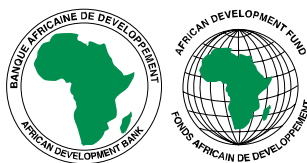


**AFRICAN DEVELOPMENT BANK GROUP**



**BENIN/TOGO**

**NANGBETO HYDROELECTRIC DAM**

**Project Performance Evaluation Report (PPER)**

**OPERATIONS EVALUATION DEPARTMENT  
(OPEV)**

**12 January 1995**

# ABSTRACT OF EVALUATION REPORTS

Number

ADB/OPEV/94/16

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1994



## OPERATIONS EVALUATION OFFICE (OPEV) AFRICAN DEVELOPMENT BANK

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BENIN/TOGO

Board Reference Number

NANGBETO HYDROELECTRIC DAM PROJECT  
(ADB LOAN NO. CS/BN/T/PU/83/001)

1. Since its establishment in 1968, CEB (Communauté Electrique du Bénin), the inter-State institution serving the two (2) Governments of Benin and Togo set itself the task of promoting the development of the hydroelectric potential of the MONO river which forms the boundary between the two countries. Engineering and economic studies culminated in the choice of the NANGBETO site for the construction of the first dam.

2. The purpose of the Nangbeto hydroelectric dam with a capacity of 60 MW and a potential of 148 GWh/year is to:

- i) satisfy the medium-term power requirements of Benin and Togo (up to 1990);
- ii) produce a large water reserve (1.7 billion m<sup>3</sup>) which should make it possible to:
  - a) have a fishery production potential estimated at between 1,000 and 1,500 tons per year,
  - b) develop 43,000 ha of irrigation blocks (with a project of two priority blocks of 2,000 ha).

3. The components of the project are as follows:

- i) civil engineering structures (dam and reservoir);
- ii) electro-mechanical equipment;
- iii) transmission network;
- iv) resettlement of the population;

- v) project management and training; and
- vi) engineering and works supervision.

4. The actual cost of project on completion in 1987 is UA 98.22 million. The ADB loan of UA 8.56 million represents 8.7% of the total cost. The rest was financed at the rate of UA 13.93 million (or 14.2%) by the Government and CEB and UA 75.73 million (i.e. 77.1%) was distributed among the other donors.

5. The project was completed in June 1987 on time and without cost overruns.

6. On the whole, considerable effort was made to solve all problems and to achieve a smooth implementation of the project.

7. Works were carried out according to contractual requirements. The procurement of goods and services was satisfactory. The services of the Engineering Consultant and the efforts made by CEB, the executing agency, contributed in the success of the project.

8. The structures are of good quality, design criteria guarantee their good maintenance and ensure a satisfactory viability of the facilities.

9. The initial goal of the project which was to satisfy the medium-term electric energy requirements of Benin and Togo has been widely achieved.

10. The IRR on completion was estimated at 5.32% against 9.47% envisaged at appraisal and the ERR on completion was 20.81% against 13.81% at appraisal.

11. The objective relating to fish breeding activities failed because no structure was put in place. The lack of equipment for fishermen and the absence of a sensitization campaign underlie this failure.

12. The projected socio-economic performances are still linked to the implementation of secondary projects whose investments are included in the Bank Group programming and concern especially fishing and irrigation schemes.

13. Lessons learnt from this experience were mainly relating to the following points:

- a) The design of a hydroelectric dam under an overall energy master plan whose effects concern several countries is a long-term successful factor promoting regional integration and the interconnection of networks at least cost.
- b) The appraisal of secondary projects (agriculture-pisciculture - with a social character) shall go hand-in-hand with the appraisal of the hydroelectric project itself. Each of the secondary projects should also contain conditions for implementation without dam. Only the net result of the project with and without dam should be integrated into the profitability study.

- c) Environmental issues relating to the dam should be addressed right at the prefeasibility studies of the project so that considered actions taken later on should be in line with the environment and that the protective measures to be taken and their costs and financing resources should be clearly identified and put forward. The appraisal and completion reports should have examined environmental issues and estimated the appropriate measures to be taken.
- d) A good technical supervision by the Engineering Consultant contributed substantially to the success of the project.
- e) The installed cost of the KW which is US\$ 2,100 at 1991 prices is correct compared to the available statistics of projects with similar sizes (ranging between 2,000 and 5,000 US\$).
- f) The organizational and staff training aspects of the project are successful as well as the security for institutional viability.

14. Consequently, recommendations have been made both to the Governments, the CEB and the Bank to improve future operations in the sector: in particular it has been recommended:

A. For the Governments of Benin and Togo

- a) The implementation of supplementary projects should be a priority so as to benefit fully from the economic possibilities which the dam can offer besides energy production. The implementation of the fish breeding development project on the reservoir should be encouraged by a priority financial support.
- b) Efforts made by the Governments to resettle the people should be pursued so as to provide a better agricultural training to farmers, reduce the use of fuel wood, ensure soil conservation and strengthen the sensitization of the population to the need of protecting the reservoir against harmful effects of all types and to protect the plant ecosystem surrounding the dam.
- c) For the long-term development of the electric sector, the Governments should encourage interconnection projects with neighbouring countries (Ghana, Nigeria and Côte d'Ivoire). The price of the KWh delivered should be more advantageous than any other solution.
- d) As regards irrigation schemes in the Mono lower valley and taking into account the encouraging results obtained from existing schemes and the competitiveness of the price of husked rice compared to imported rice (following the devaluation) and to comply with the conclusions of the impact study, it recommended that:

- i) a study of the rice sub-sector be made as well as improvements to stimulate national production;
  - ii) a management structure be put in place with the cooperation of the beneficiary population while resolving concurrently land problems.
- e) For the ADJARALLA Hydroelectric Development Project, its implementation should take into account the outcome of the environmental impact study, especially:
- i) proposed organization of fish breeding around the lake with a full component;
  - ii) enacting fishing legislation based on the outcome of the support project being implemented on FAO financing;
  - iii) taking necessary measures to demand the treatment of the effluents from the (TOGOTEX) textile factory and to avoid the risk of pollution and consequently the death of fish;
  - iv) the programme for the resettlement and compensation of villagers, taking into account the outcome of the land tenure study completed in May 1994.
- f) The Governments should, with regard to the recovery of arrears, encourage the efforts made by CEB and especially the Recovery Committee so as to stabilize the situation which will enable the cash holdings of the institution to improve.

B. As regards CEB

- a) Carry on the buttress works on the left bank to stop the phenomenon of erosion observed and in this way avoid the danger of slipping at the approaches of the dam.
- b) As regards its ongoing computerization programme, CEB should speed up the application on stock management so as to carry out its maintenance programme effectively.

Fish-breeding Component

- c) Taking into account the failure of this component in the NANGBETO project, it is recommended that necessary measures be taken to ensure that in the ADJARALLA project, this component should be well-defined and its financing should make it possible to put in place an adequate structure.

### Thermal Equipment Component

- d) Taking into account the present energy deficit, the rehabilitation of the thermal equipment appears necessary so as to enable CEB to cover needs pending the completion of the CEB/NEPA interconnection projects and the Adjaralla Dam and to avoid resorting to load-shedding.

### C. Bank Group

- a) As regards the Adjaralla Hydroelectric Development component, the ADB should play a catalytic role in filling the financing gap and in the commencement of the project as soon as possible so as to support the efforts of the Governments.
- b) With regard to the CEB/NEPA Interconnection Component; given that this project will contribute to the reduction of the investment and operating cost of electric energy, it is recommended that its implementation be accelerated and facilitated so as to satisfy requirements by the year 2005.
- c) Increase supervision and monitoring missions in order to be able to react on time to remove possible obstacles.
- d) ADB should ensure that feasibility studies include all technical, economic and environmental aspects.
- e) Stress on feasibility studies relating to all components offering a better regional integration.
- f) The ADB should ensure strict compliance with procedures for the procurement of goods and services.

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This Audit Report is based on the findings of a Bank Group post-evaluation mission mounted in June 1994 by Mr F. OUALI, Civil Engineer to Benin and Togo. Enquiries concerning the content of the Report should be addressed to Mr I.B.C. JOHN, Director OPEV on Extension 4089.

CURRENCY, ACRONYMS AND ABBREVIATIONSCurrency Equivalents

1.	Local currency	=	CFA Franc
	At appraisal	=	(4th quarter 1983)
	UA 1	=	CFAF 392.07
	UA 1	=	US\$ 1.07867
2.	At completion	=	(4th quarter 1990)
	UA 1	=	CFAF 364.61
	UA 1	=	US\$ 1.39256
3.	At post-evaluation	=	(2nd quarter 1994)
	UA 1	=	CFAF 806.595
	UA 1	=	US\$ 1.41260

Weights and Measures

1 KV	=	Kilovolt	=	1000 volt
1 KW	=	Kilowatt	=	1000 watt
1 MW	=	Megawatt	=	1000 kilowatt
1 KWh	=	Kilowatt-hour	=	1000 watt-hour
1 MWh	=	Megawatt-hour	=	1000 kilowatt-hour
1 GWh	=	Gigawatt-hour	=	1000 megawatt-hour
1 KVA	=	Kilovolt-ampere	=	1000 Volt-ampere
1 MVA	=	Megawatt-ampere	=	1000 Kilovolt-ampere
1 MT	=	Metric tonne	=	1000 kilogrammes
TEP	=	Tonne Oil Equivalent		

Abbreviations

ADB	=	African Development Bank
BADEA	=	Banque arabe pour le développement en Afrique
CCCE	=	Caisse centrale de coopération économique
CEB	=	Communauté électrique du Bénin
CEET	=	Compagnie énergie électrique du Togo
CFPP	=	Centre de formation et de perfectionnement Professionnel
CIDA	=	Canadian International Development Agency
CIMAO	:	West African Cement Factories
CTL	=	Lome Thermal Power Station
EDF	=	Electricité de France
EEC	=	European Economic Community
FYOP 3	=	Five-Year Operational Programme n° 3
GDP	=	Gross Domestic Product
GNP	=	Gross National Product
GSM	=	Gross Self-financing Margin
HV	=	High Voltage
IDA	=	International Development Agency



KfW	-	Kreditanstalt für Wiederaufbau
LC	-	Local Currency
LMT	-	Long and Medium-term
LV	-	Low Voltage
MV	-	Medium Voltage
NEPA	-	National Electric Power Authority
OPEC	-	Organization of Petroleum Exporting Countries
OTP	-	Office Togolais des Phosphates
SBEE	-	Société Béninoise d'Eau et d'Electricité
ST	-	Short Term
UNDP	-	United Nations Development Programme
VRA	-	Volta River Authority

**FISCAL YEAR**

01 January - 31 December

KEY PROJECT DATAPRELIMINARY DATA

COUNTRY : Togo, Benin

PROJECT TITLE : Nangbeto Hydroelectric Dam Project

ADB LOAN : N° CS/BN/T/PU/83/001 of  
13.07.1984

BORROWERS : Governments of the Republics  
of Benin and Togo

BENEFICIAIRES : CEB (Communauté Electrique du  
Bénin)

EXECUTING AGENCY : CEB: Nangbeto Project Department

A. KEY LENDING DATAAT APPRAISALIMPLEMENTATION

1.	Date of request	1981	
2.	Loan amount	* 22.01 at appraisal	
		* UA 15.44 M	UA 8.56 M
		at loan agreement signature	
3.	Interest rate	9.5% on amounts disbursed and outstanding	
	* Statutory charge	1% per year on amounts disbursed and outstanding	
	* Commitment charge	1% per year on the undisbursed loan portion	
	* States' onlending rate to CEB	: The same loan conditions	
4.	Duration	: 20 years	
5.	Grace period	: 5 years	
6.	Repayment modalities	: The principal in 30 half-yearly payments	
7.	Board approval	: October 1983	
8.	Loan signature	: 13 July 1984	
9.	Date of effectiveness	: 6 March 1985	

(v)

<b>B. PROJECT DATA</b>	<b>ESTIMATE</b>	<b>ACTUAL</b>
1. Total cost in millions of UA	117.15	98.22
2. Financing plan (in MUA)		
a. At appraisal		
- ADB	22.02	8.56
- Government/CEB	5.20	13.93
- Others	89.93	75.73
	<hr/> 117.15	<hr/> 98.22
b. <u>After loan agreement signature</u>		
- ADB	15.44	8.56
- Government/CEB	20.11	13.93
- Others	96.59	75.73
	<hr/> 132.14	<hr/> 98.22
3. Deadline for first disbursement	27 June 1985	
4. Deadline for last disbursement	31 Dec. 1990	
5. Actual date of last disbursement	4 July 1988	
6. Commencement of studies and works	June 1984	August 1984
7. End of works	Mid 1987	Summer 1987
8. Project completion date	-	Dec. 1987

**C. Performance Indicators**

1. <u>Overruns</u>	:	Nil
2. <u>Slippages</u>	:	2 months (39/37)
- Delay in the entry into force	:	Nil
- First disbursement delay	:	3 months
- Last disbursement delay	:	Nil
- Number of extensions of the last disbursement	:	Nil
- Delay in the completion date	:	Nil
3. <u>Project implementaton status</u>	:	Completed
4. <u>Institutional performance</u>	:	CEB - satisfactory
5. <u>Performance of the enterprises</u>	:	Satisfactory
6. <u>Engineering Consultant's Performance</u>	:	Satisfactory

		<u>Appraisal</u>	<u>Completion</u>
7.	IRR	9.74%	5.32%
8.	ERR	13.80%	20.81%

D. Missions	Date	Nbre of Persons	Man/day
- Identification	-	-	-
- Preparation	-	-	-
- Appraisal	May 1983	3	45
- Monitoring	-	-	-
- Supervision	-	-	-
- PCR	Oct/Nov. 90	1	15
- Post-Evaluation	June 1994	1	15

E. Disbursement	<u>Estimated</u>				<u>Actual</u>
* Total disbursed	15.44				8.56
* Amount undisbursed					6.88
* Amount cancelled					6.88
* Amount annually disbursed:					
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>Total</u>
	2.59	4.26	1.25	0.46	8.56

F. Other projects financed by the Bank Group in the Energy Sector in Benin and Togo.

Project	Loan	Amount in MUA	Approval	Implementation Status	PCR
* <u>TOGO</u>					
- Lome Electricity	-	2.80	27/06/1974	completed	
- Dispatching Centre	-	7.46	19/08/1987	in progress	
* <u>BENIN</u>					
- Extension of Power Distribution Network in the Coastal Area	-	1.60	05/04/1974	completed	
- " " Suppl.	-	1.90	20/12/1976	completed	
- Onigolo Cement Factory Electrification	-	5.00	17/10/1987	completed	
- AEP Study and Electrification of 9 main towns	-	0.75	22/03/1978 (FAD)	completed	
- AEP and electrification of 9 main towns	-	9.00	18/03/1982	completed	Preliminary

ABBREVIATED PERFORMANCE AUDIT MEMORANDUM (ABBREVIATED PPAM)  
OF THE NANGBETO HYDROELECTRIC PROJECT

PREFACE

1. This Project Performance Audit Report (PPAR) comprises the Project Performance Audit Memorandum produced by the Operations Evaluation Office and the project completion report produced by the Department of Infrastructure and Industry, North Region (NISI). It focuses on the NANGBETO hydroelectric project for which an ADB loan of UA 22.00 million (loan N° CS/BN/T/PU/83/001) was approved in July 1984 in favour of the Governments of Benin and Togo. ADB's contribution represents 18.8% of the total project cost which had been estimated at UA 117.15 million; the remainder was financed by the IDA, Kuwait Fund, OPEC, BADEA, KFW, CCCE, CIDA, FAC, UNDP and CEB - an Inter-State organization responsible for electric energy production and transportation in the two States.

2. The project was completed in June 1987, the semi-industrial operation of the power station started in October 1987 and the testing of all the equipment ended in December 1987. The project was implemented without delays and cost overruns.

3. A completion mission took place in October 1990. The relevant completion report (hereto attached), which was finalized in September 1992, dealt with all the aspects relating to project preparation, appraisal and implementation, as well as the evaluation of the various performances.

4. The Audit mission which took place in June 1994 comprised a visit of all the installations and helped complete aspects not covered by the PCR, in particular the technical viability of the works after six years of operations, the operational performances, the economic viability, the short, medium and long-term sustainability and development of the project. In view of the quality of the PCR, an Abbreviated Audit was considered adequate.

5. This abbreviated PPAM gives a brief summary of the findings of the PCR and deals with the durability of the effects and the development of the project. The major findings, lessons and recommendations focus on the project itself as well as on the electricity sector of the two (2) countries (Benin and Togo).

## 1. MAJOR FINDINGS OF THE PROJECT COMPLETION REPORT

1.1 Since it was established in 1968, the CEB (Communaute Electrique du Bénin) an inter-state organization, has had as its main objective the development of the MONO river hydroelectric potential. The engineering and economic studies led to the choice of NANGBETO for the construction of the first dam.

1.2 The purpose of Nangbeto dam with a capacity of 60 MW and a potential of 148 GWh/year is:

- \* to satisfy the medium-term power requirements of the Republics of Benin and Togo (deadline 1990);

- \* the large water reserve (1.7 billion m<sup>3</sup>) thus provided should enable:

- a) a fish production potential estimated at 1000 to 1500 tonnes per year; and

- b) the development of 43000 ha of irrigation blocks (with a project of two priority blocks of 2000 ha).

1.3 The project implementation unit was placed under the CEB to which project management was entrusted. The technical and administrative management as well as the training component were satisfactorily handled.

1.4 Technically, the Nangbeto project was implemented on schedule and within the estimated budget. There were no major modifications in the project. The only modification made was in the design of the equipment decided upon after the laboratory tests and it helped reduce cost. The services of the engineering consultant were satisfactory.

1.5 Goods and services for the components in which the Bank was involved, were procured in accordance with our existing rules of procedure.

1.6 One of the problems raised in the PCR and which affects sustainability focuses on the billing and recovery aspects at the CEB: the outstanding payments position shows that the CEB is facing the problem connected with the outstanding payments of the two (2) major cement companies in Benin and Togo.

1.7 Technically speaking, an analysis of the production of Nangbeto in relation to the total power sales at the CEB, with regard to the connected network, shows that the main objective of 148 Gwh has been adequately achieved.

1.8 The IRR at completion was estimated at 5.32% as against 9.47% projected at appraisal. The ERR at completion was 20.81% as compared to 13.80% at appraisal.

## II. VIABILITY AND PERFORMANCE

### 2.1 Operational Performances and Technical Viability

2.1.1 The results after six years of operation show that the criteria of design and the quality of materials used are satisfactory; the fittings and equipment of the various structures are in good condition and therefore guarantee a longer life of the scheme. The same observations were made on similar projects financed by ADB and for which the PCR have been prepared (namely the KOMPIENGA-LUPHOLO EZULWINI Dams).

2.1.2 The Dam is equipped with automatic control instruments which make it possible to monitor its behaviour in the long term.

2.1.3 With regard to investment, the cost of the Nangbeto dam is about US\$ 2100/installed KW, which is lower than the breakeven point currently admitted for this type of project, i.e. US\$ 5000/KW. For the sake of comparison with similar ADB-financed projects in Africa, the costs were US\$ 3950/KW for the LUPHOLO-EZULWINI project in Swaziland, US\$ 16370/KW for Kompienga in Burkina, US\$ 4582/KW for the SELINGUE Dam in Mali and US\$ 5090/KW for the REWEGURA Dam in Burundi.

2.1.4 Financed by ADF, the electric energy production and transportation Despatching Centre, will enable the CEB to equip itself with a centralized management centre of its network. The mission ensured that the design of this centre permits an optimum management of all the sources of energy (including the thermal power station which will help fill the gap pending the completion of the other programmed schemes).

2.1.5 The results established in 1994 demonstrate that the organizational structure put in place by the CEB for the operation and maintenance of its hydroelectric equipment as well as the efforts made by the maintenance teams in the servicing of the equipment are satisfactory enough to ensure a good long life of the installations.



## 2.2. Financial Performance and Economic Viability

### The Fish-breeding Component

2.2.1 The large water reserve formed by the dam should have served as a basis for the development of fish-breeding activities. This objective has not been achieved: no structure has been put in place for the organization of this activity; clandestine and non-conventional fishing rather resulted in a destruction of the fish potential and led the Togolese authorities to prohibit fishing.

### The Irrigation Scheme Component

2.2.2 Although its operational area remains the development and tapping of electric energy, the CEB is required to play the role of an agency coordinating the irrigation schemes of the lower MONO river valley the promotion and implementation of which is its responsibility.

2.2.3 A first tranche has been selected and proposed for Bank Group financing on the basis of the impact and feasibility study; and this in the form of a pilot project of 500 ha for each country (instead of the 2000 ha initially planned).

2.2.4 A site visit has made it possible to observe that the villagers have, pending the putting in place of this programme, space out grouped themselves into associations to cultivate rice. The yield of 11 tonnes/ha (at the rate of 5.5 tonnes/ha for each crop season) is encouraging\* and the villagers are able to sell their produce at the price of CFAF 210/kg which, since devaluation, permits to stand firm against the price of imported rice from Thailand at CFAF 240/kg (national statistics).

2.2.5 A study of the position of outstanding payments shows that the CEB is still confronted with this phenomenon, especially for the heavy users (the two cement factories in Benin and Togo, the Office Togolais des Phosphates and the Electricity Distribution Company of Togo (CEET), as SBEE had no fault at the time of the Bank's audit mission.

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\* By comparison, the yield observed for similar projects financed by the Bank are 5.5T/ha for the Kourani Baria project in Niger and 4.7 T/ha for the Boghé plain project in Mauritania.

