders. Aluminium Limited would have from the beginning, and would retain, a controlling interest in the smelter company and would together with other parties guarantee certain of its undertakings; the more important of these guarantees are menttioned below. No change would be made in holdings in the smelter company (other than those changes specified in the Master Agreement) without the consent of all parties.

663. No specific provision would be included to govern the financing of the railways and the other components of the Project which would be the concern of the Gold Coast Government alone.

Land

664. The Gold Coast Government would undertake in the Master Agreement to grant leases of land that would be needed for the construction and operation of the dam and power installation and the smelter. This would ensure, in conjunction with the Land Acquisition Bill (paragraph 689), that the necessary land was available for the Project.

Construction

665. Obligations would be imposed on the Volta River Authority to construct the dam and power installation, and on the smelter company to construct its two component parts of the Project, including their townships. These obligations would be supplemented by undertakings on the part of the Gold Coast Government to facilitate the Authority's work and by the parent aluminium companies guaranteeing the smelter company's discharge of its responsibilities. The Gold Coast Government would incur an obligation to construct the railways and other essential communications.

666. The earlier discussions indicated that the obligation on the smelter company would extend only up to construction of capacity to produce 120,000 tons of aluminium per year, but provision would be included for periodical consultation after that stage was reached, with a view to carrying capacity to 210,000 tons. The Agreement would express the common interest of the parties in construction being carried to the maximum capacity as soon as demand and other pertinent conditions permitted, and their common desire to achieve this capacity as soon as possible. The great economic advantages to be obtained from extension to maximum production have already been emphasised in paragraph 569. In case maximum capacity was not reached within 20 years of the start of commercial production of aluminium, the smelter company would be obliged to make available to other interests some electric power and bauxite on notice being given by the two Governments.

667. A provision would be included to ensure that the Volta River Authority would exercise the powers of co-ordination which are granted by the draft Bill (see paragraph 635) and that the other parties would make available to the Authority the information required for the exercise of these co-ordinating powers.

Operation

668. The next section of the Master Agreement would deal with the operation of the dam and power installation by the Volta River Authority, of the smelter and mines by the company, and of the transport facilities by the Gold Coast Government. It would also contain an undertaking by Aluminium Limited that the smelter company would operate as a separate entity in open competition and without restrictive agreement or understanding with other producers.

Disposal of Effluents

669. The smelter company would give an undertaking that the most effective methods would be followed for the disposal of any harmful waste products of the smelter. This provision is of great importance to the Gold Coast Government in order to safeguard the health, and the farming and fishing activities, of people in the neighbourhood of the smelter and in the areas dependent on the Volta River below the smelter. It should be noted that the site selected for the smelter has been chosen with a view to minimising the possible harmful effects from waste gases.

Sale of Aluminium

670. The Agreement would define the arrangements for the sale of aluminium to buyers in the United Kingdom. It was contemplated in the 1952 discussions that the smelter company would offer 75% of the aluminium produced to purchasers in the United Kingdom. The price arrangements would be stated, and a formula incorporated for revision of the price in certain circumstances. The company's obligations under this article would be modified to the extent that the British Government might be obliged at some future date to impose import restrictions or other limitations which might interfere with the free sale of aluminium to United Kingdom buyers. The smelter company would also undertake to offer aluminium for sale, in so far as it was not earmarked for the United Kingdom, to any aluminium fabricator who might operate in the Gold Coast.

Reciprocal Undertakings

671. The remainder of the Master Agreement would consist largely of reciprocal undertakings to be given by the parties. The first of these would be a general covenant by all parties for further assurance, drawn in wide terms. This would be followed by a sequence of undertakings by the Gold Coast Government of which several would deal with matters of taxation and exchange control, including undertakings that the smelter company would not be singled out for any discriminatory taxation and would be afforded the maximum relief granted to pioneer industries. Other undertakings by the Government would concern:

(*a*) priorities for manpower, transport and materials;
(*b*) provision to facilitate entry into and exit from the Gold Coast of people concerned with the Project;
(*c*) the arrangements for payment for irrigation water made available by the creation of the lake;
(*d*) an obligation by the Government to assign to the existing communities around the smelter township a sufficient priority in planning and development to ensure that the conditions in the smelter township would not be endangered (paragraph 247).

672. In addition to those undertakings by the Gold Coast Government there would be three subjects of special interest covered by the Master Agreement. The first would be an undertaking by the Gold Coast Government to associate the British Government with the exercise of certain functions relating to the Volta River Authority, and to make use of the Authority for certain purposes specified in the Bill. This undertaking would reflect the important financial contribution of the United Kingdom by a continuing association with the activities of the Authority (so long as any part of its loan was outstanding); and ensure that full use would be made of the Authority if it were necessary at any stage to supplement the resources of the Gold Coast Government in order to carry out any measures essential for the success of the Project. The association of the British Government would not affect the control of the Project by the Gold Coast Government (see paragraphs 750 to 754).

673. The second special obligation of the Gold Coast Government would be to enter into an undertaking against derogation by legislation or governmental action from the documents setting up the Project, thus ensuring that all the relevant documents, whether statutory or contractual, had a similar binding force. This undertaking is supplemented in the draft Bill for the Volta River Authority.

674. The third special matter is that of nationalisation or expropriation. It is contemplated that the Gold Coast Government would give an undertaking to pay fair compensation in the event of such an occurrence and to take over the obligations of the smelter company under the Power Contract and other documents. This provision would conform with the spirit of the clause of the Gold Coast constitution dealing with nationalisation (paragraph 605).

Undertakings by the Aluminium Companies

675. Turning to the covenants by the aluminium companies, one would provide against the disposal by the smelter company of substantial parts of its assets except in the ordinary way of business. Another would be a guarantee by Aluminium Limited and the British Aluminium Company of the payments to be made by the smelter company under the Power Contract. (A similar assurance would be given by the Gold Coast Government to the extent that the Gold Coast participated in the equity of the smelter company.) Other assurances would cover the undertaking by the companies to make technical knowledge fully available to the smelter company, and the acceptance by the smelter company of responsibility for the costs of the Health and Safety Division of the Volta River Authority in so far as they were applicable to health measures undertaken for employees of the smelter company and (up to an agreed amount) for their dependants.

676. Other articles of the Agreement would deal with questions of *force majeure* and with circumstances which could arise if there were delays in completing any items of the construction work.

Arbitration

677. There would be an arbitration clause under which a question or dispute that could not be otherwise resolved would be referred to a single arbitrator.

Chapter 38

DRAFT POWER CONTRACT

678. As with the Master Agreement, the Commission prepared a draft Power Contract in consultation with the two Governments and the aluminium companies and circulated a working document as a basis for negotiation. The Power Contract as at present envisaged comprises:

(*a*) the main obligation on the Volta River Authority to provide power to the smelter company;
(*b*) the main obligation on the smelter company to pay for power made available to it, and other financial provisions;
(*c*) technical provisions;
(*d*) miscellaneous provisions including an arbitration clause similar to that in the draft Master Agreement.

The following paragraphs describe the main features of the Power Contract as at present envisaged. The parties would, of course, amend the working draft as necessary during negotiation.

679. The only bodies which would be parties to the Power Contract would be the Volta River Authority and the smelter company, but the financial obligations of the smelter company under the Power Contract would be guaranteed for a period by the equity holders.

680. It has been agreed, for the purposes of planning, that the Power Contract should extend for eighty years, the same period as the Master Agreement.

Obligation to Provide Power for the Smelter Company

681. It is contemplated that the Authority would provide for use by the smelter company all available power except a specific amount reserved for other use by the Gold Coast Government. The Gold Coast reservation would initially be specified from year to year and at a defined stage would be stated once for all. As indicated in paragraph 58, the earlier discussions visualised 50,000 kilowatts as the maximum reservation for the Gold Coast Government, but there has been misunderstanding as to whether this was intended to represent maximum or average demand. Moreover, the fact that present estimates of power are higher than the 564,000 kilowatts used as the basis for discussions in 1952, means that consideration would need to be given to the allocation of the additional power as between the smelter company and other users. The definition of the maximum reservation for other Gold Coast consumers would therefore be a matter for negotiation.

682. The Power Contract would contain a provision under which the Authority would recognise the importance of a continuous supply to the smelter, in view of the nature of the

aluminium manufacturing process, and would oblige itself to do its utmost in consultation with the smelter company to maintain such continuity.

Financial Provisions

683. The financial clauses of the Power Contract would stipulate that all costs incurred by the Volta River Authority in the exercise of its statutory duties (with certain limited exceptions) would be chargeable to power costs. For the determination of those costs there would be an examination of the Authority's accounts by an independent firm of auditors acceptable to all parties. Any activities which the Authority might carry out on behalf of the Gold Coast Government under the draft Bill would not affect the cost of power since under the terms of the Bill the Authority would be fully reimbursed by the Government in such circumstances (paragraphs 640 and 641). Any revenue received by the Authority from any other activity, such as the sale of water for irrigation, would be taken into account in assessing the cost of power.

684. The limited class of exceptional costs which would not be chargeable to power consumers would need to be very carefully defined. Clearly there would be a case for excepting any expenditure which might be incurred as a result of action by the Gold Coast Government in breach of the Master Agreement or as a result of wilful default or negligence by the Authority. In the former case the obligation to meet the relevant costs of the Authority could reasonably be put on the Gold Coast Government. In the latter case, however, provision would need to be made for the Authority to derive the necessary revenue. Preliminary consideration given to the problem has included such possibilities as the building up by the Authority of a reserve for this purpose. Clearly a clause to provide for *force majeure* would be necessary. The details of the clause and its financial consequences would be determined during negotiations.

685. When the total cost of producing power had been ascertained, it would be divided between the smelter company and other consumers. The smelter company's share would be guaranteed for a period by the equity holders and the remaining share would be guaranteed by the Gold Coast Government. Various formulae have been discussed for the calculation of the smelter company's share of costs which would take account not only of the number of units supplied, but also of such items as the maximum demand and the power factor. The settlement of the formula would be a matter for negotiation.

686. The Power Contract would ensure that the Authority received the portion of its cost appropriate to the smelter company. There would also need to be a separate agreement, referred to in the next chapter, governing the costs to be paid in respect of other consumers, which would supplement the Power Contract and which would follow broadly similar lines.

Technical Provisions

687. The Power Contract would include a number of technical obligations on the Authority and on the smelter company covering such matters as the phase and frequency of supply, the power factor, the phase balance, the maintenance of voltage and the metering of power. These provisions would follow the normal requirements in power contracts.