2.2.6 To solve this problem raised in the PCR, a recovery committee has been set up since July 1993, and its action has made it possible to stabilize the outstanding payments: in effect, agreements have been signed with all the heavy users and, at present, they settle their bills regularly and pay their arrears by monthly tranches fixed according to the financial capacity of each institution.

2.2.7 In conclusion, the project has achieved its objective with regard to the principal component which is electricity production. The achievement of the projected economic performances remains linked to the implementation of the secondary components whose investments are maintained in the programming of the Bank Group.

### 2.3 INSTITUTIONAL VIABILITY

The CEB, as the agency responsible for the operation of the Nangbeto Dam and the management of the energy production park, has equipped itself with new management and organization tools (adapted new organization chart - computerization and optimized management by the dispatching centre), which will enable it to achieve in coming years a more efficient performance.

### 2.4 Environmental Impact

At project appraisal in 1983, this aspect was not taken into consideration. At project completion, the summary report on the resettlement of the population and on the environment concludes that there is no need for the particular protection of the plant species and wildlife found in the region.

### III. SHORT, MEDIUM AND LONG-TERM DEVELOPMENT

3.1 All the studies have concluded on an optimum plan for developing the potential of all the possible sources of energy.

#### The Hydro-electric Development Component

3.2 Within the framework of the definition of a plan for developing the hydro-electric potential of the MONO river downstream of the existing Nangbeto development, the feasibility studies as well as the technico-economic studies have concluded on the maintenance of the ADJARALA dam project.

3.3 This project, maintained under the ADB loans for appraisal in 1995, will enable the CEB to produce 400 GWh/year by hydro-electric means (at the rate of 150 GWh/year by Nangbeto and 250 GWh/year by ADJARALA), which represents 38% of its energy requirements in the year 2001.

3.4 The last diagnosis made on the thermal park of the two countries (from IBRD financing) reveals the necessity for a quick rehabilitation of this park to meet the short-term requirements.

3.5 In the medium-term, action will be taken on the electric networks interconnection project (CEB/NEPA) which forms a tranche of the global interconnection project of the networks of Côte d'Ivoire-Togo-Benin and Nigeria, whose study was carried out and adopted in 1989, more so as this multinational project is one of the best examples of regional integration which these countries and the Bank should make a success of, especially as regional economic integration corresponds to the priority objectives of the FYOP.3.

3.6 In the longer term, the Adjarala hydro-electric development project will help meet the electricity requirements up to the year 2001 (including the operation of the thermal park and the interconnection network).

#### IV. CONCLUSIONS, LESSONS AND RECOMMENDATIONS

##### 4.1 Conclusions

###### 4.1.1 Project Implementation

From the technical and works implementation points of view, the construction of the dam was a success. The works were carried out in keeping with the contractual demands, and did not necessitate major modifications.

The procurement of goods and services was satisfactory and the monitoring of the Engineering Consultant during the works contributed to the success of the project.

The project was completed on schedule and within the estimated budget.

###### 4.1.2 Project Result

The works are of good quality and the design criteria guarantee a good resistance of the structure.

The initial purpose of the project, which was to meet the medium-term electric energy requirements of Benin and Togo has been adequately achieved.

The objective relating to the development of fishbreeding activities was a failure as no structure had been put in place. Lack of fishing boats and nets and the absence of an awareness campaign and training were responsible for this failure.

###### 4.1.3 Project Performance

The behaviour of the dam since the beginning of its filling up to the date of the Audit mission (June 1994) has been satisfactory.

The performances of the executing agency were remarkable and, those of the other operators, generally satisfactory. This project is an example of coordination between the two States, and falls within the regional integration policy.

#### 4.1.4 Viability of the Project

The security factors, the quality of the materials and equipment put in place, the competence of the operating and maintenance teams, the automatic control measurements as well as staff training are highly satisfactory and guarantee the long life of the scheme.

The CEB has undertaken to reorganize its administrative management by putting in place new organizational facilities and appropriate computer equipment. Particular attention has been paid to staff training.

4.1.5 In general, all the performance criteria (of design, operational and institutional implementation) are satisfactory and the project is a success.

#### 4.2 Lessons

- The design of a hydro-electric dam within the framework of a global energy master plan whose spin-offs affect several countries is a factor of long-term success promoting regional integration and network interconnection at the lowest cost.
- The appraisal of secondary projects (agriculture-fish farming - social character) should go hand in hand with the appraisal of the hydro-electric project itself. Each of the secondary projects should also meet the conditions of an implementation without dam. Only the net income of the project with and without dam should be included in the profitability study.
- Environmental issues relating to the dam should be tackled right from the pre-feasibility studies of the project so that valorized actions taken later on can be in harmony with the environment and the protection measures to be taken, and their costs and means of financing clearly identified and put forward. The evaluation and completion reports should have examined the environmental issues and assessed the implementation of the appropriate measures.
- A sound technical supervision of the Engineering Consultant contributes considerably to the success of the project.

- The installed KW price of US\$ 2100 at the 1991 rate is correct in comparison to the statistics available on projects of similar size (between US\$ 2000 and 5000).
- The organizational and staff training aspects are factors of success of the project and guarantee its institutional viability.

#### 4.3 Recommendations

In addition to the recommendations identified in the PCR, the main actions which the Audit mission can recommend concern especially the following points:

##### A. For the Governments of Benin and Togo

- The development of complementary projects should be a priority in order to take full advantage of the economic possibilities which the dam may offer outside electric production. The implementation of the fish-breeding development project on the dam should be promoted by a priority financial support.
- The efforts made by the Governments under the relocation of the population should be pursued in order to give a better agricultural training to farmers, reduce the use of firewood, ensure soil preservation and strengthen the education of the population on the necessity to protect the dams from all sorts of harmful effects and to preserve the vegetal ecosystem surrounding the lake.
- For the long-term development of the energy sector, the Governments should promote interconnection projects with the neighbouring countries (Ghana, Nigeria and Côte d'Ivoire). The price per KW supplied should be better than any other solution.
- Concerning the irrigation schemes in the lower valley of the MONO, in view of the encouraging results obtained on the existing schemes, given to the competitive price of husked rice as compared to imported rice (following devaluation), and in order to comply with the findings of the impact study, it is recommended that:

- i) an analysis of the rice sector be carried out and proposals for improvements made to stimulate the national production;
- ii) a management structure be put in place in collaboration with the recipient population while at the same time solving the land problems.

- For the ADJARALLA hydro-electric development project, its implementation should take into consideration the results of the environmental impact study, especially:

- i) the organization of fishing around the lake with a full component;
- ii) the putting in place of a fishing legislation based on the results of the support project being implemented on FAO financing;
- iii) the launching of necessary measures to insist on the treatment of the textile factory (TOGOTEX) effluents and avoid the risk of pollution and consequently fish mortality;
- iv) in the villagers' resettlement and compensation programme, the taking into consideration of the results of the land study completed in May 1994

- Regarding the arrears recovery component, the Governments should encourage the efforts of the CEB and more especially those of the recovery committee to adjust the situation, which will help improve the cash balances of the Institution.

#### B. For the CEB

##### The Dam Component

- Construction of protective works on the dyke of the left bank in order to check the erosion phenomenon observed and so avoid the danger of landslides on the access road to the dam.

- Within the framework of its ongoing computerization programme, the CEB should speed up the application relating to stock management in order to better implement its maintenance programmes.

#### The Fish-breeding Component

- In view of the failure of this component in the NANGBETO project, it is recommended that the necessary steps be taken so that in the ADJARALLA project, this component is well defined, such that its financing can enable the putting in place of an adequate structure.

#### The Thermal Park Component

- Given the current energy shortage, the rehabilitation of the thermal park proves necessary so as to enable the CEB to meet its requirements pending the completion of the CEB/NEPA interconnection projects and the Adjaralla Dam, and also in order to avoid resorting to load shedding.

#### C. For the Bank Group

- In the Adjaralla hydro-electric development component, the ADB will be expected to play a catalytic role by assisting in the finalization of the financing and the start up of the project without delay in order to support the Governments' efforts.

- With regard to the CEB/NEPA Interconnexion component, since this project contributes to the reduction of the investment and operating cost of electric energy, it is recommended to speed up and facilitate its implementation in order to meet the requirements by the year 2005 and

- \* to multiply supervision and monitoring missions in order to react promptly in removing possible obstacles;
- \* the ADB should ensure that the feasibility studies include all the technical, economic and environmental aspects;



- \* the feasibility studies should lay emphasis on all the components which make for a better regional integration;
- \* the ADB should ensure strict compliance with the procurement procedures.

MINISTERE DES MINES  
DE L'ENERGIE ET DES  
RESSOURCES HYDRAULIQUES

---

REPUBLIQUE TOGOLAISE  
Travail-Liberté-Patrie

CABINET

N° 075/MMERH/CAB

Lomé, 29 July 1994

THE MINISTER

Subject : Nangbéto Hydro-Electric Dam Project

Mr. Director,

I hereby acknowledge receipt of two copies of the abbreviated Performance Audit Memorandum on the above project, and I am grateful for them.

I have no comments to make on the document. I am convinced that the pertinent recommendations on this document will permit a better coordination of the current policies and programmes in our countries.

Yours faithfully,

Anato AGBOZOUHOUE

COMMUNAUTE ELECTRIQUE DU BENIN  
Rue de la Kozah - B.P. 1368  
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Opérations p.1

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Date: 5 Août 1994

TELECOPY N° 261/CEB/DG/SEC/94

Subject : Nangbéto Hydro-Electric Dam  
Abbreviated Project Performance Audit Memorandum

Mr. Director,

We hereby acknowledge receipt of two copies of the preliminary version of the abbreviated Performance Audit Memorandum of the Nangbéto Hydro-electric Dam Project. Our comments are as follows:

Page (ii) Abbreviations

CFPP : Centre de Formation et de Perfectionnement Professionnel  
("Professionnel" in place of "personnel").

Page (v)

C.é Slippages: 6 months (39:37); please explain the two months delay to us.

1.5 : Write Lesquelles with two ls instead of one.

Page 2.

2.1.4 : Write ..."a centralized management centre of its network" instead of "a decentralized management centre of its network".

Page 4

2.2.5 : ceb's outstanding payments: modify the sentence in brackets as follows: "the two cement factories in Benin and Togo, the Office Togolais des Phosphates and the Electricity Distribution Company of Togo (CEET)", as sbee had no fault at the time of ADB Audit mission.

2.2.7 : The partial conclusion; as it is worked, does not seem to faithfully reflect the project background. As a matter of fact, (more than 90% in our opinion) of the principal project component concerns electricity production. The failure of the secondary components, which represent less than 10% of the project, should not lead to the conclusion that the project has not achieved the projected economic performance. A restatement of this partial conclusion, with emphasis on the interest in making a success of the secondary components, would be advisable.

2.3 : Institutional Viability

Since the current efficiency of ceb is not questioned, quality the last line of this paragraph as follows: "...will enable it to achieve in coming years a more efficient performance".

Page 6

4.1.3 : Last paragraph: Delete "and the two national electricity companies".

Thank you for the good quality of the report.

Yours faithfully,

Boukary ALIDOU  
Director-General

COMPLETION REPORT  
NANGBETO HYDROELECTRIC DAM PROJECT  
BENIN-TOGO

DEPT. OF INFRASTRUCTURE & INDUSTRY.II

JANUARY 1991

BSO/0333M

## CURRENCY, ACRONYMS AND ABBREVIATIONS

### Currency Equivalents

<u>Local Currency</u>	=	CFAF Franc
1. At Appraisal	=	(4th Quarter 1983)
1 UA	=	CFA Franc 392.07
1UA	=	US\$ 1.07867
2. On Completion	=	(4th Quarter 1990)
1 UA	=	CFAF 364.61
1 UA	=	US\$ 1.39256

### Weights and Measures

1 KV	=	Kilovolt	=	1000 Volt
1 KW	=	Kilowatt	=	1000 Watt
1 MW	=	Megawatt	=	1000 Kilowatt
1 KWh	=	Kilowatt-hour	=	1000 Watt hour
1 MWh	=	Megawatt-hour	=	1000 Kilowatt hour
1HWh	=	Gigawatt-hour	=	1000 Megawatt hour
1 KVA	=	Kilovolt-ampere	=	1000 Volt ampere
1 MVA	=	Megavolt-ampere	=	1000 Kilovolt ampere
1 MT	=	Metric ton	=	1000 Kilogramme
PTE.	=		=	Petrol ton equivalent

### Abbreviations

CIDA	=	Canadian International Development Agency
IDA	=	International Development Association
ADB	=	African Development Bank
BADEA	=	Banque Arabe pour le developpement en Afrique
LP	=	Low Voltage
CCCE	=	Caisse centrale de cooperation economique
CEB	=	Communaute electrique du Benin
EEC	=	European Economic Community
CEET	=	Compagnie energie electrique du Togo
CFPP	=	Centre de formation et de perfectionnement du personnel
CIMAO	=	Cimenteries de l'Afrique de l'Ouest
ST	=	Short term
CTL	=	Centrale thermique de Lome
EDF	=	Electricite de France
FAC	=	Fonds d'Aide et de Cooperation
HV	=	High Voltage
KFW	=	Kreditngtalt fur Wiederaufbau
LMT	=	Long and Medium Term
LC	=	Local currency
MV	=	Medium Voltage
OPEC	=	Organization of Petroleum Exporting Countries
OTP	=	Office Togolais de Phosphates
GDP	=	Gross Domestic Product
GNP	=	Gross National Product
UNDP	=	United Nations Development Programme
SBEE	=	Societe beninoise d'eau et d'electricite
VRA	=	Volta River Authority

### Fiscal Year

1st January - 31th December

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This completion report was written following a mission to Togo and Benin from 30 October 1990 to 14 November 1990. It was written by Mr. Chokki (Economist). Further information on the report could be obtained from M. BOUZAHER, Division Chief, NISI.2 (Extension 4153) and Mr. KATOMBE, Division Chief, NCPR.2 (Extension 4158). The Bank Group's operation section was written by Mr. Noel ORBE (Extension 4781).

## LIST OF ANNEXES

<u>Annex No.</u>	<u>Title</u>
1.	Layout Map at Appraisal.
2.	Layout Map on Completion.
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4.	Projected Electrification in Togo and Benin till 2010.
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BASIC DATA ON PROJECT

1. PRELIMINARY DATA
  2. COUNTRY : Togo, Benin
  3. TITLE OF PROJECT : Nangbeto Hydro-electric Dam Project
  4. REFERENCE NUMBERS OF LOANS
    - ADB : NO. CS/BN/T/Pu/83/001 of 13/07/84
    - AID : BENIN No. 1507 BEN of 26/07/84 LOAN
    - : TOGO No. 1508 TO of 26/07/84 LOAN
    - KUWAITI FUND : BENIN No. 274 of 17/07/84 LOAN
    - KUWAITI FUND : TOGO No. 275 of 17/07/84 LOAN
    - BADEA : BENIN No Number of 26/06/84 LOAN
    - BADEA : TOGO No Number of 27/06/84 LOAN
    - OPEC : BENIN No. 355 of 02/08/84 LOAN
    - CCCE : Straight to the CEB No. 52200 210010 of  
24/10/84.
- GRANTS
- KFW : BENIN of 01/09/1984  
          : TOGO of 01/09/1984
  - CIDA : TOGO of 1984
  - FAC : CEB of 24/02/1984
  - UNDP : BENIN of 29/08/1985  
          : TOGO of 15/05/1985
5. BORROWERS : Government of the Republic of Togo and Benin
  6. BENEFICIARY : CEB: (Communaute Electrique du Benin)
  7. EXECUTING AGENCY : CEB: Management of Nangbeto Project
    - a Project Manager (Togolese Engineer)
    - a Deputy Manager (Benin Engineer)
    - two Division Chiefs (technical, administrative and financial).
    - two expatriates both assisted by two nationals for a maximum duration of 55 months for the first and 28 months for the second; basic staff of about 10 nationals.

II. LOANS

1.	LOAN REQUEST	:	1981	
2.	TOTAL AMOUNT OF LOANS			
			<u>Estimate</u>	<u>Implementation</u>
			<u>At Appraisal</u>	<u>UA Thousand</u>
--	ADB		UA 15.44	8.556
--	AID		DTS 28.20	13.520
--	KUWAITI FUND		KD 6.00	15.066
--	BADEA		US\$ 10.00	6.905
--	OPEC		US\$ 4.00	2.806
--	CCCE		FF 86.00	9.182
3.	<u>TOTAL AMOUNT OF GRANTS</u>			
--	KFW		DM 44.00	14.909
--	CIDA		Can \$ 11.00	7.603
--	FAC		FF 11.4	1.067
--	UNDP		US\$ 0.8	0.168
--	AID		--	4.506

At the first meeting of donors held in Cotonou on 24th February 1984, it was decided that the ADB will provide UA 6.9 million and OPEC US\$ 8 million. These amounts were modified as stated above, when the agreements were signed.

4. INTEREST RATES OF LOANSA. State Loans

ADB	:	9.5% per annum on the disbursed amounts and outstanding.
AID	:	--
KUWAITI FUND	:	3.5% per annum on the disbursed amounts and outstanding.
BADEA	:	6.5% per annum on the disbursed amounts and outstanding.
OPEC	:	1% per annum on the disbursed amounts and outstanding.

B. Onlending Rates of States to the CEB

ADB	:	Similar loan conditions.
AID	:	10.8% per annum.
KUWAITI FUND	:	Similar loan conditions.
BADEA	:	8% per annum.
OPEC	:	4% per annum.

C. Direct CEB Loan

CCCE : 5% per annum on the disbursed amounts and outstanding.

5. STATUTORY COMMISSION

-- ADB : 1% per annum on the disbursed amounts and outstanding.

-- KUWAITI FUND : 0.5% per annum on the disbursed amounts and outstanding.

-- ~~AIB~~ <sup>AID</sup> : 0.75% per annum on the disbursed amounts and outstanding.

6. COMMITMENT CHARGE

-- ADB : 1% per annum on the undisbursed balance of the loan commencing forty-five (45) days after the signing of the loan agreement.

-- AID : 0.5% per annum on the undisbursed balance and commencing 60 days after the signing of the loan agreement.

-- KUWAITI FUND : 0.50% per annum on the undisbursed balance and commencing 60 days after the signing of the loan agreement.

-- BADEA : None

-- OPEC : None

-- CCCE : 0.50% per annum

7. REPAYMENT DURATION

-- ADB : Twenty (20) years including a grace period of five (5) years.

-- AID : Twenty-five (25) years including a five (5) year grace period.

-- KUWAITI FUND : Twenty-five (25) years including a five (5) year grace period.

-- BADEA : Fifteen (15) years including a four (4) year grace period.

-- OPEC : Seventeen (17) including a five year grace period.

-- CCCE : Twenty (20) including a five (5) year grace period.

8. DATES OF LOAN APPROVALS

--	ADB	:	October 1983
--	AID	:	1983
--	KUWAITI FUND	:	1984
--	BADEA	:	1983
--	OPEC	:	1983
--	CCCE	:	1983

9. DATES OF LOANS SIGNATURE

--	ADB	:	13th July 1984
--	AID	:	26th July 1984
--	KUWAITI FUND	:	17th July 1984
--	BADEA	:	26th and 27th June 1984
--	OPEC	:	24th August 1984
--	CCCE	:	24th October 1984

10. DATES OF EFFECTIVENESS OF LOAN : Between 1st and 6th March 1985 for any donor. Given the cross effectiveness clause of the loan, all co-financiers had to respect the period so as to ensure that financing had actually been settled.