Chapter 39

OTHER LEGISLATIVE AND CONTRACTUAL DOCUMENTS

688. This chapter discusses the various statutes, agreements and contracts, which would set out the essential commitments of the parties in addition to the three main documents described in the three previous chapters.

Land Acquisition Bill

689. There would be a Land Acquisition Bill, under which the Gold Coast Government would acquire the land needed by the Volta River Authority, including the area of about 3,500 square miles which would be subject to inundation; and the land needed by the smelter company including the area of the proposed smelter and township—an area of about 30 square miles.

Leases

690. Leases would be granted by the Government to the Volta River Authority, and also in respect of the land for the smelter. The first would be a simple document disposing of the land for 300 years; as a statutory corporation the Authority's use of the land would be regulated by its Statute. The second lease would be for eighty years, and would include covenants to build the smelter and possibly its township. Standards to be observed in building the township would be

laid down in the Local Government Bill. The lease would need to give the aluminium companies adequate assurance that their large capital investment in the smelter and township would be safeguarded.

Local Government Bill

691. A Bill would be needed to set up the special local authority proposed for the area of the smelter and township, and to define the powers which the Volta River Authority would exercise in its capacity as a local authority at Ajena. For the smelter township the Bill would establish a town plan on the lines of that recommended by Mayer and Whittlesey (Chapter 11) and would make provision for the enforcement, and (as necessary) the amendment of the plan. The Bill would define the composition of the special council which would be responsible for local administration in the early years when the smelter company would be strongly represented; and would provide for the progressive representation of the local inhabitants and the eventual transfer of the functions of the special council to a normally constituted authority.

Mortgages and Debentures

692. There would be mortgages by the Volta River Authority to each of the two Governments, providing security for the loans and for the payment by the Authority at regular intervals of a sum of constant amount calculated so that at the end of eighty years the indebtedness would be paid off together with all interest. There would also be debentures to be issued by the smelter company in respect of the United Kingdom loan. The details of these mortgages and debentures would be settled during negotiations.

Terms for Sale of Reserved Power

693. The terms and conditions for the sale by the Volta River Authority of the power reserved to the Gold Coast would need to be set out in a memorandum. Broadly speaking, these terms and conditions would follow those in the Power Contract.

Railway Agreement

694. There would be an agreement for the carriage by the Gold Coast Railway of commodities for the smelter company. It is contemplated that this would be a long-term agreement, probably for the same period as the Master Agreement and Power Contract, and that it would set out in one part the detailed terms and conditions governing the carriage of bauxite from the mines to the smelter, and would deal in a second part with the movement of imports and exports between Tema and the smelter. Provision would be made for the review of freight rates to take account of changing price levels and the development of other traffic on the new lines.

Port Agreement

695. An agreement would be required for the use by the smelter company of port facilities at Tema. This agreement would incorporate any special arrangements arising from the permanent allocation to the smelter company of one or more berths and the provision by the company of its own equipment, and would establish the port dues payable, with provision for periodical review.

Works Contracts and Accompanying Documents

696. There would be works contracts for the construction on behalf of the Volta River Authority of the dam and power installation at Ajena, including the necessary housing. Under the Master Agreement these documents would be entered into in agreement with the other parties. The Commission has consulted the Governments and companies about the form of main contract of which a draft was prepared by the consulting engineers, including—in addition to standard clauses—special provisions to put into effect the Commission's recommendations on human factors and other aspects. The arrangements for letting the contract for the dam and power installation are discussed further in paragraph 703(e) and 712.

Accounting Control

697. Effective financial procedures should be introduced in order to ensure that all works contracts were subjected to proper accounting control. Experience elsewhere indicates that the detailed planning of an accounting system which would enable all constructional work to be progressed satisfactorily, costs to be compared with estimates, and proper procedures instituted for the drawing of money and payment of contractors, should be put in hand at a very early date. This could be achieved by the appointment of financial staff and accounting advisers to the Authority as soon as a decision was taken to proceed with the Project. (See also paragraph 652).

PART VI

Future Action

Chapter 40

FUTURE ACTION

Introduction

698. In this part of the report possible future action to deal with the Project is discussed. It must be emphasised that the Commission is in no way suggesting that any particular course of action should be taken by the Governments and aluminium companies; its purpose is only to indicate action which would need to be initiated if a decision was taken, in principle, to proceed with the Project as a result of negotiations between the parties. What is proposed in the following chapters must therefore be considered merely for the purpose of facilitating future planning.

Future Developments

699. After this report and the Engineering Report have been considered by the two Governments and the aluminium companies, they would be published. The parties to the Project would then be in a position to enter into final negotiations if they so wished; this particular development and possible subsequent action is considered in Chapter 41. Chapter 42 describes action which would need to be taken if a decision was made to proceed with the scheme. Finally, a timetable showing the stages by which further action might be taken is given in Chapter 43.

Chapter 41

NEGOTIATIONS AND DECISIONS ON POLICY

A. NEGOTIATIONS

700. After the two Governments and the aluminium companies had considered this report and the Engineering Report from the consulting engineers, it is assumed that they would decide whether or not to proceed with the Project, unless they had first directed the Preparatory Commission to make further investigations which could influence their ultimate decision. Assuming that the Governments and the aluminium companies decided that further enquiries by the Preparatory Commission were not necessary, it would be possible to arrange discussions about the future of the scheme.

Preliminary Discussions

701. At meetings held with representatives of the Governments and the aluminium companies during the later stages of the Commission's work, it was suggested that further consideration of the Project should take place in two stages. The first stage would be preliminary discussions during which the reports could be reviewed and those issues defined which would need to be negotiated between the parties in order to achieve agreement.

Negotiations at the Ministerial Level

702. The final and decisive negotiations would, in view of the importance of the Project, presumably be at Ministerial level; the Gold Coast Government has indicated that it would prefer them to take place in Accra. It is assumed that the representatives of the Governments and the aluminium companies participating in these formal negotiations would, having considered the results of the preliminary discussions, then concentrate on the proposed terms of the draft Master Agreement and the Power Contract, and the other related legal documents which have been described in Chapter 39. The draft Bill for the Volta River Authority could also be considered at that time.

703. If any outstanding differences were then resolved it is assumed that consideration would next be given to certain important factors which would influence the manner in which the Project was actually carried out. The Commission suggests that:

(*a*) the current and future development plans of the Gold Coast should be reviewed so as to ensure that they would, on the one hand, provide the essential services required for the Project and, on the other, avoid creating demands which could conflict with the resources needed for the scheme;

(*b*) arrangements should be advanced as far as possible to secure the services of a chairman and members of the Board of the Volta River Authority, as well as certain members of the staff;

(*c*) a provisional decision should be made about the appointment of consulting engineers to the Authority;

(*d*) a provisional decision should be made about the appointment of auditors to the Authority;

(*e*) the technical advisers of the Governments and the aluminium companies should meet with the Preparatory Commission, and its various consultants, in order to decide the detailed procedure for inviting tenders, and the precise form of contract for the dam and power installation (all of which could have been affected by the negotiations), and whether certain preliminary works (access roads, and a limited amount of temporary housing) should, or should not, be undertaken in advance of the main contract. These problems have already been discussed at considerable length by the Preparatory Commission with the Governments and the aluminium companies.

Initialling a Memorandum of Agreed Conclusions

704. If the negotiations led to a decision, in principle, to proceed with the scheme, it has been suggested that an agreed memorandum should be initialled by the parties to the Project, but that no formal agreements should be signed until a later date. This procedure has been proposed in order to implement the Prime Minister's undertaking to the Legislative Assembly in his statement of 3rd July, 1953 (described in paragraphs 14 to 19 of Appendix II) that the report of the Preparatory Commission would be made available to the Legislative Assembly and that the Gold Coast Government "would not enter into any agreement with the United Kingdom and the aluminium companies without first debating the terms of any proposed agreement in the Legislative Assembly."

Publication of White Papers

705. It is assumed that at the appropriate time, each Government would issue a White Paper, since certain aspects of the Project would naturally require to be covered more fully in the Gold Coast than in the United Kingdom. It would clearly be of great importance to ensure that the White Paper issued by the Gold Coast Government dealt with every aspect and implication of the Project which could affect the interests of the local people.

B. DEBATE IN THE LEGISLATIVE ASSEMBLY OF THE GOLD COAST

706. The Commission has been informed that a sufficiently long period would elapse after the publication of the White Papers so that action could be taken to ensure that the Project was presented in detail to the people of the Gold Coast, and that they had adequate time to consider its implications. At the appropriate time, the debate in the Legislative Assembly would be held, thus giving the elected representatives of the people an opportunity to express their views about the scheme. This would also provide the other parties with an essential opportunity to judge whether the Project was generally acceptable to the country.

707. The Government has informed the Commission that a special meeting of the Assembly for this debate could be convened if necessary.

708. During the debate the Assembly would have before it the report of the Preparatory Commission, and the Engineering Report, together with the proposed terms of the Master Agreement, the Power Contract, and the Railway and Port Agreements.

709. If the debate proceeded satisfactorily, it would be possible for the Assembly to:

(*a*) enact the Volta River Authority Ordinance;

(*b*) enact the Land Acquisition Ordinance;

(*c*) enact the Local Government Ordinance;

(*d*) resolve to make the necessary financial provision for loans required by the Authority;

(*e*) vote supplementary funds to enable the Preparatory Commission to recruit certain key staff for the Volta River Authority and (if this had been approved during negotiations as essential) for the construction of certain preliminary works.

The Ordinances would be brought into operation at later dates.

Chapter 42

ACTION AFTER THE DEBATE IN THE LEGISLATIVE ASSEMBLY

Calling for Tenders

710. Immediately the debate in the Legislative Assembly had been completed, it would be possible for the Governments and aluminium companies to confer and review their future course of action. If all parties to the Project then agreed that it should be undertaken, arrangements could be made immediately to invite tenders for the construction of the dam and power installation. The necessary documents are already available for issue when required.

711. The Preparatory Commission has proceeded on the assumption that tenders would be called for on a competitive international basis, and that about six months would be required to enable contractors to submit bids to enable their tenders to be considered. It has already been emphasised (paragraph 76) that the contractor or contractors carrying out the work should be of proven experience and efficiency, and strongly backed by all the necessary financial and material resources.