III. PROJECT DATA

1. <u>Total Cost</u>	Estimates at Appraisal			Actual		
	--- UA Thousand ---			----- UA Thousand -----		
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total
	94.87	22.28	117.15	72,962	25,260	98,230

2. Financing Schedule

Sources	Estimates at Appraisal				Actual			
	UA Thousand				UA Thousand			
	Foreign Exchange	Local Currency	Total	%	Foreign Exchange	Local Currency	Total	%
. ADB	22.02	-	22.02	18.8	8.556	-	8.556	8.71
. AID	12.83	5.47	18.30	15.6	7.153	10.873	18.026	18.35
. Kuwait.Fund	16.48	0.86	17.34	14.8	11.616	3.450	15.066	15.34
. OPEC	6.94	-	6.94	6.0	2.806	-	2.806	2.86
. BADEA	8.67	-	8.67	7.4	6.905	-	6.905	7.03
. KWF	12.84	1.04	13.88	11.8	13.701	1.208	14.909	15.18
. CCCE	9.71	2.43	12.14	10.4	8.600	0.582	9.182	9.35
. CIDA	3.38	4.51	7.89	6.7	7.603	-	7.603	7.74
. FAC	1.13	0.17	1.30	1.1	1.067	-	1.067	1.08
. UNDP	0.87	2.60	3.47	3.0	0.168	-	0.168	0.18
. CEB	-	5.20	5.20	4.4	4.787	9.143	13.933	14.18
. TOTAL	94.87	22.28	117.15	100.0	72.962	25.260	98.220	100.00

- . Deadline for first disbursement : 31 March 1985
- . Actual date of first disbursement
  - . ADB : 27 June 1985
  - . AID : 15 June 1985
  - . KUWAITI FUND : 10 June 1985
  - . BADEA : 30 March 1985
  - . OPEC : 20 June 1985
  - . CCCE : 30 June 1985
- . Deadline for final disbursement : 31 December 1990
- . Actual date of final disbursement
  - . ADB : 4 July 1988
  - . AID : 10 September 1989
  - . KUWAITI FUND : 25 July 1988
  - . BADEA : 15 March 1988
  - . OPEC : 10 July 1988
  - . CCCE : 15 September 1988
- . Estimated starting date of works : June 1984
- . Actual starting date of works : August 1984
- . Launching of international competitive bidding for the supply of equipment and civil engineering works : July 1983
- . Expected date of works completion followed by watering of the dam : Mid-1987
- . Actual date of works completion
  - . Watering of dam : Summer 1987
  - . Semi-industrial operating of station : October 1987
  - . Equipment testing successfully out : December 1987
- . Estimated date of the end of complementary activities : 1990

IV. Performance statement

1.	<u>Overrun</u>	:	None
2.	<u>Schedule delay</u>	:	$\frac{39}{37}$
	- delay in effectiveness	:	None
	- delay in first disbursement	:	3 months
	- delay in last disbursement	:	None
	- No. of extension of last disbursement	:	None
	- delay in completion date	:	None
3.	<u>Status of completion of project</u>	:	Completed
4.	<u>Performance of structures</u>	:	CEB-Satisfactory
5.	<u>Performance of firms</u>	:	Satisfactory
6.	<u>Performance of Consulting Engineer</u>	:	Satisfactory
7.	IRR		
	At Appraisal	:	9.74%
	At Completion	:	5.32%
8.	ERR		
	At Completion	:	13.80%
	At Completion	:	20.81%

V. Missions

	<u>Number of Date</u>	<u>No. of persons</u>	<u>Man/days</u>
- Identification	-	-	-
- Preparation	-	-	-
- Appraisal	May 1983	3	45
- Follow-up	-	-	-
- Supervision	-	-	-
- PCR	Oct/Nov. 1990	1	15

VI. Disbursement

.	Disbursed total	:	UA 8 556 183.31
.	Amount cancelled	:	UA 6 883 816.69
.	Unused balance	:	UA 6 883 816.69

## 1. INTRODUCTION

### 1.1 Background

1.1.1 Since the energy crisis of 1973, Benin and Togo, like the other developing countries, have become increasingly aware of the extent to which energy utilization and requirements affect their economies and their development. The oil import bill increased at a time when they were trying to establish a small but viable industrial sector. At the same time, the traditional sources of energy, mainly firewood and charcoal, were being exploited irrationally owing to the population growth and the development of agricultural production.

1.1.2 It is in this rather dismal energy context where, to make matters worse, development efforts in the economic sectors of the two countries require a more efficient use of energy and more abundant and cheaper supplies, that the Communauté Electrique du Bénin (CEB) does its job which consists in the development and exploitation of the electric power resources of Benin and Togo and their supply to the national electricity corporation of the two countries.

1.1.3 Since its establishment in 1968 by the Governments of the People's Republic of Benin and the Republic of Togo, the CEB, which is an inter-State agency, has been working to promote the development of the hydro-electric potential of the Mono river and the studies it undertook resulted in the choice of Nangbeto as the site for the construction of the first dam.

1.1.4 The comparative analysis of possible solutions for meeting the increased energy requirements of the two countries has shown the economic advantage in building the Nangbéto dam which seems to be the best solution, and one which will, in addition, give the two countries a certain autonomy as far as energy is concerned, considering that the present power supply comes from Ghana and, to a lesser extent, from thermal power centres.

1.1.5 In anticipation of power requirements estimated at nearly 100 MW, much higher than the guaranteed voltage of the Volta River Authority coming from its plant in Akossombo (Ghana), measures were taken in 1975-1976 by an Italian Consulting Firm, Electroconsult, with the help of the UNDP, to define an optimal electric energy supply scheme for the CEB and to update the

prefeasibility study on the Mono River Development Scheme, prepared in 1965/1966 by a Consortium of French Consulting Firms and Agencies under the coordination of SOFRELEC. The various phases covered prior to the signing of the agreements and the onset of works are appended to this report (Annex N° 5).

1.1.6 The feasibility studies consequently threw light on the economic advantage of developing the hydro-electric potential of the Mono river through the hydro-electric development of Nangbéto, and CEB was able to mobilize the necessary funds from various donors and in July 1983 launched competitive bidding for civil works and equipment supply.

1.1.7 The final agreement of international financing agencies was reached early summer 1983 so that the various contracts with the civil engineering firms and with the builders were signed in summer 1984.

1.1.8 Civil works and equipment studies then started and progressed according to the engineer's schedule. The dam was watered in summer 1987 and the semi-industrial operation of the Nangbéto station started as planned in October 1987. Equipment tests were completed without difficulty end 1987 and following a training course organized by the Consulting Engineer, the CEB operation staff gradually took over the installation (from October 1986 at the Moméhagou station to November 1987 for the turbines-alternators unit) and has since then operated it.

## 1.2 Sources of information

Documents that have been used as sources of information are the following:

- ADB Appraisal Report (October 1983);,
- ADB Loan Agreements;
- all documents provided by CEB, SBEE and CEET.

## 1.3 The Bank Group Role

1.3.1 This project which is the subject of this completion report was the Bank Group's first operation for the CEB in Benin. The Group has, however, carried out operations in the two countries at different periods.



I. Bank Group's Operations in Benin

1.3.2 The Bank Group's operations in Benin are given hereunder:

N°	Date of Approval	Title of Project	Amount (in millions UA/FUA)		
			ADB	ADF	NTF
1.	23/03/72	Dogbo-Tota Azové-Abomey Road Study		0.160	
2.	19/10/72	Irrigation of 1,200 ha in Oueme left bank valley	0.310		
3.	05/04/74	Extension of the electricity network in the coastal region	1.600		
4.	19/09/75	Oueme Valley Irrigation II		3.500	
5.	17/10/75	Reconstruction of the bridge and construction of a dam on the Cotonou Lagoon	4.000		
6.	16/07/76	First Line of Credit to BBD	1.000		
7.	20/12/76	Extension of the electric distribution network in the coastal region (suppl. loan)	1.900		
8.	27/06/77	Development of medico-sanitary services		5.000	
9.	23/11/77	Dogbo-Tota-Azové-Abomey Road		8.000	
10.	29/06/78	Development of stock-breeding		4.500	
11.	17/10/78	Elect. of the Onigbolo Cement Factory	5.000		
12.	17/10/78	Extension of the Port of Cotonou			2.420
13.	22/03/78	Pre-investment study for water supply and electrification of 12 district principal towns		0.751	
14.	24/04/79	Pobona Polytechnique Complexes		8.000	
15.	27/11/80	Pobé-Kétou Road		8.000	
16.	30/03/81	Second Line of Credit to BBD	2.500		
17.	03/12/81	Dogbo-Tota-Azové-Abomey Rd (suppl. loan)		0.900	
18.	18/03/82	Water & electricity supply in 9 district principal towns		9.000	
19.	26/08/82	Planting of firewood in South Benin		12.000	
20.	15/11/84	EAbomey-Bohicon-Kétou-Illara and Road Study Savé-Okeowo		0.950	

N°	Date of Approval	Title of Project	-----Amount----- (in millions UA/FUA)		
			ADB	ADF	NTF
21.	12/06/85	Integrated Rural Development of Oueme Prov.		8.820	
22.	24/10/85	Reinforcement of conception and implementation capacity of health project		0.734	
23.	24/10/85	Health Sector Study		0.455	
24.	20/11/85	Savé-Parakou Road Construction		8.000	
25.	19/08/87	Study for Cotonou access & transversal Rds.		0.770	
26.	26/10/87	Rehabilitation of the Porto-Novo/Pobé Rd.		7.850	
27.	26/10/87	Development of Stockbreeding Project		14.000	
28.	26/10/87	National Telecommunication Network Maintenance Improvement Plan		11.640	
29.	28/04/88	Mono Province Integrated Rural Development		13.000	
		Total	16,310	126,030	2.42
			=====	=====	===

1.3.3 The implementation status of the various projects is summarized as follows:

1. Agriculture

Seven (7) projects amounting to BUA 0.31 million from ADB resources and FUA 55.82 million from ADF resources, have been financed in this sector. They are:

- Oueme left bank irrigation;
- Oueme valley irrigation II.

These two projects have been post-evaluated.

- Development of stock-breeding:

The project was completed in 1986 and the completion report has been prepared. The loan agreement for the second phase was signed on 4/12/1987.

- South Benin Firewood Plantation :

The project implementation schedule which started in 1986 was later revised and the project will be completed late 1991 instead of 1990. This revision is the direct consequence of the slow pace with which project works started, resulting from the delay in acquiring equipment needed for its smooth running. Indeed, the goods and services procurement process was very long firstly because ADF procedures were slighted and ADF had to draw the attention of the Project Unit so that its procedures could be respected and secondly because of red tape during the signing of contracts (it took the new Minister some months to familiarize himself with the file). Project implementation was slowed down because of the sanctions imposed on Benin and these have blocked disbursements for the project since July 1988. The sanctions were lifted in September 1989.

- Oueme Province Integrated Rural Development:

Because of the country's financial difficulties, the provision of the Government's contribution to the project is being done intermittently. This is delaying project implementation. Although the project entered its active phase in 1987, it experienced a slow-down in 1988 and 1989. All the works on the construction of the various buildings are behind schedule because of sanctions. Farm tracks development works are being held up because of non-disbursement of the loan granted by ABEDA which is also awaiting repayment of its previous loans.

- Development of stock-breeding, phase II

The project has entered its active phase especially after the lifting of sanctions against Bénin

- Mono Province Integrated Rural Development.

The loan agreement has just been signed, the delay was due to sanctions.

## 2. Public Utilities

1.3.4 This sector has benefited from five Bank Group operations totalling BUA 3.50 million from ADB resources, FUA 21.39 million from ADF resources. The projects of this sector are::

- Extension of electricity distribution in the coastal region.  
The project has been completed and is operation.
- Pre-investment study for water and electricity supply in twelve (12) district principal towns.  
The study has been fully completed.
- Water and electricity supply in nine (9) district principal towns.  
The project has been completed.
- National Telecommunications Maintenance Improvement Plan. The first contracts have just benefited from a takeoff advance in September 1989.

## 3. Transport

1.3.5 Six projects and three studies have been financed in this sector: six from ADF resources (including TAA) for a total amount of FUA 33.86 million, one from ADF resources for BUA 4 million and finally one from NTF resources for UA 2.42 million. The projects and studies are the following:

- Dogbo-Tota-Azove-Abomey Road Study:  
The study has been conducted and has facilitated the construction of the road.
- Reconstruction of the bridge and construction of a dam on the lagoon at Cotonou:
- Development of medico-sanitary services.  
The project has been completed.
- Reinforcement of conception and implementation of health projects.

The project has been completed.

Health Sector Study:

The consultant has completed his study which is now the subject of a Government/ADF analysis.

4. Industry

1.3.6 Two lines of credit amounting to BUA 3.50 million have been granted by the ADB to the "Banque Beninoise pour le Developpement" (BBD).

II. Bank Group Operations in Togo

1.3.7 Since the beginning of its operations in Togo in 1972 until 30th June 1990, the Bank Group has financed 13 projects and one study at the national level. The total amount out of ADB resources stands at BUA 18.46 million and has been used for the implementation of 6 projects. NTF has cofinanced with ADB one project amounting to UA 4.5 million and ADF has, in addition to one supplementary programme for the amount of FUA 54.45 million. At the multinational level and with respect to Togo, the Bank Group has contributed to the financing of four projects for the total amount of FUA 8.68 million out of ADF resources and 23.64 million out of ADB resources. The list of all these projects is given hereunder:

A - National Projects

N°	Date of approval	Title of project	Amount		
			(In million UA/FUA)		
			ADB	ADF	NTF
1.	20/06/72	Line of credit to BTD	1.35		
2.	27/06/74	Electrification of the Lome area	2.80		
3.	23/03/75	Route SOKODE-BASSAR		4.50	
4.	18/09/75	YEGUE-LANGABOU Rd. Feasibility & Eng. Study		0.25	
5.	20/12/76	TABLIGBO-Lome Port Railway	5.00		
6.	19/09/77	Construction of the Lome Oil Mill	3.81		
7.	23/03/78	Const. and Equipment of Tech. Sec. Schools		5.70	
8.	07/06/78	SOKODE-BASSAR (supplementary loan)		5.00	
9.	17/10/78	Construction and equipment Lome CHU	2.00		4.50
10.	26/04/79	YEGUE-LANGABOU Road		8.00	
11.	25/03/80	Second Line of Credit to BTD	3.50		
12.	08/04/82	KARA-KETAO-KEMERIDA Road and the KETAO-KPAGOUA Slip Road		10.00	
			18.46	63.10	4.50
			=====	=====	=====

B - Multinational Projects

<u>N°</u>	<u>Date of approval</u>	<u>Title of project</u>	<u>Amount</u>		
			<u>(In million UA/FUA)</u>		
			<u>ADB</u>	<u>ADF</u>	<u>NTF</u>
1.	16/07/76	CIMAO Cement Works	8.20		
2.	03/12/81	Feasibility Study for the Irrigated Agricultural Development of the Lower Mono Valley		1.22	
3.	15/12/83	NANGBETO Hydroelectric Dam	15.44		
4.	19/08/87	Electric Energy Generation and Transmission Dispatching		7.46	
			23.64	8.68	
			=====	=====	=====

The state of execution of the projects by sector of operation is as follows:

A. National Projects

1. Agriculture

The two loans previously granted for the agricultural sector (the East MONO rural development project and the forestry project) have been cancelled because of the changes in the components and agricultural policy made by the Government. Consequently, the Forest Development project (FUA 14.65 million) for which the loan agreement was signed on 05/05/87 is the Bank Group's first operation in the sector.

2. Public Utilities

This sector represented by the electricity supply project in the Lome area, has been granted UA 2.8 million by the Bank, and implementation has been completed.

### 3. Transport

Six (6) loans have been granted to the sector including UA 5.0 million out of ADB resources for a single project and FUA 27.75 million out of the Fund's resources for five projects and studies. All the projects and studies have been fully completed:

- Construction of the TABLIGBO-Lome Port Railway to ensure the supply of fuel to the Lome refinery at the West African Cement Works (CIMAO) at TABLIGBO and the transport of clinker; the loan of UA 5.0 million has been granted by the ADB. The rail link has been in operation since June 1979;
- Improvement and tarring of the SOKODE-BASSAR road, which is 57 km long was granted two loans in 1975 and 1978 for FUA 4.50 million and FUA 5.00 million out of the Fund's resources and was completed in July 1979;
- Feasibility and Engineering Study on the YEGUE- ANGABOU road financed by the Fund with a loan of FUA 0.25 million which has been used to construct the road;
- Improvement and tarring of the YEGUE-LANGABOU road which is 58.8 km long and whose works were completed in 1982. The amount of FUA 8.0 million out of the Fund's resources was required to finance this project;
- Construction of KARA-KETAO-KEMERIDA road (25.4 km) and the KETAO-KPAGOUDA slip road (border with Benin, 14.6 km) financed by the Fund with a loan of FUA 10.0 million. The works were smoothly completed with a substantial unexpended balance and were handed over provisionally on 11 December 1985.

### 4. Social

- Two projects in this sector share three loans from ADB, the Fund and NTF of UA 2.0 million, FUA 5.7 million and UA 4.50 million respectively. They are:

- Construction and equipment of the University Hospital Centre (CHU) of Lome to which UA 2.0 million has been allocated out of ADB resources and UA 4.50 million out of NTF's. Construction work initially planned was completed and provisionally received in February 1985. The medical equipment has been procured and installed. Supplementary works (sanitation, kitchen, laundry room and administrative departments) approved by the Bank are being finalized. The revised list of goods and services has also made it possible to finance the installation of an air extractor and air conditioning in the dark room, the blood test and hematology rooms of the laboratory, additional material for the kitchen, a toilet for the X-ray centre, as well as the building of a rest centre.

#### 5. Industry

The Bank has carried out three operations in this sector for a total amount of BUA 8.66 million which has been used to finance three projects, two of which have been entirely completed.

The projects are:

- First line of credit to the Banque Togolaise de Développement whose loan of BUA 1.35 million was entirely used up on schedule;
- Construction and equipment of a palm kernel and cotton seed oil mill in Lome the final reception of which took place on 10 January 1985. The funds granted by the Bank amounted to UA 3.81 million. Commercial production began in April 1983, after two tests the second of which was successful;
- Second Line of Credit to the Banque Togolaise de Développement (BTD) amounting to BUA 3.5 million. It is being used slowly for want of viable and substantial sub-projects eligible under the ADB line of credit. Consequently, the



Bank intends to finance for the benefit of the BTD, a technical assistance mission with a view to identifying viable sub-projects.

6. Multisector

A loan of the amount of FUA 15 million was granted to Togo in 1988 for the financing of a structural adjustment programme (SAP). The first tranche of the loan was disbursed in January 1989. The implementation of measures to be taken during the second half of 1988 and the first half of 1989 is underway. The mid-progress appraisal report is expected during the 4th term of 1989.

B. Multinational projects

The Bank Group has financed a study and multinational projects which involved the Republic of Togo. They are:

- Cimenterie de l'Afrique de l'Ouest involving Côte d'Ivoire, Ghana and Togo and cofinanced by the Bank with a loan of BUA 8.2 million, which has been completed. But technical and financial problems since January 1980 as well as a persistent operational loss, have caused the promoters to interrupt production and to look for ideal solutions. Plans were therefore made for the structural adjustment of the CIMAO, with an investment higher than the international going prices. Given the situation, the solution to the problem could not only be technical.
  
- Lower Mono Valley irrigated agricultural development study (Benin/Togo) financed with a loan of FUA 1.22 million. The study has been completed and has been used to design an irrigated agricultural development project for each of the States involved (Benin/Togo);

NANGBETO Hydro-electric dam (Benin/Togo) which has been cofinanced by ADB with a loan of UA 15.44 million. The construction of the dam has been completed and the dam inaugurated.

Electricity energy generation and transmission dispatching centre. The loan (FUA 7.46 million) has just been signed by the Governments of Togo and Benin. The Communauté Electrique du Bénin (CEB), the project's executing agency is endeavouring to satisfy the loan conditions. Bids are currently being assessed.

## 2. THE ENERGY SECTOR

### 2.1 Organization of the sector

2.1.1 Since the appraisal of the Nangbeto Project, the organization of the sector is still the same, similar in both Benin and Togo, where responsibilities are assumed by various Ministries according to the types of energy sources. Two Ministries are still in charge of defining the energy policy of each country; one with policy relative to fuel wood and coal and the other in relation to other sources of energy.

2.1.2 In Benin, the Ministry of Industry, Mines and Energy and in Togo, the Ministry of Equipment, Post and Telecommunications in lieu of the same name as in Benin in 1983, together with their various national departments, are responsible for all activities relative to the exploration, production, processing and marketing of hydrocarbon. Their respective Mines and Geology departments are responsible for implementing official policy in the specific field of oil and mineral research.

2.1.3 The Ministries of Water and Forest Resources in Benin and Rural Development in Togo are still in charge of biomass resources development and play a decisive role in the elaboration of rural energy policy. The Ministries for Higher Education through the national university research units, also play a cardinal role. These units further the extension of innovative energy systems, thereby contributing to the definition of the national energy policy which takes into account all the available sources of energy in both countries.

2.1.4 The electricity sub-sector is still under the exclusive responsibility of the CEB, with regards to the development, exploitation and transmission of power resources in both countries; of the CEET (Compagnie d'Energie Electrique du Togo) and of the SBEE (Société Béninoise d'Eau et d'Electricité) for the production and supply of electricity. These three corporations are still under the technical jurisdiction of the Ministries of Mines and Energy of both countries. The organization and activities of the CEB, the Nangbeto Project's executing agency are described in chapter 6.

## 2.2 Energy performance in Togo and Benin

2.2.1 The importance of the energy sector in Togo and Benin was acknowledged by the powers-that-be in both countries as one of the priority development areas. Hence a consistent energy policy was defined with a view to improving management and energy supply conditions, in line with the economic and social development plan. The layout map of the Nangbeto project at appraisal and on completion are shown in annexes 1 and 2.

2.2.2 The energy system in both countries comprises a varied gamut of energy products of which the most important are fuelwood, charcoal, oil products and electricity. The last two make it possible to supply a very limited modern sector accounting for 30% in Togo and 35% in Benin of final energy consumption; petroleum products represent almost 26% (Togo) and 18% (Benin) and electricity about 4% in each country. As to the traditional sector the most important, it accounts for 70% (Togo), 75% (Benin) of final consumptions; energy demands are met mainly by biomass products.

2.2.3 In Togo as in Benin, only traditional energy equipments have increased regularly to cover household needs which goes to show that the modern energy demand for domestic purposes is not great. The upshot of the situation, together with the difficulties of the industrial sector at a time of crisis has meant stagnation or depreciation of modern energy consumption. Consequently, in order to uphold the estimated growth over the next five years emphasis should be put not only on a better management of the energy potential but also on the promotion of new and renewable energy sources. Seeking funds for energy projects or development projects in general for that matter, is still a major problem since they cannot be funded from domestic savings.

## 2.3 Situation in the sub-sector

### A. The Plant Biomass

2.3.1 The plant biomass is by far the most important energy source. It is obtained from fuelwood, charcoal and plant waste, which are used as energy fuel in the domestic sector. Plant resources are derived from natural forests, reforestation and agricultural plant waste. The natural vegetation is characterized by a thick forest covering a small area and situated mainly

in accessible mountainous areas and in protected reserves. The plant waste potential depends on the annual agricultural output. Their availability also depends on the regions where these products are cultivated. From the agricultural production for 1985, it is estimated that the possible plant waste potential should be around 450 Ktep in Togo and 400 Ktep in Benin though only 10 to 20% of this plant residue is used as energy. Although the national fuel wood production is as badly known as the demand and consumption of it, it is estimated however that production and consumption are at par because there is no noticeable big annual stock nor any significant movements of fuelwood or charcoal across national boundaries.