Form of Contract

712. The consulting engineers, after consultation with the Preparatory Commission, have drawn up a draft contract for the dam and power installation (paragraph 696). This draft has been considered by the Governments, the aluminium companies, and the Preparatory Commission. The proposed contract is dealt with in detail in Chapter 11 of the Engineering Report. It might be amended as a result of negotiations (paragraph 703(e)).

Preliminary Works

713. Tenders for preliminary works could be invited without delay if the parties to the Project had agreed during negotiations that this procedure should be followed.

Decision on Tenders

714. It is anticipated that the consulting engineers would make a report to the Preparatory Commission as soon as possible after the closing date for tenders for the dam and power installation. The Commission would then make arrangements for the Governments (in consultation with the aluminium companies) to decide whether a tender should be accepted.

Establishment of the Volta River Authority and Signing of the Master Agreement and Power Contract, etc.

715. Immediately a decision had been taken on tenders for the dam and power installation, the Volta River Authority Ordinance could be brought into operation, thus constituting the Authority. The Preparatory Commission would be wound up.

716. The chairman and members of the Board would be appointed immediately. Certain key staff for the Authority would already be available if the suggestion advanced in paragraph 652 had been adopted. The full complement of staff would then be appointed as quickly as possible.

717. When the Volta River Authority had been brought into being it would be possible for the Master Agreement and the Power Contract, together with other related legal documents, including the contract for the dam and power installation, to be signed. It would be only at this point, after all the stages previously described had been completed, that the parties would be finally and irrevocably committed to the Project.

718. The Gold Coast Government has made it clear that there would be marked advantage if it could enter into these agreements as an independent nation. This is also referred to in paragraph 765.

United Kingdom Legislation

719. It is assumed that any United Kingdom legislation authorising the United Kingdom loan would be passed into law at some time before the stage of signing the various legal documents in the Gold Coast.

Chapter 43

POSSIBLE TIMETABLE OF EVENTS AFTER THE COMPLETION OF NEGOTIATIONS

Introduction

720. In order to assist the future planning of the Project, a summary is given here of the possible sequence of events which might take place if negotiations between the parties led to a decision, subject to a debate in the Legislative Assembly of the Gold Coast, to proceed with the Project.

STAGE A

721. (*a*) Negotiations, ending with an agreed memorandum initialled by the parties to the Project, but no formal agreement signed.

(*b*) White Papers issued by *the two Governments*.

(*c*) *The Gold Coast Government* could

(i) make preparations to set up the organisation that would be required to deal with compensation and resettlement in the area subject to inundation, and with the effects of the Project on the riparian communities;

(ii) complete preparations for ordering railway and telecommunications equipment;

(iii) consider whether it would proceed with the second stage of the development of Tema, if the Volta scheme went ahead;

(iv) make the necessary preparations to proceed with its Second Development Plan based on the assumption that the Project would be undertaken;

(v) prepare a certain amount of office accommodation and housing for the staff of the Volta River Authority;

(vi) consider developments which would be made possible by the lake, e.g. agriculture, fisheries, inland navigation.

(*d*) *The Preparatory Commission*, with the approval of the two Governments, could

(i) arrange for the completion of tender documents for any preliminary works which the parties to the Project considered should be started in advance of the contract for the dam and power installation;

(ii) ensure that all tender documents and the draft contract required for the dam and power project were ready for issue when necessary;

(iii) take preliminary steps to arrange for the recruitment of key staff who would ultimately be required for the Volta River Authority;

(iv) arrange for the preparation of informative booklets designed to assist local and overseas staff.

STAGE B

722. It is anticipated that an appropriate period would elapse after the completion of negotiations (Stage A) in order to ensure that sufficient time was provided for the people of the Gold Coast to be made fully aware of the Project and its implications.

723. The Gold Coast Government would then arrange for the debate in the Legislative Assembly. If the outcome was satisfactory (see paragraph 706):

(*a*) *the Assembly* could, if it thought fit,

(i) endorse the terms of the proposed Master Agreement and Power Contract;

(ii) enact the Volta River Authority Ordinance (but it would not then be brought into operation);

(iii) enact the Land Acquisition Ordinance (which would be brought into force later);

(iv) enact the Local Government Ordinance (which would be brought into operation when needed);

(v) resolve to make the necessary financial provision for loans to the Authority;

(vi) vote supplementary funds to enable the Preparatory Commission to recruit key staff for the Volta River Authority and for the construction of certain preliminary works.

(*b*) *the Preparatory Commission*, with the approval of the two Governments, could *immediately*

(i) instruct its consulting engineers to invite tenders (by whatever procedure had been agreed) for the dam and power installation. By this stage it should be reasonably

certain that a contract would be awarded at the appropriate time for the hydro-electric section of the Project, and the following additional measures could be taken without undue risk;

(ii) authorise the survey of proposed tunnel for the railway between Koforidua and Kpong;

(iii) recruit an entomologist, field officer and technician for preliminary observation and experiment on *S. damnosum*;

(iv) recruit an epidemiologist to take charge of initial health measures;

(v) authorise preparation of detailed architectural plans for the power station;

(vi) take any preliminary action needed to preserve the landscape.

(*c*) *The Gold Coast Government* could *immediately*

(i) adopt its Second Development Plan;

(ii) take any further necessary action on those items in the Plan which were directly related to the Volta Project (e.g. trunk roads, road detour around Accra, improvement of certain bridges);

(iii) (dependent on policy), authorise its consulting engineers to invite tenders for the construction of the second stage of port development at Tema;

(iv) place orders for additional locomotives and rolling stock;

(v) place orders for additional telecommunications equipment;

(vi) establish the organisation to deal with compensation and resettlement in the area subject to inundation, and to assist the riparian communities;

(vii) survey the region and the villages adjacent to the smelter site.

STAGE C

724. This would cover a period of about six months, and would extend from the time of calling for tenders for the dam and power installation until a decision to accept a particular tender had been made.

725. During this period:

(*a*) *the Gold Coast Government* could follow up the action outlined in Stage B;

(*b*) *the Preparatory Commission* could—

(i) appoint certain key staff who would be required for the Volta River Authority and

(ii) (dependent on policy) award contracts for the construction of access roads to the dam site and a limited amount of temporary housing.

726. At the end of this period:

(*a*) *the consulting engineers* would make a report to the Preparatory Commission on tenders submitted for the dam and power installation;

(*b*) *the two Governments* (in consultation with the aluminium companies) could decide on the acceptance of a particular tender;

(*c*) (dependent on policy) *the Gold Coast Government* could accept a tender for the second stage of port development at Tema.

STAGE D

727. Immediately a decision had been made to accept a tender for the dam and power installation, it would be possible for

(*a*) *the Gold Coast Government* to bring the Volta River Authority Ordinance, by then enacted, into operation, and thus constitute the Authority;

(*b*) *the parties to the Project* to appoint their respective members to the Board;

(*c*) (a few days subsequently) *the parties to the Project* to execute on the same occasion the Master Agreement, the Power Contract and the Railway and Port Agreements. It would be necessary for any *United Kingdom* legislation authorising the Government loan to the Volta River Authority to have passed into law some time before this stage.

(*d*) *the Gold Coast Government* to acquire under the Public Lands (Leasehold) Ordinance land needed temporarily by the Volta River Authority; and then to lease this land to the Authority;

(*e*) *the Gold Coast Government* to bring into operation the Land Acquisition Ordinance as regards the area to be inundated and the areas around Ajena and Kpong, leases being granted immediately to the Volta River Authority, and in respect of the smelter and township;

(*f*) the first amount of loans to be received by *the Volta River Authority* against mortgages executed by the Authority;

(*g*) *the Volta River Authority* to appoint its consulting engineers;

(*h*) *the Volta River Authority* to let the contract for the dam and power installation;

(*i*) *the Volta River Authority* to repay to the Governments and the smelter company the agreed amounts expended on preliminary investigations.

(*j*) *the Gold Coast Government* to implement those parts of its Development Plan which were essential to the execution of the Volta Project;

(*k*) *the Gold Coast Government* to proceed with the compensation and resettlement operation, and take action as necessary amongst the riparian communities;

(*l*) *the Gold Coast and United Kingdom Governments* to arrange for the appointment of auditors to the Authority.

PART VII

General Observations and Acknowledgements

Chapter 44

GENERAL OBSERVATIONS AND ACKNOWLEDGEMENTS

A. GENERAL OBSERVATIONS

Objective of the Preparatory Commission

728. Throughout its work the Commission endeavoured to make a thorough and conservative analysis of the Volta River Project so as to enable the two Governments and aluminium companies to make policy decisions with as clear a picture as possible of the scheme before them. In the expanded terms of reference given to the Commission (shown in paragraph 3 of Appendix II) the Special Commissioner was asked to submit a report embodying his recommendations on the feasibility of the scheme, any modifications which seemed to him desirable and any action which he wished to suggest for its furtherance.

729. Accordingly, some general observations are made in this chapter which it is suggested might be taken into consideration when the future of the Project is decided.

Implications of Success or Failure

730. The size and complexity of the Project must be kept in mind constantly when assessing its chances of successful development. Not only would it involve the physical construction of several major works, but it would also represent a remarkable example of co-operation in a less developed country, at a time of very rapid political transition, between the public enterprise of two Governments and the private enterprise of two aluminium companies situated in different parts of the world. Very large sums of money—in dollar, sterling and Gold Coast currencies—would be involved in the scheme.

731. The results of such a great undertaking would not only have major and direct consequences for the parties to the Project themselves; they could also have an indirect effect on the willingness of other Governments and private interests to make large investments in schemes of similar magnitude now under consideration in other parts of the world.

732. A successful outcome of the Volta Project would have beneficial results for all concerned with it. To the aluminium companies it would mean that an additional source of ingot would have been brought into production at a competitive price. Such a development would appear to fit in with the general policy of expansion which has characterised the operations of various aluminium companies—particularly Aluminium Limited—since the end of the World War II.

733. To the British Government, as emphasised in the White Paper, the successful operation of the scheme would make available at competitive prices, a further Sterling Area supply of aluminium far in excess of the Area's present production. It would also advance the Government's policy of encouraging the development of the resources of the Commonwealth. The scheme, if successful, could save the Sterling Area about one hundred million dollars annually when at full production.