## B. Oil Products

2.3.2 Because Benin is highly dependent on energy from abroad, she has intensified mining prospection into lignite, uranium and petroleum. The result has been positive for the latter and since 1982 the tapping of offshore deposits has been one of Benin's chief resources. Given the high level of cost price per cubic metre of processed deposit compared with the imported product, at national level, the entire production is exported. National consumption therefore comes from what SONACOP imports, for which the trend over the years in cubic metres is as follows:

Period	Petroleum			Oil	Gas oil	JET	Fuel
	Super	Others	Total				
1986	23 254	49 059	72 313	13 129	53 664	21 940	7 105
1987	18 277	38 073	56 350	11 136	53 902	23 442	7 407
1988	13 007	29 989	42 996	12 913	49 281	22 009	6 663
1989	9 571	22 640	32 211	13 655	43 823	24 405	7 083
1990 (June)	4 049	8 548	12 597	6 033	21 218	9 896	4 630

The reduction in time of petrol and gas oil consumption, the constant level of that of oil, testify the illicit trading of these products from Nigeria.

2.3.3 Togo has no exploitable petroleum resources and about 80% of its conventional primary needs are met by oil product imports. In 1987, Togo imported 41.333 tons of industrial fuel-oil and 152 236 m<sup>3</sup> of miscellaneous products (super, petrol, gas-oil etc). The cost of these products amounted to CFAF 6.7 billion, i.e. 5.2% of the country's total import costs. In 1984, it was CFAF 13.4 billion. The sharp decrease can be explained by the winding up

in 1984, of the cement factory which together with OTP consumed 93% of the 117 000 tons of products used in industry during 1982. The table below shows the consumer trend of the various petroleum products:

Périod	Petroleum			Oil (m <sup>3</sup> )	Gas-oil	Diesel Tonnes	Fuel
	Super	Others (m <sup>3</sup> )	Total				
1983	39 272	21 783	61 055	15 327	45 527	4 164	38 541
1984	40 981	21 812	62 793	15 742	61 557	8 488	51 756
1985	44 644	21 878	66 522	12 475	54 969	31	41 423
1986	47 017	19 733	66 750	10 890	57 071	7 408	32 049
1987	52 595	20 559	73 154	12 267	56 234	11 581	41 333
1988 (8 mths)	35 726	13 367	49 093	6 973	35 171	7 123	33 424

### C. Hydro-electric Power Resources

2.3.4 The hydroelectric power resources of the two countries have not varied since the project's appraisal. Both countries are very wet because they have five large river basins: the Niger and Oti in the North, the Mono in the centre, the Oueme to the East and Lake Togo in the South. As opposed to Togo which has a small 2MW hydroelectric station built in 1963, and in operation, Benin has no hydroelectric installation despite its hydraulic riches. Since late 1967, the two countries have received energy from the Nangbeto dam and in a few years will receive energy from the Adjamala dam both of which are on the Mono river. The survey of the two countries hydroelectric power resources carried out by GIBBS/TRACTEBEL in March 1984 shows that the overall electric power generation potential of the two countries is about 2500 GWh per annum, with an installed capacity of nearly 631 MW. When the two dams have been built they will represent only one sixth of the total available power.

#### Renewable energy

2.3.5 Since project appraisal, the use of this energy has been limited to wind energy in the coastal regions where water-pumping equipment are worked by wind energy. Regarding solar and biomass energy, they are still at an experimental stage in both countries.

### 2.4 Energy Sector Strategy

2.4.1 The general strategy of the energy sector are laid down in the broad lines of the five year development policy of both Governments which has two main aims in view:

- make it possible to cut down on energy consumption while pursuing measures to increase production not only in the traditional energy sub-sector, but also in the modern sub-sector (electricity);
- lay down a more harmonious energy development line.

2.4.2 Since both Benin and Togo are limited in terms of energy resources, a rational use not only of traditional energy but also of conventional energy could only contribute to the recovery of the national economy, especially through foreign exchange savings. Unfortunately, energy losses are considerable in the production of energy and an energy saving plan is therefore indispensable. The plan must aim firstly at the traditional sub-sector (wood, charcoal) and electricity and more gradually at all the other sub-sectors. The extension of improved stoves must continue in order to preserve the forests and so must research into substitute energy for the residential sector. These measures will give positive results only if there is a national energy programme. Unfortunately, one of the defects of these countries energy programme is the lack of planning which could enable the sector to serve better the goals of the economic and social development plan. To that end, a study on the energy masterplan will highlight the development objectives of the sector in accordance with national development prospects.

## 2.5 The Electricity sub-sector

2.5.1 Since the appraisal of the Nangbéto project, almost all the activities of the electricity sub-sector of Benin and Togo are still carried out by the SBEE (Benin), the CEET (Togo) and the CEB. The SBEE and the CEET are still Government industrial and commercial institutions responsible for the production and distribution of electricity in their respective countries. They are under the aegis of the Ministry of Industry, Mines and Energy in Benin and the Ministry of Equipment, Post and Telecommunications in Togo.

2.5.2 The CEB, an inter-State agency established by the two States, is under the two Ministries mentioned in the previous paragraph. Its main responsibility is the development and exploitation of the electric power resources of the two countries and their supply to the national corporations, the SBEE and the CEET. The CEB is responsible for interconnection programmes

with the countries sharing boundaries with Benin and Togo and in this regard purchases and transmits electricity from the Akossombo hydro-electric dam in Ghana. For this purpose, the CEB has been given the monopoly of the production and transmission of electricity in Benin and Togo. It is also a Directorate to which the Government of both countries have delegated vast powers for the running of the electricity sector.

#### Means of production

2.5.3 With the Nangbeto hydroelectric project operating since 1987, the CEB disposes of one of its most important means of production pending the implementation of the various electric energy development and supply projects (Annex 14). While waiting to be better equipped, supplies are brought from the Akossombo hydroelectric dam in Ghana. All the existing means of electricity production in Benin and Togo, apart from a few isolated independent power generating outfits, are the property of the national electricity corporation.

2.5.4 In Benin, the SBEE is at present operating sixteen (16) diesel-thermal power stations located in sixteen (16) different towns and having a total installed capacity of about 43 MW instead of 27.7 MW in 1983. The biggest is the Cotonou thermal power station with a capacity of about 32 MW. In addition, the CEB still received electricity from Akossombo on the one hand and from Nangbeto on the other, through the CEB, which brings its total exploited capacity to about 80 MW. At the end of 1989, the total energy supplied to the distribution network (purchase and thermal generation) was about 189.010 GWh, showing an increase of nearly 4% per annum since the Nangbeto project appraisal in 1983. CEB purchases represent more than 89% of the total energy supplied to Benin. Since the cost price of kWh from abroad is lower than energy generated in the country.

2.5.5 The power generation facilities of the CEET in Togo comprises eleven (11) thermal power stations instead of 8 at project appraisal (a 2 x 25 MW gas power station, a 4 x 10 MW diesel thermal station, a 2 x 8 MW diesel thermal station, eight independent power stations) and still a 2 x 1 MW hydroelectric power station. The CEET's installed capacity is 121 MW and the available capacity is 68 MW; following technical difficulties, the four 10 MW diesel



generators have never been operational. Under normal circumstances at least 95% of CEET sales to the interconnected coastal region are covered by the CEB. The remaining 5% are covered by equipment in Lome. The total nominal capacity of networks supplying stations in the interior is 13 MW. Kara is the largest supply station in the interior with 11 MW. This supply station is the core of the interconnected northern network.

2.5.6 Between 1978 and 1981, electricity sales to Togo went up to the high rate of 18.5% per annum. They slumped in 1981 and 1986 with only a 2% growth rate, owing mainly to the very significant decrease of commercial, and industrial consumption. This decline would have been worse if residential sales had not increased during the same period thanks to new subscribers and to the electrification of new areas. During the 1986/1987 and 1987/1988 financial years, the selling rates increased by 5.4%. CEET sales during the 1987/1988 financial years were 229.181 GMh.

#### Means of transmission and distribution

2.5.7 Under the agreement establishing the CEB, the latter has the monopoly of power transmission in Benin and Togo. Thus the CEB currently operates installations comprising a 161 KV power transmission and the corresponding high voltage/medium voltage transformer stations. Since the time of the projects evaluation, the CEB's installations are still the same. With the completed project, the CEB has been able to strengthen its means of transmission of electricity to Benin and Togo. Other electricity supply projects are under review with a view to increasing the distribution capacity of both countries.

#### 2.6 Review of the demand for electricity

2.6.1 Annex 6 gives the trend of the CEB's past and future electricity supply to the two corporations; these do not include the 5 to 11% which the national installations in Togo and Benin must both supply annually. A review of the demand for the 1986/89 period shows an annual sale rate of 4% which is rather low, much lower than the sale rate for the 1973/82 and 1983 period (when the annual average was 21%) at project appraisal in 1983. This is tributary to the economic downturn still persistent in both countries and to the limited power from Ghana, resorted to because local production is expensive.

2.6.2 One gathers from the situation that the CEB continued to record positive technical results in the operation of its system between 1986 and 1989. Since 1973 losses have been kept within the limits generally considered satisfactory for this type of network, (i.e. not more than 5%). The load factor also took a positive turn (67%) over the period. This technical aspect being the reflection of the annual average effective utilization rate of the available energy. This result may be considered satisfactory in so far as the system whose peak load corresponds mainly to peak lighting and air-conditioning times gives a relatively limited utilization time.

#### Power demand forecasts

2.6.3 The power demand forecasts (annex 6) were prepared for the 1989-2005 period in the last study on the next hydroelectric project in Adjarala, logical follow-up to Nangbeto. The most likely assumptions of economic growth in Togo and Benin as well as the expected growth of low voltage household consumption for the period in question have been revised downwards, given the persistent recession. On the other hand, some large consumer corporations ((CIMAO, OTP, ONIGBOLO Cement Works) are either being liquidated, or else limited by the low demand of the products they manufacture.

2.6.4 From the results of Annex 6, it appears that the average power demand growth rate is about 6.4% between 1990 and 1995, 5% from 1995 and 2000 and 4% from 2000 to 2005. Not only has the level of expected demand gone down in comparison with that projected in the appraisal report, but so has the 5 year average annual rate. These figures are fairly realistic and reflect the trend generally observed in electricity consumption in developing countries, that is to say a tendency toward decline and stabilization of the demand growth rate when a certain level of economic and social development has been reached.

### 3. PROJECT IDENTIFICATION, PREPARATION AND APPRAISAL

#### 3.1 Origin of project

3.1.1 The Nangbeto site situated on the Mono River which serves as a boundary between Benin and Togo, was discovered by an engineer of the Coyne & Bélier Consulting Firm, following prospection surveys conducted in the two countries; the initial studies were carried out by SOFRELEC with UNDP financing only towards late 1964 and early 1965. The findings of these studies made it possible to estimate the cost of the hydroelectric dam at almost US\$ 5 million. The donors at the time were of the opinion that the cost was rather high for a pretty low demand of electric power. Hence their decision to make the Akossombo hydroelectric dam which had already been built in Ghana, cost effective. In 1967, a prefeasibility study on the development of the Mono River was prepared by the same Consulting Firm, SOFRELEC.

3.1.2 Since the CEB's establishment by the two State in July 1968, it has endeavoured to promote the development of river Mono's hydroelectric potential and studies conducted led to the choice of the Nangbeto site for the first dam. Annex 5 summarizes all stages (studies, missions, meetings, main actions undertaken, preparations etc ...) which led to the signing of contracts in July 1984. All loan agreements were signed before December 1984 and they became effective between 1st and 6th March 1985.

#### 3.2 Loan effectiveness

##### Conditions of loan effectiveness

##### A. African Development Bank

3.2.1 The conditions of the ADB loan effectiveness were fulfilled in time after the signing of the loan agreement on 13th July 1984. All the conditions suspensive to the first disbursement were fulfilled before 6th March 1985 given the cross clause which justified the settling of financing. These conditions were:

A. Conditions precedent to first disbursement

1. Prior to the first disbursement the Government shall undertake to make adequate annual budgeting allocations to meet their share of the project cost in accordance with their recovery plan.
2. Undertake to find additional sources of finance in the event of overruns of the projects actual cost.
3. Provide proof that financing agreements with other donors have been signed or that the latter have undertaken in writing to participate in the financing of the project or that in any event, the financing plan has been finalized.
4. Show evidence that the loan has been on-lent to the CEB on the same conditions as those granted by ADB. The CEB will reimburse ADB directly to amortize the loan (principal, interests and commissions), but this shall, however, not alter the main obligations of the Borrowers to the Bank.
5. Give an undertaking not to use proceeds from the loan in defraying customs duties or any form of taxes charged on the goods and services required for project implementation.
6. Communicate to ADB a repayment schedule spread over a period of three (3) years of all arrears of the public sector (Government, State Corporation and Board) due CEET and SBEE. This plan will be implemented in 1984 at the latest.
7. Cause to be submitted to ADB a plan for the collection of arrears owed by CEET and SBEE to the CEB.
8. Give an undertaking to renew the provisions relating to the tax exemptions enjoyed by CEB.

B. Other Conditions

The Governments shall in addition:

1. Cause the CEB to keep records of all investments made in connection with the project, whether fully or partially financed with the loan and to keep separate accounts for the loan funds and funds obtained from other sources.
2. Cause statutory amendments to be made, the object of which shall be to:
  - state clearly, that the CEB is the owner of the installations which it is establishing; and define the fate of CEB's property in the event of dissolution;
  - oblige the two national electricity corporations (CEET and SBEE) to purchase all the power of the CEB;
  - conclude an agreement to organize the exploitation of the Mono river and obtain an assurance that no unilateral action likely to affect the Nangbeto project or threaten the smooth running of the CEB even in the event of a dispute will be taken by one of the States, throughout the period of the loan agreements.
3. The Government of Togo shall undertake to communicate to the Bank for its comments the decision it intends to take regarding the transfer of the Lome Thermal Station (CTL) to the CEB.

B. AID

3.2.2 The projects leading bank, the World Bank, contacted the other donors after ensuring, by means of conditionalities, that issues raised by the States, by the national electricity corporations had been and could be solved. These problems concern the countries leveraging, the structural adjustment of the national corporations, the CEB, training within the three energy corporations and in the training centre, their performance and

computerization. In order to avoid any delay in the start of works and concerned about the finalization of the financing plan, the World Bank had all the donors bound by a cross clause. The on-lending condition eased off all problems linked to the loan.

#### C. CCCE, Kuwaiti Fund, OPEC, BADEA

3.2.3. These various donors were contacted at the propitious time. The Caisse Centrale made a loan directly to the CEB having judged the latter credible, whereas an on-lending condition was necessary for the others. The various conditionalities made it possible to solve the problems which arose at the appraisal stage of the project.

#### 3.3. Project Objectives

##### Objectives at appraisal

3.3.1. The Nangbeto hydroelectric dam project with its 60 MW capacity and 148 GWh/annum potential aims at satisfying the medium-term power requirements of the Republics of Benin and Togo. The dam will enable the CEB (Communauté Electrique du Bénin) to double its power supply to the two countries to meet the projected increase in power consumption between 1982 (496 GWh) and 1990 (1067 GWh). Moreover, the large water reserve (1.7 billion m<sup>3</sup>) which will be formed by the Nangbeto dam will provide the basis for the development of agricultural activities (43.000 ha of irrigation schemes) for which feasibility studies are now in progress with financing provided by ADF.

##### Objectives reached on completion of works

3.3.2. On the technical plane, the Nangbeto project was smoothly implemented according to schedule and cost. To date, other than the 1990 drought, the Nangbeto hydroelectric dam has since it started operating in 1988, produced 518 GWh of which 212 were produced in 1988, 190 in 1989 and the rest up to end October 1990, including 43%, 38%, 22% respectively of actual CEB sales over the period.

3.3.3. On the economic level, implementation of the project made it possible for the CEB to meet about an average of 35% of its yearly power requirements. A large water reserve (1.7 billion m<sup>3</sup>) formed by the dam provides the basis

for agricultural and piscicultural development activities (43,000 ha of irrigation schemes). In addition, the river Mono on which it is built has been regularized and as a result there are no more floods or crop losses.

3.4 Manner in which the project falls in line with national development plans

The Nangbeto hydroelectric dam project is an integral part of the electricity development plans of the two countries. Given the implementation deadlines, it was taken into account in current socio-economic five-year plans, in short term plans, as well as in current plans.

3.5 Project description at appraisal

3.5.1 The main components of the project at appraisal were the following:

A. Civil Engineering

3.5.2 This component comprises:

1. A buttress or enrockment dam with crest at the height of 147m, and a maximum height on foundation of 48m for the buttress and 42m for the enrockment, a length of 520m and a crest width of 6.5m.
2. Two intake structures according to the type of dam;
3. A spillway consisting of 4 buttresses, 13,50m wide, or, in the case of the enrockment dam, a concrete structure. It comprises, as the case may be, 5 segmental sluice gates of 10m x 9.30m and a dewatering conduit, or 4 segmental gates 10.60m wide and 11.30m high; spillway channel or mill-race leading up to a dissipating basin, designed to evacuate a peak flow of 4 500m<sup>3</sup>/s.
4. Two power tunnels equipped with steel penstocks.
5. A power house comprising a machine room, a control room, administrative offices and various other facilities.

6. A developed access road 37km long.
7. Living quarters which will be used later by the personnel who will be operating the dam.

B. Electro-mechanical equipment

3.5.3 This component comprises two vertical shaft turbines with 32.8MW unit capacity for a nominal head of water of 30m; two cranes, one main and the other auxiliary, of the electric travelling bridge variety with nominal loads of 120 tons and 15 tons respectively, two vertical shaft alternators; mechanical equipment, a stand-by power plant comprising two 500 KVA auxiliary transformers, a 400 KVA standby generator, a main general power house control desk and a distribution platform, direct current supply, telecommunications and safety installations.

C. Transmission network

3.5.4 The transmission network comprises:

- an external type 161 KV sub-station at Nangbeto, equipped with two sets of bars for connecting four 161 KV lines and two generating sets of the power station through two transformers.
- a 161 KV sub-station at Momehagou with two sets of bars for connecting five 161 KV lines, two 161/63 KV transformers.
- a 100 km transmission line of 161 KV voltage between Nangbeto and Momehagou.

D. Population resettlement

3.5.5 The resettlement programme involves 34 villages with a total population of 7,780. Actions include the rehabilitation of feeder roads, the sinking of about thirty wells to provide drinking water and the construction of homes.

E. Personal training, consultancy services for implementation studies, works supervision and control



#### 4. IMPLEMENTATION, OPERATION AND COST OF PROJECT

##### 4.1 Description of final project after implementation

4.1.1 The main components of the project are the following:

- Civil engineering
- Electro-mechanical equipment
- Transmission network
- Resettlement of the populations
- Project management unit and training
- Engineering and works supervision

##### 4.2 Detailed features of project components

###### A. Civil engineering

4.2.1 The civil engineering component consists of the following structures:

- a 443m buttress dyke with an impervious vertical core
  - . maximum height on foundation : 52 m
  - . width at crest : 7 m
  - . maximum width at base : 157 m
  - . elevation at top of dam : 147 IGN
- a lateral right bank dyke in mud, 2785m long and a maximum height of 12m; heights of crest: 147 IGN.
- a lateral right bank dyke in mud, 1635m long and a maximum height of 21m; heights of crest: 147 IGN 147.50 IGN.

4.2.2 These dykes have led to the formation of a water reserve at an elevation of 144 (normal water reserve level), covering 190 sq. km and with a total volume of 1.7 billion m<sup>3</sup>. Between the main dyke and the right bank lateral dyke are concrete structures which comprise:

- a spillway with 4 spillway jump ski passes and dissipating basin. It is equipped with 4 radial gates including 1 to 2 flaps with the capacity to evacuate 4464m<sup>3</sup> of water per second. This flow corresponds to the 10 thousand year flood.
- an intake structure comprising two power station supply sluices each with a penstock and an outlet. Sluice equipped with a screen penstock and a hollow valve.
- a power house comprising a machine room, a control room, administrative offices not bigger than 63m long, 27m wide and 33m high.
- a 20km dirt track comprising the access road deviation to the Nangbeto development site and the inner roads.
- living quarters for the staff who will be operating the dam.

**B. Electro-mechanical equipment**

4.2.3 This component comprises equipment for the dam and for the hydroelectric power station:

1. Dam structure equipment:

. Spillways:

- . 4 sluice gates including one with a flap 10.60m wide and 11.52m high.

. Intake structure:

- Entry gate : 2 x 12 x 14 m
- Penstock : 2 x 60.6 m
- Guard gate of the type with 2 fixed wheel gates  
2 x 4.50 x 5.28 m

. Outlet:

- entry gate : 5 x 10 m
- penstock 75.60m long and 3m in diameter
- hollow jet valve type, manually operated sluice valves  
2.80m in diameter.