734. The Gold Coast Government would stand to gain marked advantages from the effective development of the Project. New and very large capital assets would be created in the Gold Coast. Opportunities for employment and training in new professions and skills would be provided. The present dangerous dependence of the national economy on a single export, cocoa, would be substantially reduced. The interests of the Gold Coast in the Project have been analysed for the Government by Professor W. Arthur Lewis. Probably his most significant conclusion is that its successful development could do more to increase per capita income than any other contemplated use of the national resources. He has calculated that aluminium would earn at least twice as much per worker employed as cocoa.

735. Such are some of the possible results of success.

736. The failure of the Project would clearly have grave consequences for the aluminium companies; large sums of money would be lost and their willingness to invest in countries such as the Gold Coast would be prejudiced.

737. The consequences for the British Government would be very serious. As indicated in paragraph 16 the failure or success of this scheme could have a profound influence on the possibility of raising finance for the development of other large-scale schemes in the less developed parts of the world.

738. The repercussions on the Gold Coast would also be very serious. Participation in the Project would involve the use of a substantial part of the country's resources and if (say) towards the end of the construction period it was apparent that the scheme could not succeed, the country would be left with very costly services—for example the new railways—which would have practically no economic justification for many years to come except as part of the Volta scheme. A large hydro-electric installation would have been built with a capacity to produce power vastly in excess of the country's foreseeable needs, so that any power which could be used would be inordinately expensive.

739. The stakes are thus very high.

The Special Position of the Gold Coast

740. It is against that background of possibilities of success and failure that the special position of the Gold Coast should be considered.

741. A decision to participate in the Project would clearly be a major act of Governmental policy—which it is hoped that the debate in the Assembly would show to be national policy as well[1]—and could be interpreted as a willingness on the part of the Government and people to make certain sacrifices over the next eight to ten years in order to achieve a great and permanent strengthening of the national economy.

742. The sacrifices would come primarily through an appreciable modification to the plans for other national development over that period. Some attractive plans would have to be deferred, and this could cause a certain amount of difficulty.

743. Attention has been drawn in the report to the likelihood of adverse criticism of some of the salaries which would have to be paid to obtain the services of essential staff for the Volta River Authority.

744. The practical limitations of the rate at which certain appointments could be Africanised would also need to be taken into account by the Government. There is complete agreement that the training of Africans at all levels, and in all professions and skills, should be a most important objective of the scheme; but it must be realised that training of itself would not be enough. The individual would also need to be efficient—if he were efficient, economic reasons alone would ensure the development of Africanisation. Yet some of the most responsible posts throughout the scheme could probably not be filled by Africans for a considerable number of years, simply because they would require professional qualifications which, as yet, very few local men possess; and, equally important, demand many years of practical experience, reinforced by a record of successful service.

745. A further factor which would also have to be taken into account would be the great demand for Africans of outstanding ability to work in the professions, in Government Service and in commerce, which is bound to exist for many years to come.

746. Thus, whilst all the parties to the Project have expressed their strong support for the training of Africans as quickly as possible, it would be prudent to acknowledge the factor of time in certain cases.

747. The sociological impact of the scheme needs to be emphasised in particular for it could easily extend over decades. The impact would be that of a very modern large-scale industry suddenly planted in the middle of a society which is itself now undergoing marked changes. With understanding, imagination and good human relations in all spheres, the impact could be beneficial; but if the social problems created by the scheme were ignored or underestimated they would result in very harmful consequences.

748. Reference has already been made to the possible national advantages which the Gold Coast would secure from the successful development of the Project. It is a fortunate fact that the strong financial position of the Gold Coast would already permit it to enter the scheme as an equal partner.

749. These are some of the factors which the Gold Coast Government might take into account in determining its attitude towards the scheme. Most of the difficulties should disappear with the end of the construction phase. They would all probably vanish if the Project was brought into successful operation.

Control of the Project

750. It is convenient to deal here with a fear which has been expressed sometimes in the Gold Coast that the Volta River Project would represent some method of overseas control, but in a disguised form. The facts of the situation do not support this fear, and they should be made clear to everyone.

[1] The formation of the Gold Coast National Committee (paragraph 12) was intended by the Gold Coast Government to assist in placing the Project on a national basis.

751. First, the physical assets (the dam, the power station, the smelter, the railways, the mines and the townships) would all be created in the Gold Coast. Obviously it would be quite impracticable to move any of them out of the country.

752. Secondly, the Volta River Authority which would have primary responsibility for the scheme would be a statutory body subject to the Gold Coast Government. It would have a majority of Africans as members.

753. Thirdly, the Gold Coast Government, as a sovereign government, would control all the affairs of the country. Amongst other powers, it would naturally have the power to tax the profits of the smelter company in accordance with normal Government policy.

754. Control of the Project thus involves no risks for the Gold Coast; the risks would be taken by the overseas investors putting money into physical assets which they could not move.

Assessment of the Prospects

755. In assessing the prospects for the Project it can be said immediately that if the parties agreed, in principle, to proceed with it, all the elements essential for success would be available. In the Gold Coast, the bauxite and a potential source of cheap power already exist; the aluminium companies could provide the technical knowledge and administrative and organisational experience required for the mining and smelter operations; and the necessary manpower and financial resources could be provided.

756. The task would then be for the parties to ensure that all those resources were used during the phase of construction in such a way that the Project was built efficiently and economically, thus achieving, amongst other things, the fundamental requirements of cheap power.