C. Power Station equipment

4.2.4 This component consists of:

- two kaplan vertical shaft turbines with 32.8 MW unit capacity producing an average of 150 GWh/year for a nominal head of water of 30m, equipped with 4.20m diametre wheels with feathering blades.
- two cranes, one main and one auxiliary of the electric travel-ling bridge variety with nominal loads of 145 tons and 15 tons, respectively.
- two vertical shaft, air-cooling alternators of 35.5 MVA nominal capacity.
- mechanical equipment consisting of two metallic screens, two sets of cofferdams located upstream and downstream and two sluice gates.
- a standby power plant comprising two KVA auxiliary transformers, a 400 KVA diesel standby generator, a main general power house control desk and a distribution platform, direct current supply, telecommunications and safety installations.

D. Transmission network

4.2.5 Power produced in Nangbeto will be supplied to the 161 KV network of the CEB from the Momehagou station through a transmission network comprising:

- an external type 161 KV sub-station at Nangbeto equipped with two sets of bars for connecting four 161 KV lines and two generating sets for the power station through two group transformers with a voltage of 10.3/161 KV and a nominal capacity of 37 MVA.
- a 161 KV sub-station at Momehagou with two sets of bars for connecting five 161 KV lines, two 161/63 KV transformers to be provided later under the Ghana-Togo-Benin-Nigeria interconnec-

tion project and the modification of the existing station to permit connection to the new station;

- 110 km transmission line between Nangbeto and Momehagou, of 161 KV voltage with a single set of three conductors consisting of galvanized steel pylons, three 253 mm<sup>2</sup> aluminium alloy conductors and aluminium guard cable with 94mm<sup>2</sup> section steel core.
- a 35km long line between Atakpame with the same features as the Nangbeto-Momehagou line.

#### E. Population resettlement

4.2.6 Population resettlement involved 45 villages with a total population of 12,000 affected by the dam's construction as opposed to the estimated 34 villages and 7780 persons during project appraisal. Other actions carried out under this component resulted in the construction of 130 km of feeder roads, the sinking of about sixty wells to provide drinking water for the displaced population and those in the receiving areas, assistance in the reconstruction of homes, community investments (schools, dispensaries, market, agricultural storage rooms) food aid, provision of transport for goods and for the people to be rehoused as well as agricultural production support services. In order to highlight the impact of the Nangbeto dam and reservoir on the environment these various population resettlement actions were carried out with focus on five salient areas: agricultural development, cattle rearing, pisciculture, health and infrastructure rehabilitation.

#### F. Implementing Agency and Training

4.2.7 The management of the project was entrusted to the CEB within which a Project Management Unit (see basic data: project executing agency) was set up to carry out the following duties:

- technical management of investment (studies, construction and manufacturing, works and commissioning).
- administration and financial management of investments (making funds available, loans management, drawing up of agreements, contracts).

- reviewing and settling of all issues relating to the construction of the dam, in its social environment (resettling of the inhabitants of the area, effects on the environment).
- coordination with other public services of development projects connected with the works.
- making preparations for the operations and maintenance of the dam project. The Project Management Unit was consequently provided with the budget and with human and material resources needed for its running.

4.2.8 By its size and diversity, the Nangbeto project together with all its components, constitute a valuable training ground. Training activities (see Chapter 6.3) will take the following forms:

- organization of courses abroad for engineers and technicians in charge of maintenance and operation of equipment;
- on-the-job training of the CEB staff (managerial and executing staff) in the various departments of the project: civil engineering, electro-mechanical equipment and transmission network.

The monitoring and organization of these training activities were also part of the duties of the Project Management Unit.

#### G. Consulting Firm Services

4.2.9 These services were rendered by the Sogreah-Electrowatt Consulting Firm recruited through international competitive bidding. Throughout project implementation it worked with local agents and the duties defined at project appraisal were carried out respectively as follows:

- Preparation of detailed technical studies and working plans for civil engineering works, checking and approving studies and plans for assembling mechanical and electrical equipment supplied by contracting firms.

- monitoring the manufacturing of equipment, as well as their testing and handing over at the factories.
- Continuous management of project time and costs through regular updating and evaluation of the implementation schedule and the project's financial position.
- the acceptance and commissioning of the dam.

4.2.10 A project monitoring committee made up of members of the High Authority (Top civil servants) regularly checked and supervised works development. An expert committee made up of three specialists (one in civil engineering, one in electricity and one in geology) served as adviser to the CEB and went from time to time to inspect works.

#### 4.3 Important Project Changes

Tests carried out on the hydraulic model in the Sogreah Laboratory made it possible to replace the standard spilling basin, stated in the draft bid submission, located upstream of the spillway, by a spillway chute forming a ski jump. The final decision as to the sizes of generators and various equipment was made on the basis of proposals put forward by the lowest bidding manufacturers.

#### 4.4 Implementation schedule

4.4.1 Project implementation started with the recruitment through international competitive bidding of the Sogreah-Electrowatt Consulting Firm. The project was implemented according to the schedule laid down during appraisal with slight time lags in connection with bid examinations and donor agreements (see past and present schedules in Annexes 11 and 12), with various negotiations and signatures and in connection with the works proper, which started when weather conditions became clement, a two-month time overrun, although on the whole works ran to schedule.

4.4.2 The various contracts with engineering and buildings firms were signed in August 1984. Engineering works and equipment studies started and moved according to the Engineering Firm's plan, so that the power station's

semi-industrial operation started as expected in October 1987 with some key operating dates:

1. Concreting of the dam's intake structure blocks to a level enabling the builder to erect the intake structure armouring: 01/11/1985.
  2. Concreting of the bottom outlet block up to a level which will make it possible for the builder to erect the bottom outlet armouring: 01/01/1986.
  3. Completion of concreting of spillways enabling the builder to erect the crestgate and stoplogs: 01/09/1986.
  4. Completion of concreting of the erection bench and of the long timer abutment of the travelling gantry of the plant and its erection: 01/01/1986.
  5. Completion of the plants primary concrete enabling the erection of the power station's equipment: 01/04/1986.
  6. Posting of the fitter of the departure station platform.
  7. Completion of the final civil engineering works so as to allow for the dewatering of the structures: 01/07/1987.
  8. Completion of finishing touches, dismantling of installations, cleaning and rehabilitation of premises: 31/12/1987.
  9. Supplying of turbine shaft N° 1 : 1/02/87  
Supplying of turbine shaft N° 2 : 1/04/87.
  10. Semi-industrial operation of generator 1 : 1/08/87,  
Semi-industrial operation of generator 2 : 1/10/87
  11. Supplying of intake structure equipment of generators: 1/02/87.
  12. Supplying of outlet valve equipment: 1/02/87.
  13. Supplying of the power station: 1/04/87
  14. Supplying of the upstream cofferdams: 1/02/87.
  15. Semi-industrial commissioning of the Momehagou station: 1/12/86.
  16. Semi-industrial commissioning of the Nangbeto station: 1/07/87.
- 4.5 Procurement of goods and services

4.5.1 Pursuant to the provision laid down in the loan agreements, contracts signed under the project which are relative to components involving the Bank, were awarded in accordance with Bank rules and procedures.

4.5.2 For bid package I, civil engineering, an invitation for the prequalification of contractors was published twice (8th January and 10th February 1981) in the following newspapers: le Monde (Paris), Frankfurter Allgemeine (Frankfurt), Financial Times (London), Wallstreet Journal (New-York) and Jeune Afrique (Paris). Bid documents from 42 candidates were opened (11 from groups of firms and 31 from firms), originating from 17 countries. On analysis of data and information supplied by the competitors, 12 contractors or groups had the required qualifications (see Annex 7). Works were awarded on the basis of financial bids to the lowest bidding firm Hoechstief, Essen RFA.

4.5.3 For the electro-mechanical equipment of the dam, the invitation for manufacturers to prequalify was also published twice (8th January and 10th February 1981) in the same newspapers as for the civil engineering package. After the 31st March 1981 deadline, 47 documents had been sent in. This bid-package II relative to electromechanical equipment for the dam and the power station was divided into the following four sub-bid packages:

- sub-bid package 1: turbines, regulation, pivots
- sub-bid package 2: alternators
- sub-bid package 3: sluice valves, handling equipment
- sub-bid package 4: electrical and connected equipment for the dam and power station.

4.5.4 For the prequalification of sub-package 1, 22 applications or confirmations were received; comprising 11 manufacturers of 9 nationalities were selected. 19 applications or confirmations were received in connection with sub-bid package 2 out of which, 10 candidates from 8 countries were selected. Sub-bid package 3 attracted 25 applications or confirmation from which only 10 manufacturers were selected. As to sub-bid package 4, 24 applications or confirmations were received, from which 10 manufacturers were selected. Annex 8 gives a list of candidates selected per sub-bid package.

4.5.5 Bid package II comprising study, supply and assembly of the Nangbeto power transformers, Nangbeto sub-stations, Nangbeto-Momehagou sub-stations, Nangbeto-Momehagou 161 KV transmission line, can be detailed as follows:



- sub-bid package 1: Nangbeto power transformers
- sub-bid package 2: Nangbeto sub-station and extension of Momehegou sub-station
- sub-bid package 3: Nangbeto-Momehagou 161 KV transmission line

4.5.6 Concerning sub bid package 1, out of the 25 applications or confirmations received, 7 manufacturers were selected; 31 applications were received for sub-bid package 2, out of which 15 manufacturers prequalified, and for sub-bid package 3, 15 out of 27 manufacturers were selected. The list of applicants selected per sub-bid package is given as Annex 9 of the report.

4.5.7 The Nangbeto dam and power station equipment was put to contract in the form of two bid packages comprising 4 and 3 sub-bid packages respectively. An analysis of proposals received showed that it was more interesting to take into account the lowest bidders for each sub-bid package all the more so as this method simplified the distribution of the various financing sources available. The various sub-bid packages were therefore awarded to the following manufacturers:

#### Bid Package II

- sub-bid package 1: Turbines-Escher Wyss (FRG)
- sub-bid package 2: Alternators-SIEMENS (FRG)
- sub-bid package 3: Sluice valves, hoisting machines - NEYRPIK/-KRUPP/STR (France, FRG)
- sub-bid package 4: Electrical equipment - SPIE-BATIGNOLLES (France)

#### Bid Package III

- sub-bid package 1: Transformers - ALSTHOM (France)
- sub-bid package 2: 161 KV sub-station - CLEMESSY - (France)
- sub-bid package 3: 161 KV transmission line - Transelec-SINTRA-BELT - (Canada)

4.5.8 The contracts pertaining to the resettlement programme to be financed by the UNDP and the Government of Benin and Togo were awarded on the basis of limited shopping involving only the two countries, owing to the peculiar nature of the works (removal and resettlement, rehabilitation of feeder roads, deforestation, drilling etc).

4.5.9 A rather large number of tenders participated. Bank procedures worked well. Deadline for the awarding of contracts, as well as the procurement of goods and services procedure were respected.

#### 4.6 Organization and Management

4.6.1. The technical and financial management of the project was entrusted to a Project Management Unit representing Project Managing Authority. The latter is made up of a Managing Director (a Togolese), a Deputy Managing Director (a Beninese), a Head of the Technical Division (an EDF officer), assisted by a CEB Officer, an Administrative Division Chief (an EDF officer) assisted by a CEB Officer and an Environmental and Population Resettlement Division Chief (a CEB professional). The general organization of the project is shown in Annex 10.

4.6.2 The engineering consultant group SOGREA-H-ELECTRO-WATT is the chief contractor. Throughout the project's implementation, the Group worked with officers, supervising and controlling works and developing the project. A project monitoring committee made up of some members of the High Authority (top civil servants from both countries) regularly controlled and checked the progress of works. An expert committee made up of three specialists (one in civil engineering, one in electricity and one in geology) served as adviser to the CEB and supervised the works from time to time. Chapters 4.2.7, 4.2.8 and 4.2.9 give an idea of the chief contractor's mandate. Both committees proceeded with the project's implementation in a way that satisfied the parties concerned. Half-yearly progress reports were prepared regularly and distributed to all donors and so was a wrap-up report which served as completion report at the end of works.

#### 4.7 Project Cost

4.7.1 At the time of appraisal, the projects total cost was estimated at UA 117.15 million, including UA 94.87 million in foreign exchange and UA 22.28 million in local currency.

4.7.2 The summary of estimated cost by component at appraisal was as follows:

Table 4.1  
Summary of Estimated Cost by Component  
(in UA million)

<u>Components</u>	<u>F. Exchange Costs</u>	<u>Local Cost</u>	<u>Total</u>	<u>%</u>
A. Civil Engineering	39.88	4.60	44.48	37.97
B. Electromechanical equipment	16.52	2.51	19.03	16.24
C. Transmission network	7.12	3.15	10.27	8.77
D. Population resettlement	0.57	3.44	4.01	3.42
E. Project Management and Training	1.74	1.60	3.34	2.85
F. Engineering and works control	<u>4.89</u>	<u>0.79</u>	<u>5.68</u>	<u>4.85</u>
Sub-total	70.72	16.09	86.81	74.10
Physical contingencies	6.43	1.55	7.98	6.81
Price escalation	<u>17.72</u>	<u>4.64</u>	<u>22.36</u>	<u>19.09</u>
Grand total	94.87	22.28	117.15	100.00
	=====	=====	=====	=====

4.7.3 The projects actual total cost duty free after implementation amounts to UA 98.23 million, of which UA 72.97 million in foreign exchange and UA 25.26 million in local currency.

4.7.4 The summary of the projects actual cost per component is as follows:

Table 4.2  
A. Actual Cost of Project for all Donors and the CEB  
 (UA)

	1985		1986		1987		1988		1989		TOTAL		
	<u>F.Exchange</u>	<u>Local</u>	<u>F.Exchange</u>	<u>Local</u>	<u>F.Exchange</u>	<u>Local</u>	<u>F.Exchange</u>	<u>Local</u>	<u>F.Exchange</u>	<u>Local</u>	<u>F.Exchange</u>	<u>Local</u>	<u>Grand</u>
	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Currency</u>	<u>Total</u>
1. Eng.	1107339.44	4807451.71	10141599.30	4394598.38	5043289.80	2182954.01	2150483.24	829339.64	-	-	28432711.78	12214343.74	40647055.52
2. Turb.	1348028.63	101464.52	1231977.95	92729.52	2496508.58	187909.25	681408.01	51288.78	-	-	5757923.17	433392.07	6191315.24
3. Alter-nators	232833.18	25870.35	-	-	2775751.33	308416.81	874551.35	97172.37	-	-	3883135.86	431396.53	4314532.39
4. Sluice Valves	1404963.65	122170.75	3007315.56	252293.76	3728806.66	314531.26	669271.25	58197.50	-	-	8810357.12	747193.27	9557550.39
5. Elect. equip.	193369.97	10735.97	674032.90	40742.18	2099569.47	125304.93	80617.19	7945.91	-	-	3047589.53	184728.99	3232318.52
6. Trans-formers	68762.98	215.56	-	-	631087.18	1279.91	102408.72	15629.02	-	-	802258.88	17124.49	819383.37
7. HV stat.	275514.24	60902.83	2519717.14	545229.12	280604.58	402069.11	121174.31	242402.36	-	-	3197010.27	1250603.42	4447613.69
8. HV sig.	4736751.23	-	2866541.61	-	-	-	-	-	-	-	7603292.84	-	7603292.84
9. Eng. 10. Contra.	1119473.18	775572.98	1059980.92	690458.55	817818.72	543370.08	443850.19	299596.40	-	-	3441123.01	2308998.01	5750121.02
Auth.	132512.76	207705.11	102650.09	228928.88	154967.43	280456.65	163348.20	280362.69	-	-	553478.48	1608998.01	2162476.49
11. Tech.-Asst.	351757.45	-	346549.97	-	128586.21	-	239969.45	-	-	-	1066863.08	-	1066863.08
12. Reset. & defore-station	-	288073.00	-	1992517.54	-	1945352.64	-	1138559.70	-	913030.32	-	5252833.20	5252833.20
13. Misc.	-	2468.06	155310.80	36933.93	543335.10	134194.29	880946.12	220602.85	2439.68	-	1582031.70	394199.13	1976830.83
14. TOTAL	20961306.71	6402630.84	22105676.25	8274431.86	18700324.54	6425838.94	6407028.03	324117.22	2439.68913030.31	-	68177775.21	25257049.18	93434824.39
15. Interests during	806893.30	-	1350849.72	-	1861955.59	-	767902.57	-	-	-	4787601.08	-	4787601.08
16. GRAND TOTAL	21768199.91	6402630.84	23456525.97	8274431.86	20562280.65	6425838.94	7175930.60	324117.22	2439.68913030.32	-	729653736.8125257049.18	98222425.99	98222425.99

4.7.5 At appraisal, the financing plan was as follows:

Table 4.3  
Financing at Project Appraisal  
(UA 10<sup>6</sup>)

<u>Sources</u>	<u>Foreign Exchange</u>	<u>Local Currency</u>	<u>Total</u>	<u>%</u>
1. ADB	22.02	-	22.02	18.8
2. AID	12.83	5.47	18.30	15.6
3. KUWAITI FUNDS	16.48	0.86	17.34	14.8
4. OPEC	6.94	-	6.94	6.0
5. BADEA	8.67	-	8.67	7.4
6. KFW	12.84	1.04	13.88	11.8
7. CCCE	9.71	2.43	12.14	10.4
8. ACIDI	3.38	4.51	7.89	6.7
9. FAC	1.13	0.17	1.30	1.1
10. UNDP	0.87	2.60	3.47	3.0
11. CEB	-	5.20	5.20	4.4
Total	94.87	22.28	117.15	100.0

Table 4.4  
Financing after Examination of Bids  
(UA 10<sup>6</sup>)

<u>Sources</u>	<u>Monnaie Devises</u>	<u>locale</u>	<u>Total</u>	<u>%</u>
1. ADB	6.48	-	6.48	4.94
2. AID	28.10	0.09	28.19	21.49
3. KUWAITI FUNDS	18.16	0.96	19.12	14.33
4. OPEC	7.52	-	7.52	5.73
5. BADEA	9.56	-	9.56	7.16
6. KFW	14.19	1.41	15.60	11.89
7. CCCE	9.30	0.75	10.05	7.67
8. ACIDI	7.52	1.13	8.65	6.59
9. FAC	1.13	0.28	1.41	1.07
10. UNDP	0.19	0.56	0.75	0.57
11. CEB	14.19	10.15	24.34	18.56
Total	116.34	15.33	131.67	100.00

4.7.6 Following financing confirmation from the OPEC Fund for \$4 million i.e. UA 7.52 million instead of UA 3.76 million and taking into account the initial cost estimate of UA 139.6, ADB's contribution was brought to UA 15.44 million and that of the CEB, to US\$ 21.4 million i.e. UA 20.11 million giving the following financing schedule after the signing of the loan agreements:

Table 4.5

<u>Sources</u>	<u>Contribution in UA 10<sup>6</sup></u>	<u>%</u>	<u>Date and venue of signing of agreements</u>
1. ADB	15.44	11.68	13/07/1984 in Abidjan
2. AID	28.19	21.33	26/07/1984 in Washington
3. KUWAITI FUNDS	18.79	14.22	17/07/1984 in Kuwait
4. OPEP	3.76	2.84	24/08/1984 in Vienna
5. BADEA	9.40	7.11	26/06 and 27/06.1984 in Cotonou and Lomé respectively
6. KFW	15.60	11.80	01/11/1984 in Lomé
7. CCCE	10.05	7.60	October in Lomé
8. ACDI	8.64	6.54	1984
9. FAC	1.41	1.06	24/02/1984 in Cotonou
10. UNDP	0.75	0.60	15/05 and 29/08./1984 in Cotonou and Lomé respectively
11. CEB	<u>20.11</u>	<u>15.22</u>	- do -
Total	132.14	100.00	

4.7.7 On completion of the project, the final financing schedule per donor and according to disbursements is as follows:

Tab 1.6  
Final Financing Schedule of Project  
(UA)

SOURCES	1985	1986	1987	1988	1989	TOTAL	%
1. ADB*	2588992.93	4254734.89	1249027.70	463427.79	-	8556183.31	8.71
2. AID	4785764.84	5825354.35	4162045.57	2849906.82	403191.93	18026263.51	18.35
3. KUWAIT FUND	6006019.70	4729831.87	2507624.86	1822542.03	-	15066018.45	15.34
4. OPEC	1216963.49	860867.02	715805.14	12591.93	-	2806227.58	2.86
5. BADEA	2534234.15	2950097.44	1387372.88	34232.87	-	6905937.34	7.03
6. KFW	2077474.79	3072862.28	7602138.75	2156855.41	-	14909331.23	15.18
7. CCCE	1430940.77	2226229.60	5067026.62	458546.38	-	9182743.37	9.35
8. ACIDI	4736751.23	2866541.61	-	-	-	7603292.84	7.74
9. FAC	351757.45	346549.97	128586.21	239969.45	-	1066863.08	1.08
10 UNDP	-	6071.54	68526.44	93997.23	-	168595.21	0.18
11 CEB	2441931.40	4591817.26	4099965.42	2284977.91	-	13930970.06	14.18
TOTAL	28170830.75	31730957.83	26988119.59	10417047.82	403191.93	98222425.99	100.00

\* The balance (UA 6,883,816.69) of the Bank loan (UA 15,440,000) on completion of the project was cancelled by the borrowers.

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Table 4.7

Final Financing Schedule (Foreign Exchange and Local Currency)  
(UA)

Cofinanciers	1985		1986		1987		1988	
	F. Exchange	Local Currency	F. Exchange	Local Currency	F. Exchange	Local Currency	F. Exchange	Local Currency
1. ADB	2 588 992.93	-	4 254 734.89	-	1 249 027.70	-	463 427.79	-
2. IDA	1 620 219.70	3 165 545.14	2 335 387.29	3 489 967.06	1 555 457.76	2 606 587.81	639 638.61	1 210 268.21
3. Kuwaiti Fund	4 664 429.35	1 341 590.35	3 572 100.07	1 157 731.80	1 863 825.71	643 799.15	1 515 913.63	306 628.40
4. OPEC	1 216 963.49	-	860 867.02	-	715 805.14	-	12 591.93	-
5. BADEA	2 534 234.15	-	2 950 097.44	-	1 387 372.88	-	34 232.87	-
6. KFW	1 920 597.67	156 877.12	2 844 825.58	228 036.70	6 963 282.91	638 958.13	1 972 199.47	184 655.94
7. CCCE	1 327 360.74	103 580.03	2 068 500.84	157 728.76	4 768 542.60	298 484.02	436 057.05	22 489.33
8. ACDI	4 736 751.23	-	2 866 541.61	-	-	-	-	-
9. FAC	351 757.45	-	346 549.97	-	128 586.21	-	239 969.45	-
10. UNDP	-	-	6 071.54	-	68 526.44	-	93 997.23	-
11. CEB	806 893.20	1 635 038.20	1 350 849.72	3 240 967.54	1 861 955.59	2 238 009.83	767 902.57	1 517 075.34
TOTAL	21 768 199.91	6 402 630.84	23 456 525.97	8 274 431.86	20 562 280.65	6 425 838.94	7 175 930.60	3 241 117.22

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**FINAL FINANCING SCHEDULE**

(UA)

Cofinanciers	1989		TOTAL		REMARKS
	F. Exchange	L. Currency	F. Exchange	Monnaie locale	
1. ADB	-	-	8 556 183.31	-	8 556 183.31
2. IDA	2 439.68	400 752.25	7 153 143.04	10 873 120.47	18 026 263.51
3. Kuwaiti Fund	-	-	11 616 268.76	3 449 749.70	15 066 018.46
4. OPEC	-	-	2 806 227.58	-	2 806 227.58
5. BADEA	-	-	6 905 937.34	-	6 905 937.34
6. KFW	-	-	13 700 803.34	1 208 527.89	14 909 331.23
7. CCCE	-	-	8 600 461.23	582 282.14	9 182 743.37
8. ACDI	-	-	7 603 292.84	-	7 603 292.84
9. FAC	-	-	1 066 863.08	-	1 066 863.08
10. UNDP	-	-	168 595.21	-	168 595.21
11. CEB	-	512 278.07	4 787 601.08	9 143 368.98	13 930 970.06
<b>TOTAL</b>	<b>2 439.68</b>	<b>913 030.32</b>	<b>72 965 376.81</b>	<b>25 257 049.18</b>	<b>98 222 425.99</b>

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Table 4.8  
A. Actual Cost of Project per Donor  
(UA)

Components	1985		1986		1987		1988		1989		TOTAL		
	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	Grand Total
<b>I. ADB</b>													
1. Civil													
Eng.	2313476.88	-	1735002.27	-	968422.68	-	342254.69	-	-	-	5359156.52	-	5359156.52
2. Station	275516.05	-	2519732.62	-	280605.02	-	121173.10	-	-	-	3197026.79	-	3197026.79
TOTAL	2588992.93	-	4254734.89	-	1249027.70	-	463427.79	-	-	-	8556183.31	-	8556183.31
<b>II. AID</b>													
1. Civil													
Eng.	494933.77	2696345.71	1116454.40	2192680.43	176932.92	1319009.82	292411.49	358646.83	-	-	2080732.58	6570682.79	8651415.38
2. Engineer	992773.17	330924.39	967043.54	322347.85	748748.75	249582.92	396930.03	132310.01	-	-	3105495.49	1035165.17	4140660.66
3. Contract.													
Authority	132512.76	-	102650.09	-	154967.43	-	163348.20	-	-	-	553478.48	-	553478.48
4. Resettling & defore- station	-	138275.04	-	942178.94	-	933768.78	-	546566.49	-	400752.25	-	2961541.50	2961541.50
5. Misc.	-	-	149239.26	32759.84	474808.66	104226.29	786948.89	172744.88	2439.68	-	1413436.49	309731.01	1723167.50
TOTAL	1620219.70	3165545.14	2335387.29	3489967.06	1555457.76	2606587.81	1639638.61	1210268.21	2439.68	400752.52	7153143.04	10873120.47	18026263.51
<b>III. KUWAITI FUND</b>													
1. Civil													
Eng.	4537729.35	961490.34	3479162.69	878919.68	1794756.26	436590.80	1468993.47	165867.92	-	-	11280641.77	2442868.74	13723510.51
2. Engineer	126700.00	380100.01	92937.38	278812.12	69069.45	207208.35	46920.16	140760.48	-	-	335626.99	1006880.96	1342507.94
TOTAL	4664429.35	1341590.35	3572100.07	1157731.80	1863825.71	643799.15	1515913.63	306628.40	-	-	11616268.76	3449749.70	15066018.45
<b>IV. OPEC</b>													
1. Civil													
Eng.	1216963.49	-	860867.02	-	715805.14	-	12591.93	-	-	-	2806227.58	-	2806227.58
TOTAL	1216963.49	-	860867.02	-	715805.14	-	12591.93	-	-	-	2806227.58	-	2806227.58

A. Real Cost of Project per Donor  
(UA)

Components	1985		1986		1987		1988		1989		TOTAL	
	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local	F. Exchange Currency	Local
V. <u>BADEA</u>												
1. Civil Eng.	2534234.15	-	2950097.44	-	1387372.88	-	34232.87	-	-	-	6905937.34	-
TOTAL	2534234.15	-	2950097.44	-	1387372.88	-	34232.87	-	-	-	6905937.34	-
VI. <u>KFW</u>												
1. Sluice Valves	339735.86	29542.25	1612847.63	135307.18	1690818.42	142632.07	416240.11	36194.79	-	-	4059642.02	343676.29
2. Turbines	1348028.63	101464.52	1231977.95	92729.52	2496610.87	187909.25	681408.01	51288.78	-	-	5758025.46	433392.07
3. Alter-nators	232833.18	25870.35	-	-	2775751.33	308416.81	874551.35	97172.37	-	-	3883135.86	431459.53
Total	1920597.67	156877.12	2844825.58	228036.70	6963180.62	638958.13	1972199.47	184655.94	-	-	13700803.34	1208527.89
VII. <u>CCCE</u>												
1. Sluice Valves	1065227.79	92628.50	1394467.94	116986.58	2037885.95	171899.19	253031.14	22002.71	-	-	4750612.82	403516.98
2. Electric equipment	193369.97	10735.97	674032.90	40742.18	2099569.47	125304.92	80617.19	486.62	-	-	3047589.53	177269.69
3. Transfor-mers	68762.98	215.56	-	-	631087.18	1279.91	102408.72	-	-	-	802258.88	1495.47
TOTAL	1327360.74	103580.03	2068500.84	157728.76	4768542.60	298484.02	436057.05	22489.33	-	-	8600461.23	582282.14
VIII. <u>ACDI</u>												
1. Lines	4736751.23	-	2866541.61	-	-	-	-	-	-	-	7603292.84	-
Total	4736751.23	-	2866541.61	-	-	-	-	-	-	-	7603292.84	-
IX. <u>FAC</u>												
1. Technical Assit.	351757.45	-	346549.97	-	128586.21	-	239969.45	-	-	-	1066863.08	-
Total	351757.45	-	346549.97	-	128586.21	-	239969.45	-	-	-	1066863.08	-

Table 4.10

A. Actual Cost of Project per Donor

(UA)

X. UNDP	1985		1986		1987		1988		1989		TOTAL	
	F. Exchange	Local	F. Exchange	Local	F. Exchange	Local	F. Exchange	Local	F. Exchange	Local	F. Exchange	Local
1. Misc.	-	-	6071.54	-	68526.44	-	93997.23	-	-	-	168595.21	-
Total	-	-	6071.54	-	68526.44	-	93997.23	-	-	-	168595.21	-
XI. CEB												
1. Civil Eng.	-	1149615.66	-	1322998.27	-	427353.39	-	304824.87	-	-	-	3204792.19
2. Electrical Equipment	-	-	-	-	-	-	-	7459.29	-	-	-	7459.29
3. Trans-formers	-	-	-	-	-	-	-	15629.02	-	-	-	15629.02
4. HV station	-	60902.83	-	545229.12	-	402069.11	-	242402.36	-	-	-	1250603.42
5. Engineer	-	64548.58	-	89298.58	-	86578.82	-	26525.92	-	-	-	266951.90
6. Contract. Authority	-	207705.11	-	228928.88	-	280456.65	-	280382.69	-	-	-	997473.33
7. Resettling & defore-station	-	149797.96	-	1050338.60	-	1011583.86	-	591993.21	-	512278.07	-	3315991.70
8. Misc.	-	2486.06	-	4174.09	-	29968.00	-	47857.98	-	-	-	84468.13
9. Interests during construct.	806893.20	-	1350849.72	-	1861955.59	-	767902.57	-	-	-	4787601.08	-
TOTAL	806893.20	1635038.20	1350849.72	3240967.54	1861955.59	2238009.83	767902.57	1517075.34	-	512278.07	4787601.08	9143368.98
GRAND TOTAL	21768199.91	6402630.84	23456525.97	8274431.86	20562280.65	6425838.94	7175930.60	3 241 117.22	2439.68	913030.32	72965376.81	25257049.18

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#### 4.8 Performance of participants

4.8.1 The African Development Bank: the Bank's assistance was more useful prior to the project's implementation. One of the Bank's legal experts assisted the CEB management and both countries involved in the revision of the corporation's status and corrections to be made to it. The Bank was represented in the various project preparation meetings. However, disbursements as a whole were rather regular.

4.8.2 The World Bank for its part played well its leading role in the project. The project was monitored from the time of preparation up to completion. It organized four important meetings for donors between 1979 and 1984 in order to round off the project's financing and the last of these meetings was held in Cotonou on 23rd and 24th February 1984. It had set up an excellent Project Management Unit which carried out its duties well. The training programme that it set up is still in progress with the computerization of the training centre and the further training of SBEE, CEET and CEB staff. The World Bank's expert committee made up of electricity, civil engineering and geology specialists assisted the CEB and the Project Unit regularly especially during implementation and the final phases of the project.

4.8.3 In April and May 1983, the World Bank, the Caisse centrale, the BADEA and ADB evaluated the project. In December 1983 the KF and Kuwaiti Fund did the same. OPEC however did not appraise the project but used the World Bank, ADB and BADEA reports. They all kept track of the projects various preparation phases. The KfW which sent a completion mission supervised the project's implementation well and so did the BADEA and the CCCE. All the donors including the UNDP, FAC, CIDA took proper care of the components they had to finance. On the whole, all participants attended well to their duties facilitating thereby the engineering consultants function which was to carry the project through according to plan and under good conditions; as excerpts of the World Bank speech at the dam's inauguration testify: "Regarding the Nangbeto project, I can act as an interpreter for all the donors and express their compliments and satisfaction in the implementation of the project; indeed deadlines as well as cost were respected. The commissioning of the structures came up a few months earlier than expected and cost was lower than estimates.

## 5. FINANCIAL ANALYSIS

### 5.1 Rate of Return

The projects 9.74% IRR at appraisal was calculated by deducting investments, provisions for price escalation which represented around 19% from the projects total cost i.e. UA 22.36 million. On completion, the IRR is 5.32%; not only because investments take into account price escalation, but because the average annual sale price over the period is identical to that put forward at appraisal: (CFAF 30.71 per KWh against CFAF 30.88 per KWh). The 13.80% ERR at appraisal, went up to 20.81% after completion, thanks to the large profits gained from consumption in areas of Atakpame in Togo, Bohicon and Abomey in Benin.

### 5.2 Financial Commitments and Compliance

5.2.1 Financial commitments involved only the financial schedule. They were presented in the form of loan conditions obliging the two Governments to earmark annual allocations in their respective budgets to meet their share of the project cost in accordance with the financing plan and to find additional sources of finance in the event of overruns of the project actual cost.

5.2.2 These conditions were met by the various parties and works commenced approximately as planned during evaluation and finished even earlier.

6. CEB: PERFORMANCE AND TREND

6.1 Legal Status and Objective

6.1.1 Established by International Agreement and the Code Dahomais de l'Electricité signed on 27 July 1968 by the Republics of Benin and Togo, the Communauté Electrique du Bénin is an international public institution vested with the fullest legal status accordable to corporate bodies by the laws of the two States. It possesses the nationality of each of the two States and is recognized as such by third party States. The CEB has the monopoly in both countries of the production and transmission of electric energy originating from installations other than those existing at the time of entry force of the "Dahomaise Code" as well as the monopoly over the establishment of such installations.

6.1.2 This monopoly is, however, rendered less absolute by the system of declaration or authorization. For example, power generating plants intended solely for their owners' own use and whose total output does not exceed the 100 KVA limit fixed by the Code can be set up without prior authorization. A declaration must, however, be made to the CEB as soon as they are put into service. On the other hand, power generating units serving industrial, commercial or agricultural enterprises other than those mentioned above can be set up by the enterprise concerned provided it has been authorized to do so by the CEB. Moreover, each State or group or public enterprise which depends on it can:

- i) hand over to the CEB, if the latter agrees, any power generation, transmission and distribution facilities belonging to it and existing before the coming into force of the Code, or
- ii) entrust its operations to it.

6.1.3 The CEB, whose headquarters is in Lome, is under the technical supervision of the Ministries of Public Works, Mines and Energy and Water Resources of Togo, and the Ministries of Industry, Mines, Land Energy of Benin. Its functions include, among other things:

- i) the establishment and operation in accordance with the regulations applied by the industrial and commercial companies of the facilities over which it has been granted the monopoly defined earlier on;
- ii) the control, by delegation of the Governments of the two countries, of the generation, transmission and distribution of electric power in the two countries and, in particular, the co-ordination, normalization and standardization of power installations and facilitating their integration into the general network as well as fixing of rates for power sales to the public;
- iii) drawing up and implementing electrification programmes based on the needs of the two States and participating in the formulation of general plans for the economic development of the two countries particularly as regards energy policy;
- iv) assuming responsibility for the selection, training and further training, in a vocational training centre placed under its authority, of the executing and supervisory personnel required to man the public electricity service in the two countries;
- v) providing to the communities and public or private enterprises in their electrification efforts through the establishment of a repair and maintenance centre as well as a central service for the procurement of standard or standardized plant and equipment.

6.1.4 The real activities of the CEB can at present be summed up as consisting in the implementation of the power supply contract with the VRA (Ghana), and in the management of the Abomey-Calavi Training Centre. Since the CEB means of production are limited, the two national electricity corporations (SBEE and CEET) not only continue to operate their old plants but are acquiring new ones. In order to prevent this situation from undermining the production monopoly, statutory amendments are being made in order to strengthen the CEBs position and enable it to play a role in the drawing up of electrification programmes and rate structures on the one hand and the normalization and standardization of plants with the view integrating them into the general network, on the other.



6.1.5 The CEB is still administered by an Inter-State Supreme Council of the Community (Ministers of Industry and Mines, Planning, Foreign Affairs, Economy and Finance of both countries) and a High Authority of the Community (Top Civil Servants from the Departments of Mines and Industry, Planning, Economy and Finance, Civil Service), assisted by a Managing Director. The Inter-State Supreme Council meets at least once every year, alternatively in the two countries, following the close of a financial year and at the request of the Chairman of the High Authority chosen from among top civil servants. It exercises the widest powers in carrying out the CEB's missions; it determines the general principles of its action and supervises the management of all its organs. It exercises on behalf of the two Governments, the statutory powers delegated by the latter to the CEB. The Chairmanship of the Supreme Council is assumed by the current Head of State of the country where the meeting is held. The Chairman of the High Authority and the Managing Director of the CEB attend the meetings of the Supreme Council in an advisory capacity.

6.1.6 The High Authority of the Community comprises twelve (12) members at most including ten (10) chosen on equal basis among the nationals of the two States and two by international organizations or agencies of which the two States are members. Members of the High Authority are elected for six years by the Inter-State Supreme Council upon presentation by the States. The High Authority determines the broad lines of action of the High Authority and supervises its management. The High Authority is invested with the widest powers for the administration of the Community's affairs. It looks after the interests of the CEB and supervises its management. It directs and supervises the work of the General Manager. The High Authority is headed by a Chairman elected for two years. It meets as often as necessary and at least twice a year. The General Manager of the CEB attends these meetings in an advisory capacity.

## 6.2 Organization and Management

6.2.1 The CEB is headed by a General Manager appointed by the Inter-State Supreme Council upon proposal by the High Authority. The General Manager is responsible for the day-to-day management of the institution and, under the general provisions laid down by the High Authority, he organizes and directs all the departments of the CEB. As the organization chart in Annex 13 shows, the CEB comprises three main departments:

- \* An administration and finance department comprising an administration division, an economic affairs division and an accounts division;
- \* An engineering department comprising a Togo regional division and a Benin regional division;
- \* A Survey and Inspection department comprising an engineering division and an inspection division.

6.2.2 In addition to these three departments, there is a vocational training and further training centre which is directly under the authority of the General Management which is now back under the supervision of the administrative and financial department after the latter's reorganization.

6.2.3 The organization structure of the CEB since project appraisal is more or less the Bank. Two studies on the organization and financial management of the Corporation were conducted by Hydro-Quebec (1984) on the one hand and by Eurequip (1988) on the other, and the findings of these studies are about to be applied. The CEB's activities still consist mainly in the resale of electric power purchased from the VRA and in the operation and maintenance of the Nagbeto dam, in the maintenance of power transmission network as well as in the sale of power from the dam. Other development projects scheduled in the electrification plan of the two countries will enable the CEB to play its full role with the definite reorganization of the corporation.

### 6.3 Staff and Training

6.3.1 Since project evaluation in 1982, the staff of 185 employees has gone up to 289 in 1990 making a 6% average annual growth rate with a more accelerated increase towards the end of the projects implementation. As of 1986, the power station site started to attract permanent staff for the operation of the dam. The two tables given below highlight the trend and distribution of the CEB staff by category and by rank on the one hand and their distribution in the various departments, on the other. As decided in 1983, the staff was increased to operate the dam and as usual there is on the whole a predominance of technicians: 70% on average as opposed to 30% who hold administrative positions.

Table 6.1  
Trend and distribution of CEB personnel by category and rank

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986*</u>	<u>1987</u>	<u>1988*</u>	<u>1989</u>	<u>1990</u>
1. Executive	8	12	11	13	18	16	15	18	17
2. Supervisory staff	44	45	45	53	65	68	77	82	82
3. Executing staff	<u>133</u>	<u>135</u>	<u>138</u>	<u>141</u>	<u>145</u>	<u>159</u>	<u>185</u>	<u>189</u>	<u>186</u>
Total	185	192	194	207	228	243	277	289	285

\* In 1986, out of 228 persons, there were 7 women including one professional, 4 executing staff and 2 supervisory staff. In 1988 out of 277 there were 13 female employees of which 1 was a professional, 9 were executing staff and 3 supervisory staff.

Table 6.2  
Status of distribution of CEB personnel in the various departments, divisions, training centre and Nangbeto power station

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
1. General Management	31	35	33	43	43	41	45	55	55
2. Regional Div. Togo	78	81	84	87	98	95	98	97	97
3. Regional Div. Bénin	61	60	60	60	60	56	63	60	57
4. Nangbeto Hydro-elec. power station	-	-	-	-	10	32	50	58	59
5. Train. Centre (CFPP)	<u>15</u>	<u>16</u>	<u>17</u>	<u>17</u>	<u>17</u>	<u>19</u>	<u>21</u>	<u>19</u>	<u>17</u>
Total	185	192	194	207	228	243	277	289	285

6.3.2 The CEB Vocational and Further Training Centre is still reserved exclusively for the two member States of the community. The purpose of this centre is to train staff to meet the requirements of the two countries. There are two training courses: production and electricity network, to which will be added as of 1991; management and finance. Recruitment is by competition organized for technical students in form five and lower sixth. The course lasts two years and comprises theory sandwiched with field work. Courses are taught by nationals (professional teachers and technicians from the SBEE, CEET and CEB) and one expatriate on secondment from the EDF. At the end of their course, trainees are categorized: good, average and weak. Those of the first category take up duty immediately and preferably in the two corporations (SBEE and CEET) where they are recruited under a ten year bond; those of category two do another year in the centre so as to become more competent. This permanent classification makes it possible for the centre to produce an appreciable quality service (Annexes 17 and 18). Within the framework of the project, the centre benefited from technical assistance for the development of human resources, for maintenance, diesel distribution, staff training and

further training and for equipping itself with micro-computers for training its students.

6.3.3 1988 was devoted to teacher training and to the follow-up of the study on the centre's expansion project. It is in the expectation of this extension that the centre has had no new student recruits to train, despite the graduation last March of students enrolled on year 13 and 7 for the two year training course. After the graduation of this last set, the number of officers trained or given further training courses by the centre amounts to 218, categorized as follows:

Table 6.3

	<u>CEB</u>	<u>CEET</u>	<u>SBEE</u>	<u>OTHERS</u>	<u>TOTAL</u>
Number	39	77	56	46	218
%	17.89	35.32	25.69	21.10	100

6.3.4 Established in 1968, its early years were laborious and as the needs became felt, the number of trainees increased to meet these needs reaching 30 (15 per State) per cycle and the training programme was spread over two years. The total number of trained: 218, is therefore significant and with the working implements put at the training centre's disposal, the further training given to teachers through the Nangbeto project, the CEB, SBEE and CEET will appreciate some of the benefits that have emanated from the accommodating actions decided during the project's appraisal. The centre's development programme is given as Annex 19.