757. It may be asked again " What are the prospects for the successful development of the Project? Is it technically sound? Is it economically attractive? Is it, in fact, feasible? "

758. Such questions strike directly, and correctly, at the terms of reference given to the Commission. In response it can be stated that, subject to what is said in the appropriate parts of this report, the Commission considers that the Project is technically sound and economically attractive.

759. The feasibility of the scheme, however, requires very careful consideration in relation to the time of its inception.

Period of the Agreement and Timing of the Project

760. Planning has been based on a partnership extending over eighty years. The most active link in the partnership during that period would necessarily be between the Gold Coast Government and Aluminium Limited. This is said because the Project would be built and operated in the Gold Coast, and on the assumption that Aluminium Limited would have the largest interest in the smelter company; the direct interest of the British Government would be reduced with the passage of years and the repayment of its loans.

761. One thing can be said with certainty. If any Gold Coast Government was to enter into an agreement extending over eighty years, and with a sincere desire to see it respected, it would be of fundamental importance that the Project and its basic implications should be fully accepted and supported by people all over the country.

762. Obviously that acceptance and support could only exist if there was widespread knowledge and understanding of the scheme amongst all sections of the population. It follows therefore that the Gold Coast Government would have an imperative responsibility to ensure that every opportunity was provided for the development of that knowledge and understanding. It has been made very clear to the Commission that the present Government of the Gold Coast is sensitive to this responsibility and intends to do everything in its power to discharge it; a considerable amount has been done already (see Appendix II, footnote to paragraph 21).

763. The process of spreading knowledge about the scheme would therefore have some bearing on the timing of the start of the Project, but another factor would be the timing of the next stage of constitutional development in the Gold Coast.

764. The investigations into the Project have been carried out during a period of rapid constitutional transition in the Gold Coast. This political development has naturally, and always, been treated by the Gold Coast Government and the British Government as a separate and distinct issue of policy from the Volta River Project. It would seem essential that this distinction should continue to be preserved until both issues are settled.

765. The Commission is, of course, in no way concerned with the policies of the British Government and the Gold Coast Government in relation to future constitutional development. The timing of any new change in the constitution of the Gold Coast, however, has a bearing on the time when the scheme might be started as a result of the signing of formal agreements. Since those agreements would be designed to last for eighty years, the Gold Coast Government has made it

clear to the Preparatory Commission that the Government considers that there would be great and lasting advantages if the timing of the Volta Project could be so arranged that the Government only entered into final agreements as the Government of a sovereign independent nation. The other parties to the Project are fully aware of the Gold Coast Government's views on this matter.

Commonwealth Relations

766. The Gold Coast Government has declared its desire to remain within the British Commonwealth and the Sterling Area. One of the attractions of the Project is that it would represent another practical example of Commonwealth co-operation, envisaging, as it does, a working partnership between various authorities and interests in the Gold Coast, the United Kingdom and Canada.

Race Relations

767. Today the relations between various races in the Gold Coast are harmonious. It would be essential to ensure that all those concerned with the Project contributed to that harmony, and did nothing to prejudice it. This consideration is another reason for the emphasis placed on human factors throughout the report.

Conclusion

768. The Commission has endeavoured to place before the parties to the Project the results of its investigations and its views on the scheme, but it is not, of course, concerned in any way with the policies which the parties, either individually or collectively, may adopt. The Commission has no doubt that the prospects of success and the possible risks involved in going ahead with the scheme will be assessed carefully; it assumes that the consequences of not proceeding with the Project will be considered with equal care.

B. ACKNOWLEDGEMENTS

769. It remains only for the Preparatory Commission to acknowledge the assistance which it has received throughout the period of its existence. The debt is a heavy one.

770. The Commission has worked constantly and intimately with virtually every Ministry and Department of the Gold Coast Government. That association has always been an exceedingly happy one, and the Commission wishes to express its appreciation to the Governor and Commander-in-Chief, to the Prime Minister and Ministers, and to all the officials and staff, both in Accra and throughout the country, who have given so much help.

771. The Prime Minister, the Minister of Finance and his two predecessors, and the Minister of State have all been concerned on a daily basis with the Commission's work. The Commission wishes to thank them for their constant support and assistance, and for their valuable advice about conditions in the Gold Coast. The Commission benefited to a special degree by the fact that the Prime Minister and the Minister of Finance (who was previously Minister of Commerce and Industry) were both associated with the Commission's work from beginning to end, thus providing most valuable continuity.

772. The Gold Coast Commissioner in London and his staff provided help which the Commission gratefully recognises.

773. The Commission wishes to acknowledge the many useful comments and suggestions which were made on its draft reports by the Gold Coast National Committee for the Volta River Project.

774. Acknowledgement is made, too, of the assistance and support given to the Commission by Her Majesty's Government in the United Kingdom; and, in particular, by H.M. Treasury, the Board of Trade, the Colonial Office, the Ministries of Works, Supply, and Fuel and Power, the Department of Scientific and Industrial Research and its Research Stations (particularly the Building Research Station), and by the British Transport Commission and the Central Electricity Authority. The Crown Agents also gave valuable assistance, and H.M. Stationery Office was most helpful in making arrangements for the printing of the report. The Ministry of Materials also gave much help to the Commission until its functions were transferred to the Board of Trade.

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