6.3.5 For its own manpower requirements, the CEB still recruits from the training centre and in order to improve the skills of its staff, it has adopted an on-the-job training system. To provide further training for its executives and top level technicians, enabling them to be in constant touch with novel techniques in the field of electricity, various contracts were signed with Hydro-Quebec, EDF etc.

6.3.6 The commissioning of the Nangbeto hydroelectric dam towards the end of 1987 was the initial phase in the development of the CEBS units of output and hence in the growth of its activities as well as those of the SBEE and the CEET. In order to cope with this new workload and improve their technical, administrative and financial management, the staff of these entities have

benefitted from a thorough training with the help of foreign experts. These technical assistance and training actions were distributed as follows:

1. AT THE CEB:

a) For operating the dam:

- Technical assistance from the EDF which sent an experienced engineer to assist the Head of the plant for eighteen months;
- Training and further training of 4 engineers and 19 technicians who are responsible for operating the dam.

b) For the Abomey-Calavi Vocational and Teacher Training Centre (see Chapter 6.3.2)

c) For the technical departments:

- Further training courses for survey and operating staff.

d) For the administrative and financial departments:

- Computer management
- Further training courses for staff

2. AT THE CEET:

a) For the technical departments:

- Assistance for the metering and graduation of meters;
- Training of operating staff for the PCV 12 generators for the 66 KV sub-stations, for the Lome thermal power station and relaying in the repairing station;
- Training of professional and operating staff abroad.

b) For the administrative and financial divisions:

- Further training of professionals abroad and training in the following field:
  - . Internal auditing
  - . manpower planning.

c) For the commercial department:

- Further training for the computer staff;
- Technical assistance for on-the-job training on customer services management.

d) For the finance and accounting department:

- On-the-job training and further training of the accounts staff;
- Training abroad for executives.

e) For the commercial affairs department:

- Training abroad for executives;
- Seminars organized at work for the staff.

3. AT THE SBEE

a) For the operations department:

- Technical assistance for the research and non-technical loss decrease campaigns;
- Training or research into technical loss;
- Measuring of harmonics on the network to allow for the installation of condensers;
- Cartography campaign survey for the MV and LV network;
- Relaying and testing mission for repairing stations;
- Training of staff abroad.

6.4 Accounting and Auditing

6.4.1 The financial year of the CEB begins on 1 January and ends on 31 December. The accounting is based on the 1957 accounting plan. At the end of each financial year, the Accounts Division draws up a general income statement, a profit and loss accounts and a balance sheet. Each year, the CEB prepares budget estimates incorporating the requirements of the regional divisions and general management. The budget is prepared first in the engineering departments; it is then centralized in the administration and finance department discussed by the general management and presented to the High Authority before being submitted for approval to the Inter-State Supreme Council. These accounting procedures which have not changed since the projects appraisal, are on the whole satisfactory.

6.4.2 At the end of each financial year, the accounts of the CEB are submitted for approval to the High Authority and Inter-State Supreme Council together with the auditors' report. The accounts are audited by two auditors

(one from each State) selected by the Supreme Council from the list of chartered accountants at the Court of Appeals. Like company auditors, these auditors are to inspect the books, cash, portfolio and assets of the CEB, to check the regularity and accuracy of the balance sheets as well as the accuracy of the information provided on the accounts in the report of the High Authority. In addition, the Governments of the two States have the option to establish, in agreement with the Inter-State Supreme Council, a joint finance and accounts inspection committee to carry out any inspections, probes and audits that may be deemed desirable at any time. Inspection reports are sent to the members of the Supreme Council and to the Chairman of the High Authority. Despite these provisions, CEB'S financial statements have been audited every year by the Coopers and Lybrand Firm since 1981 and its various recommendations have helped the CEB to improve.

## 6.5 Rates

6.5.1 CEB's rates are based on three parameters: fixed monthly rate, voltage and power. The fixed monthly rate represents the amortization passed on to the customers by the CEB in respect of investments made on their behalf. The voltage is calculated on the basis of the peak recorded during the month and the power consumed represents the amount of KWh consumed during the month. The current rates are given in Annex 16. They are expressed in US Dollars (US\$) and, as a rule, are revised every three years. This is due to the fact that the electric power supplied the CEB by the VRA is billed in US Dollars and, according to the terms of the contract between the two parties, the KWh price is revisable every three years. It may be noted that the last revision of the CEB rates was in April 1988 (Annex 15).

6.5.2 The rate applied by the VRA to the CEB consists of the same elements applied by the community to its own customers. The current rate is as follows:

- Fixed rate US\$ 24.500 (unchanged since project appraisal)
- Voltage US\$ 7 kw/month
- Power US\$ 0.0343 per kwh.

Table 6.4  
Trend of average sale and purchase price of the KWh  
(CFAF)

<u>Year</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Average kw sale price	15.67	20.94	25.98	22.90	20.32	23.88	24.38
Average kw purchase price	9.40	13.09	15.85	13.64	12.28	14.86	17.97
Margin/kw of CEB	6.27	7.85	10.13	9.26	8.04	9.02	6.41
	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	
Average kw sale price	32.68	32.22	31.87	31.36	30.93	30.56	
Average kw purchase price	18.06	19.99	21.76	21.76	23.42	23.42	
Margin/kw of CEB	14.62	12.23	10.11	9.60	7.51	7.14	

For the 1990 financial year, the CEB average kw purchase price is CFAF 21.76, against an average kw sale price of CFAF 31.68 making a CFAF 14.62 per kw margin for the community. As the table illustrates, the average annual margins per kw vary because the average kw sale price depends on the price of the voltage, the price of power and the quantities of voltage and power sold to the CEB. These margins oscillated around 38% of the average annual sale price between 1983 and 1990. The CEB's billing system is rather simple but because its accounts are kept in CFA Francs, the CEB is obliged to denominate its bills in CFA Francs even though the rates are expressed in dollars - a situation which gives rise to problems.

## 6.6 Billing and collection

6.6.1 The CEB's bills are still prepared manually once monthly pending computerization in 1991. Billing is made easy especially because clients are limited in number, four in all, including the two national electricity corporations, the CEET and the SBEE. For 1989 for instance, they consumed 80% of the power sold by the community against 20% for the other industrial customers whose consumptions account for 25% of the turnover, due to the different rates applied. The bills of all these customers are denominated in CFAF francs at the rate prevailing on the day of billing. While this method presents an advantage from an accounting point of view, it is nevertheless a serious drawback for the CEB because of the difficulties it encounters in recovering debts particularly since it is obliged for its part, to settle its bills within the given deadline i.e 60 days, while clients often miss the deadline sometimes by 90 days.



6.6.2 Since the appraisal of the Nangbeto project, paying deadlines have not changed. Indeed, bills sent by the CEB, the CEET and the SBEE are payable within 30 days, while industrial customers are allowed 15 days from the date of the receipt of the bill; the latter is deemed under the terms of the contract, to have been received three days after it was dispatched by the CEB. After the deadline, if the bill is unpaid, 1.5% of the account is added each month to the bill. This penalty is applied to all customers. Besides these measures, the CEB is empowered by its Articles to cut off all supplies, if within three months following the submission of a bill and despite the usual reminders, a consumer or a public or private distributor fails to settle the amount due.

6.6.3 As shown in Annex 20 in the outstanding debt situation, this prerogative to cut off supplies is not exercised systematically. As a result, the CEB is faced with the problem of unpaid bills concerning two large Cement Firms to which it supplies power directly. The ONIGBOLO Cement Works in Benin and the CIMAO in Togo both owe the CEB as at 14 August 1990, CFA francs 2 billion and almost 1 billion CFA francs, respectively. Concerning the former, an agreement has been reached between Benin and the CEB so that the latter could retrieve its due over a 5 year period (a monthly payment in addition to the current bill). The CIMAO for its part, is about to be liquidated and its financial statement takes the arrears into account. In addition, and as a result of the crisis the sum of CFAF 3 billion frozen in one of the Benin Banks, disappeared during 1988. Fortunately, on a World Bank initiative, negotiations are in progress with a view to solving the problem. The 3.5 billion of arrears also includes unpaid bills for 1984 (CFAF 699.480 million) which are in fact the surcharge labelled above quota, that the CEB had to pay as a result of the drought of the same year. The various clients acknowledge this debt but keep postponing payment and for which the CEB has not sent any strong reminder.

## 6.7 Analysis of Operating Results

6.7.1 The analysis will refer to operating accounts for the years 1982 to 1989 shown in the table below and for which details are given as annex 22 of the report:

Table 6.5

Summary of Operating Accounts from 1982-1989

(CFA.F 10<sup>6</sup>)

	1982	1983	1984	1985	1986	1987	1988	1989
I. Proceeds from operation	5841.23	7517.19	6537.79	11392.65	9766.58	9132.34	11701.78	12557.25
Energy sales	5718.60	7452.66	6396.68	11298.77	9575.34	8849.55	11458.22	12309.60
Other revenues	122.63	64.53	141.11	93.88	191.24	282.79	243.56	247.65
II. Operating costs	4242.97	5156.97	4703.04	7669.56	6728.57	5907.02	5484.31	6420.07
including:								
Energy purchases	3817.57	4620.35	4158.93	7100.43	6011.49	5053.35	4396.80	5338.61
Personnel	232.74	260.62	258.66	293.83	328.19	361.71	449.00	510.60
Amortizations	312.73	442.64	479.14	1482.74	543.98	1095.02	2447.19	2531.98
III. Net operating results	1175.84	1713.81	968.96	1610.40	1877.22	1775.98	2456.79	2037.51
IV. Cash flow	1488.57	2156.45	1448.10	3093.14	2421.20	2871.00	4903.98	4569.49

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6.7.2 The summary of the CEB's general income statement emphasizes the fact that the bulk of its revenue comes from power sales, other revenues (secondary and financial) account for only 1.4% of the total per annum. Sales increased on an average rate of 14.4% per annum between 1982 and 1989, becoming more constant as of 1988 the year the dam became operational. At the same time, power purchases stagnated and from 1982 to 1987 accounted for more than 80% of the CEB's total expenses, though these went up to 66% the following 2 years. In terms of financial benefit, it is easy to see what this utility means for the sub-regional institution.

6.7.3 From 1982 to 1980 operating revenues increased by an average of 14% annually. They therefore went from CFAF 5.84 to CFAF 12.56 million. Over the same period running costs minus provision for amortization and financial expenses went from CFAF 4.24 billion to CFAF 6.42 billion making an 8% average annual increase. The make-up of these expenses illustrates the role played by the CEB's prime activity "Power Purchase" and the tendency of the latter to decrease with time. This item is followed by financial charges (9.3% on average) which seemed more important in 1988 and 1989 following debt reimbursement for CEB loans. Personnel expenses account for only 5% on average per annum.

6.7.4 The variation in the CEB operating results, dependent on that of income and expenditure, stems from two factors: the variation of the dollar and the demand made by industrial clients (CIMAO, ONIGBOLO Cement Works, OTP). In the first case, bills of CEB's potential customers are denominated in dollars and converted into CFA Francs at the rate prevailing on the day of billing; in the second case, clients, excluding the CEET and the SBEE demand fluctuate regularly. As far as running costs are concerned, although they are on the decrease since production of the Nangbeto dam started, the level depends on power purchases from Ghana, and as of 1985, on provisions for amortizations and supplies. For this year, CFAF 912.500 has been earmarked as provisions for doubtful customers, including 660,531 million for CIMAO and 250,060 million for ONIGBOLO Cement Works (an accumulation of 2 1/2 years of arrears).

6.7.5 In 1986, in the wake of negotiations with these two clients, the provisions were omitted in 1987 since promises were not all kept, they again figured in the accounts. In 1988 and 1989, years when the dam's operating results were taken into account, these provisions trebled almost, resulting in

a significant reduction in the net operating results. However, as the CEB's financial statements illustrate, its financial situation is rather satisfactory. Indeed, the gross margins largely cover the financial charges whose trend reflects the community's debt policy and the provisions made for amortization; although operating results fluctuate, they are all in surplus, the financial years have all recorded profits and the internal cash generation is quite substantial, especially since the profits realized are neither distributed nor taxed. Generally speaking, the CEB's operating results are well controlled and increase less rapidly than the turnover. This is due to the steady growth of power sales, to the availability of cheap power and the possibility for the CEB to revise its rates any time the VRA increases its rates.

## 6.8 Balance Sheet Analysis

6.8.1 The analysis of the financial structure will be done on the basis of balance sheets for the years 1982 to 1989 as shown in the table below. Details are given in annex 21.

Table 6.6  
Summary of Balance Sheets from 1982 to 1989  
 (CFA.F 106)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
<u>I. ASSETS</u>								
1. Fixed assets	10 346.38	14 012.95	18 241.45	30 533.37	44 635.58	55 629.32	60 599.45	63 695.99
2. Current fixed assets	4 535.12	6 939.98	7 165.22	6 490.15	6 259.93	7 544.68	45 842.02	46 225.34
3. Outstanding assets	1 556.41	1 092.81	2 987.45	14 932.34	28 094.04	37 864.86	2 117.44	1 927.02
. ST current assets	4 254.85	5 980.16	8 088.78	9 110.88	10 281.61	10 219.77	12 639.99	15 543.63
. Liquid assets	3 790.60	4 912.09	7 052.14	6 405.07	6 438.13	6 271.48	8 308.12	8 006.71
	464.25	1 068.07	1 036.64	2 705.81	3 843.48	3 948.29	4 331.87	7 536.92
<u>II. LIABILITIES</u>								
1. Capital stock	10 346.38	14 012.95	18 241.45	30 533.37	44 635.58	55 629.32	60 599.45	63 695.99
2. Long & Medium term debts	2 522.09	5 845.42	6 649.58	10 292.94	15 467.95	23 038.13	26 151.39	30 398.40
3. Short term debts	5 255.00	5 297.98	5 247.98	13 661.08	22 197.53	26 217.43	26 305.35	24 469.62
4. Results	1 604.66	2 031.82	5 210.71	3 996.63	3 906.27	3 753.00	4 571.53	5 812.42
5. Revolving fund	964.63	837.73	1 133.18	2 582.72	3 064.03	2 620.76	3 571.18	3 015.55
6. Equity debt ratio	2 650.19	3 948.34	2 878.07	5 114.25	6 375.34	6 466.74	8 068.46	9 731.21
7. Liquidity ratio	0.51	0.92	0.74	0.73	0.71	0.86	0.96	1.10
8. Quick liquidity ratio	2.65	2.94	1.55	2.28	2.63	2.72	2.76	2.67
	0.29	0.53	0.20	0.68	0.98	1.05	0.95	1.30

6.8.2 The analysis of this table shows that the CEB's fixed asset was not very high from 1982 to 1987, for an electricity corporation whose job it is to produce and transmit electric power. This situation was due to the fact that the CEB did not have its own means of production then, and its capital assets consisted mainly of transmission networks. As of 1988, when the dam started operating, fixed assets chalked up an appreciable level going from CFAF 4.535 million in 1982 to CFAF 45.84 million and CFAF 46.22 million in 1988 and 1989. This significant increase brought about a marked growth of the balance sheet total which then went from CFAF 10.35 million in 1982 to 60.60 million and 63.63 million CFA Francs in 1988 and 1989.

6.8.3 Although the liquidity ratio reflects a generally interesting liquidity position, the CEB experienced liquidity problems from 1982 to 1985 as is illustrated by the immediate liquidity ratio, which expresses the covering of short-term debts by liquid assets showing throughout the period a certain deterioration of the cash flow. In the CEB's financial statements current assets consists of short-term realizable assets and liquid assets; the immediate liquidity ratio also shows the size of the realizable assets where the item "customers with outstanding payments" occupies an important place. Indeed, as at 4 August 1990, CEB's statement of unpaid bills shows an amount of CFAF 3.491 billion i.e. the equivalent of 28% of the 1989 turnover; breakdown by customer is as follows: SBEE: CFAF 2167.80 million; including 2005 million just for the ONIGBOLO Cement Works; CEET: CFAF 228.65 million; CIMAO: CFAF 865.4 million; OTP: CFAF 229.34 million. These arrears represent almost 75% of the CEB's net operating results for 1989 weighing down its financial statements. The debt ratio which was till 1986 rather far from the unit, improved greatly and became more than satisfactory at the end of the 1989 financial year. Furthermore the debt level can be explained by the fact that for implementing most of the projects, both States contracted loans which were then on-lent to the CEB on conditions generally much less interesting than those of the donors. In addition, since the CEB has liquidity problems which are due to the size of its unpaid bills, it was obliged to resort to further loans to reduce its contribution.

## 7. CONCLUSIONS

### 7.1 Implementation of project objectives

7.1.1 The main objectives aimed at by the project were reached. From a technical point of view, the Nangbeto project was implemented within the fixed deadline and at reasonable costs. To date, other than the 1990 drought, the Nangbeto hydroelectric dam has produced since its commissioning late 1987, 518 GWh; including 46 in 1987, 211 in 1988, 180 in 1989 and 81 GWh till end October 1990, i.e. 42, 36 and 16% respectively, of actual CEB sales. We can assert that an important part of Togo and Benins requirements are met; these requirements were revised downward, as opposed to those laid down in appraisal given the economic recession which has been noticeable in both countries for almost four years now.

7.1.2 From an economic point of view, implementing the project has meant that the CEB can cover a yearly average of about 35% of its power demands. The huge water reservoir formed by this dam (1.7 billion m<sup>3</sup>) serves as a basis for the development of agricultural and piscicultural activities (143.000/ha of irrigated land). In addition, the Mono River on which the dam is built has been regularized and consequently there will be no more floods or crop losses.

7.1.3 As far as training is concerned, the supporting measures financed by the World Bank and the UNDP have made it possible to strengthen the CEET's sectoral structures in Togo, the SBEE in Benin as well as the CEB through the improvement (computerization) of their management, the training of their officers following level tests carried out within each corporation. The training programme which is spread over 10 years will involve nearly 150 to 200 persons in both national corporations, at the training centres and at the CEB.

7.1.4 Population resettlement involved 45 villages with a total of 12000 inhabitants affected by the dam's construction, instead of 34 villages and 7,780 inhabitants as previously estimated. Other actions have led to the construction of 130 km of feeder roads, the sinking of about 60 wells for the supply of drinking water for the displaced population and those living around the dam, assistance in the reconstruction of houses, community investments (11 primary schools, 1 general education high school, 2 health centres, one

community centre, 2 agricultural stores, 3 small markets, one central market and about a hundred public toilets, food aid, transport for goods and the displaced population, as well as agricultural production support services. These various population resettlement actions are planned on the basis of prime factors which highlight the impact of the Nangebto dam and reservoir on the environment. These factors are: agricultural development (agricultural production support), stockraising, pisciculture, health and the restructuring of the infrastructure.

7.1.5 One other aspect of the project deserves to be pointed out and it is the improvement of women's conditions: thanks, especially to the wells equipped with taps, fetching water is now much less of an arduous task for the women and children, not to mention the positive influence of these taps on the hygiene and health of these populations.

## 7.2 Lessons learnt from the Project

7.2.1 The Nangbeto dam project was a good example of cooperation and solidarity between the two States (Benin and Togo). A special atmosphere surrounded the project known as the "Nangbeto spirit" and featured close ties between the political authorities, leaders, professionals, firms, consulting firms and donors. The propitious conditions in which works progressed and good organization made it possible to satisfactorily face all difficulties met. On the whole, no major problem really hindered the project's implementation..

7.2.2 The main lessons learnt from the project concern:

- a) The implementation deadlines; they were respected despite the intricacy of the works, thanks to:
  1. rather favourable weather;
  2. the team spirit which prevailed;
  3. the competence and qualification of leaders, of CEB professionals and those of the Project unit;
  4. the will and courage shown by the project Unit and the inhabitants of the area;
  5. proper coordination of works.



- b) Relations with donors: the World Bank being lead bank, it followed closely the various progress reports. Periodic reports were sent regularly to each donors;
- c) Proper coordination within the CEB Management: The CEB supervised the work of the Unit very well, in collaboration with the Monitoring Committee and the Committee of Experts. A collaboration which made both deadline and financial envelope possible;
- d) Proper management of the project: the bulk of financing which the project required, meant setting up a good computerization system within the CEB General Management, to facilitate the monitoring of project operation and offset the CEBs various new changes.

7.2.3 Apart from the interest which personnel training represents from a technical vantage point, the project was the instrument of steady contacts between the various professionals of the CEET, the CEB and the SBEE, creating adequate conditions for the proper monitoring and commissioning of the entire project.

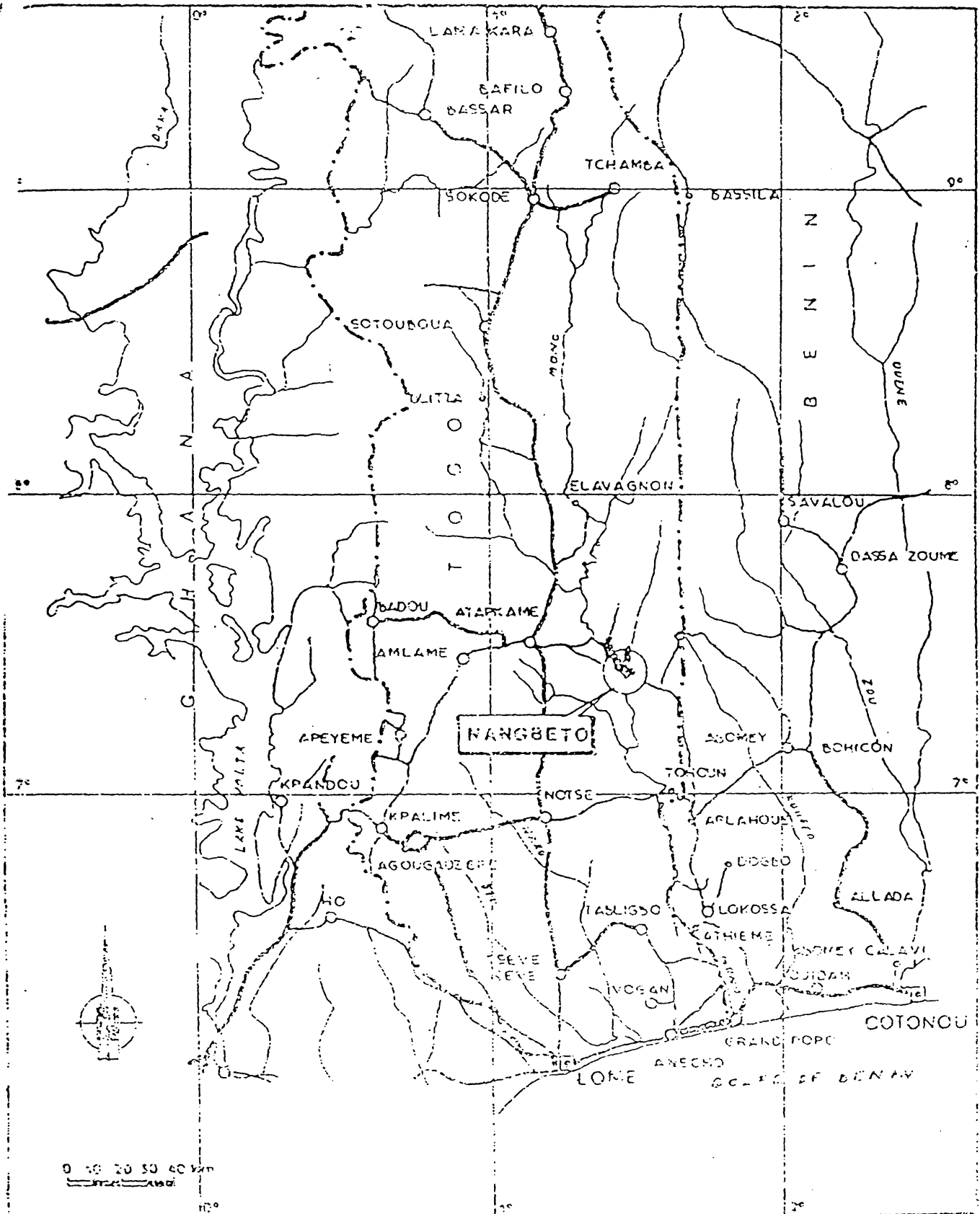
7.2.4 As a conclusion, the Nangbeto dam project falls perfectly in line with the CEB's integration objective and is for the sub-region a good example of cooperation and solidarity not only between States but also between national corporations.



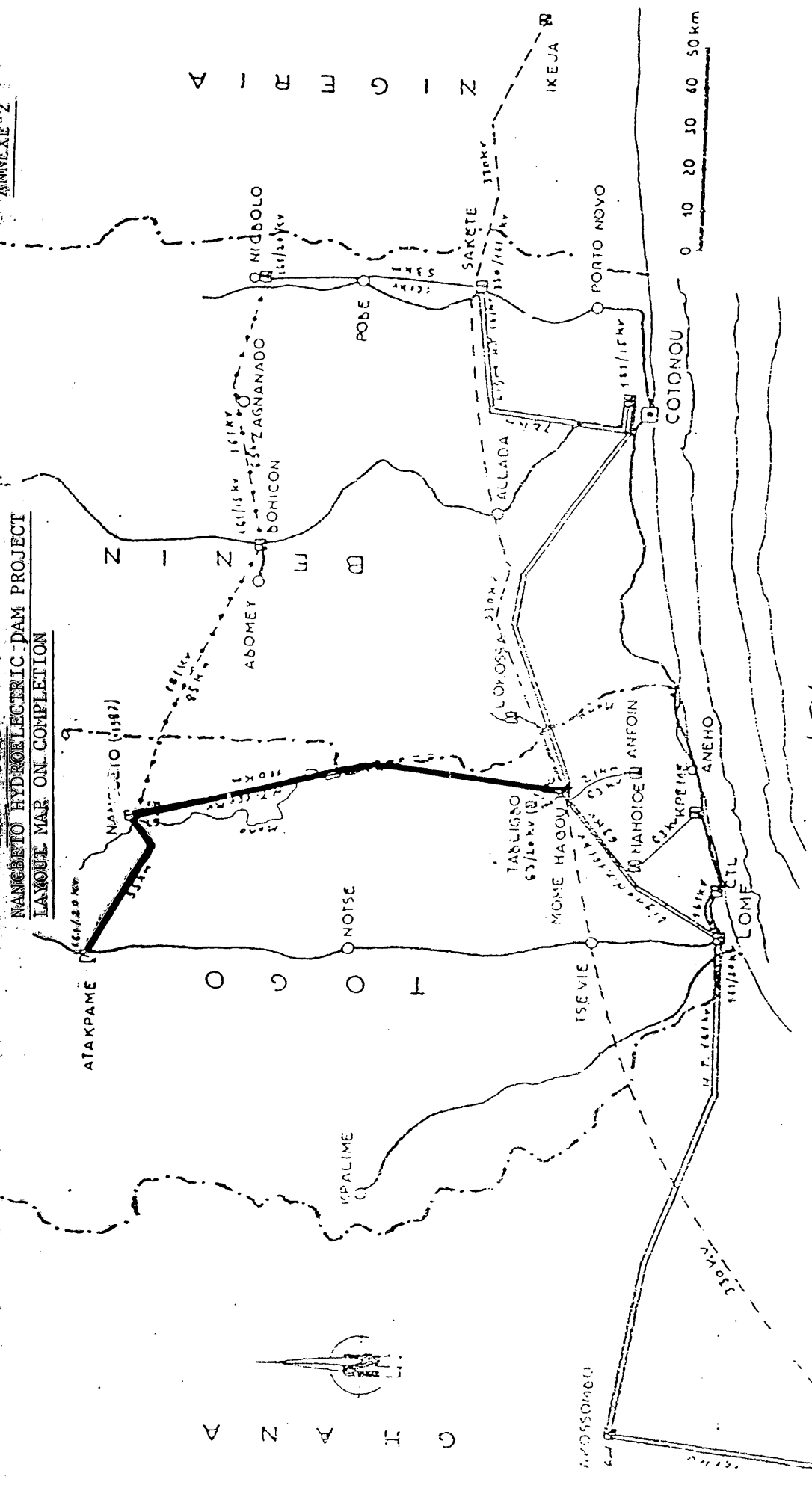
BENIN - TOGO

NANGBETO HYDROELECTRIC DAM PROJECT

General Outline (at Appraisal)



**NANGBETO HYDROELECTRIC DAM PROJECT  
LAYOUT MAP ON COMPLETION**

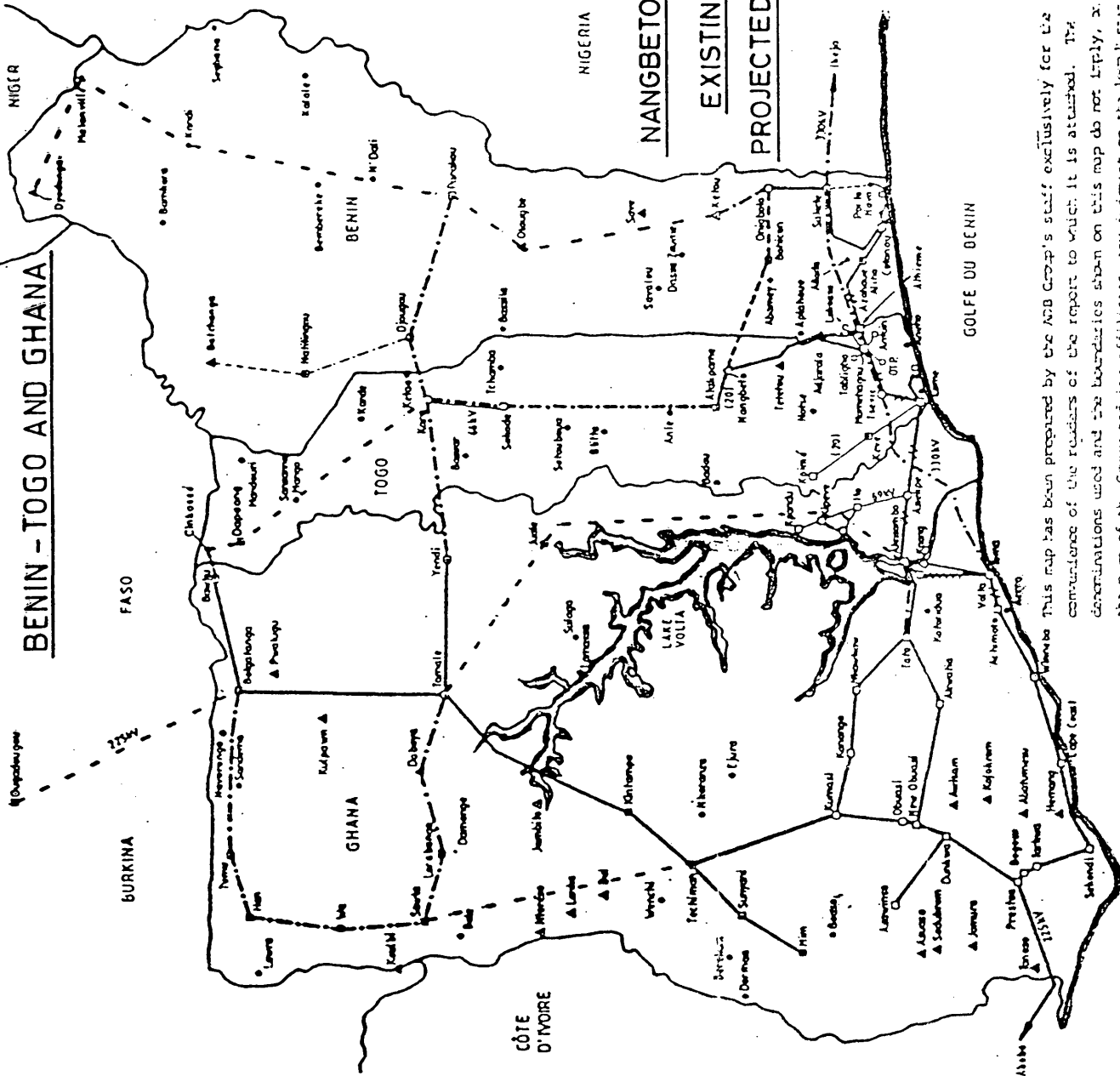


**KEY**

- ☐ TRANSFORMER STATION (Existing)
- 63 Kv line (Existing)
- 161 Kv line (Newly built)
- 161 Kv line (One circuit existing)
- 161 Kv line (Two circuits existing)
- 330 Kv line (Projected)
- ⊕ Interconnection (VRA-CEB-NEPA)

- ☐ Hydroelectric station (Built)
- ☐ Hydroelectric station (Existing)
- ☐ Transformer station (Future)
- 161 Kv line (Future)
- Road

**BENIN - TOGO AND GHANA**





- KEY:**
- HYDROELECTRIC STATIONS**
- ◻ Existing
  - ▲ Projected
- TRANSMISSION LINES**
- Possible / Projected 161KV
  - - - 161KV or more possible extension
  - (T) Existing 63 KV (now in 20KV)
  - - - 63KV future extensions
  - · - · Possible / Projected 63 KV
- Towns
  - National Boundaries

**SCALE:**

0 50 100km

**NANGBETO HYDROELECTRIC DAM PROJECT.**

**EXISTING TRANSPORT NETWORKS AND PROJECTED FUTURE NETWORKS GHANA, TOGO AND BENIN**

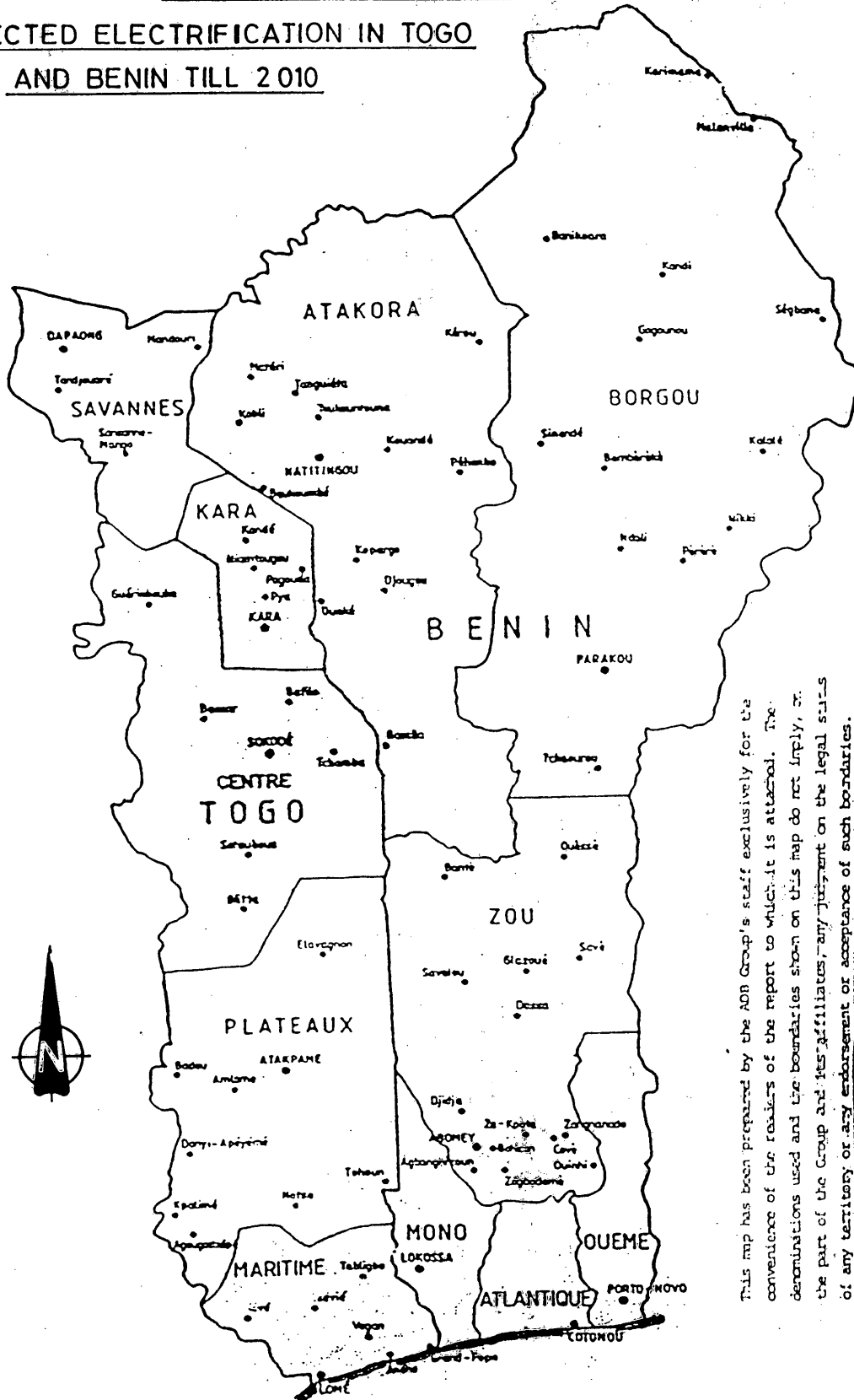
COMMUNAUTE ELECTRIQUE DU BENIN	
NORTHERN TOGO AND BENIN INTERCONNECTION	
EXISTING TRANSPORT NETWORKS AND PROJECTED FUTURE NETWORKS IN GHANA, TOGO BENIN	
 ELECTROWATT INGENIEURS CONSEILS FURCHER - SUISSE	 SOGREAH INGENIEURS CONSEILS ORANGE - FRANCE
DATE. 2 / 90	FIGURE No. (II)
	A

This map has been prepared by the AEB Group's staff exclusively for the convenience of the readers of the report to which it is attached. The designations used and the boundaries shown on this map do not imply, on the part of the Group and its affiliates, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

BENIN - TOGO



NANGBETO HYDROELECTRIC DAM PROJECT

PROJECTED ELECTRIFICATION IN TOGO  
AND BENIN TILL 2010



This map has been prepared by the ADN Group's staff exclusively for the convenience of the readers of the report to which it is attached. The denominations used and the boundaries shown on this map do not imply, or the part of the Group and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

- SOKODÉ - Chief Town of Region ( TOGO )
- Bassar - Chief Town of Prefecture ( TOGO )
- PARAKOU - Chief Town of Province ( BENIN )
- Kandi - Chief Town of District ( BENIN )
- Zones approximées électrifiées en 2010

<b>COMMUNAUTE ELECTRIQUE DU BENIN</b>	
NORTHERN TOGO AND BENIN INTERCONNECTION	
PROVINCES AND CHIEF TOWNS OF TOGO AND BENIN AND ELECTRIFIED ZONES BY 2010	
 <b>ELECTROWATT</b> INGENIEURS CONSEILS LUXEMBOURG - SUISSE	 <b>SOGREAH</b> INGENIEURS CONSEILS GRENOBLE - FRANCE

## I. STATUS OF PREPARATIONS

### 1. Studies

- 1967 : Prefeasibility studies for the development of the Mono River by SOFRELEC.
- 1976 : Updating of the SOFRELEC study and pre-feasibility of a multi-purpose dam in NANGBETO by ELECTROCONSULT (Italy).
- 1980 : Feasibility study of the NANGBETO hydro-electric dam by ELECTROWATT/SOGREAH (Switzerland/France).
- 1981 : Engineering study including the competitive bidding document by ELECTROWATT/SOGREAH (Switzerland/France).
- 1982 : Comparative study between buttress and enrockment solutions for the dam by ELECTROWATT/SOGREAH.
- 1982 : Study on the 161 KV transmission line by EDF-DAFECO (France).
- 1982 : Study to update the economic report to the October 1982 conditions, by ELECTROWATT/SOGREAH.

### 2. Missions

- September-October 1982 : World Bank Preparatory Mission.
- 14-20 February 1983 : Financial pre-assessment mission by the IBRD.

### 3. Meetings

- June 1980 : First meeting of donors in Paris which decided on the feasibility of a buttress dam and on a 63 MW hydro-electric plant in NANGBETO
- October 1981 : Second meeting of donors in Paris with a view to examining the engineering studies and to agree on a preliminary financing schedule for the project.

## ANNEX 6

## BENIN/TOGO

## NANGBETO HYDROELECTRIC DAM PROJECT

Projected Demand on the CEB Network from 1990 - 2005

(GWh)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real	Real
Benin demand	139	144	178.9	168.6	187	194	206	224	242	254	287	308	324	340	366	383	398	415	431	451
Togo demand	277	290	316.1	326.9	355	373	392	412	432	485	509	529	547	569	589	611	634	656	678	702
Ghana demand	1	2	2	4.6	5	5	5	6	6	7	7	7	7	8	8	8	8	8	9	9
Total demand	417	436	496.6	501	547	572	603	642	680	746	803	844	878	917	963	1002	1040	1079	1118	1162
Loss in %	5	5	5	4	4	4	5	5	5	5	5	5	5	5	6	6	6	6	7	7
Loss in GWh	20	22	27	22	24	26	29	31	34	37	41	44	48	53	58	63	69	75	82	90
CEB demand	437	458	524	523	571	598	632	673	714	783	844	888	926	970	1021	1065	1100	1154	1200	1252
Exchange factor	0.67	0.67	0.67	0.66	0.65	0.65	0.65	0.65	0.65	0.64	0.62	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Power (MW)	80	85	88.8	91.1	100	105	111	118	125	140	155	170	176	185	194	203	209	220	228	238
Actual sales CEB*	437	458	496.6	495.5	518	498	528	567	605	671	728	769	803	842	888	927	965	1004	1043	1087
Nangbeto GWh																				
Production	-	46	211	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

\* Further needs are met by national productions.

BSO/0333M



NANGBETO HYDROELECTRIC DAM PROJECTPRESELECTION OF FIRMSBid-Package N° 1

DAM AND PLANT - CIVIL ENGINEERING

LIST OF CONTRACTORS AND PREQUALIFIED GROUP OF FIRMS

No	Country	Firm or Group of Firms	Address
1	<u>France</u>	Campenon-Bernard Wayss & Freytag UDETCO	92-98, boulevard Victor Hugo 97115 Clichy (France)
2		Dumez-Afrique	354, Av. G. Clémenceau 92022 Nanterre (France)
3		Grands Travaux de Marseille (GTM)	61, Av. Jules Quentin 92003 Nanterre (France)
4		Sainrapt et Brice Société Générale d'Entreprises SATOM	315 Av. Gallieni Gentilly (France)
	<u>Germany</u>		
5		Bilfinger & Berger Dyckerhoff & Widmann	Carl-Reise Platz 1-5 D-6800 Amnheim (RFA)
6		Hochtief	Rettinghauserstrasse 53-57 BP 101762 D-4300 Essen (RFA)
7		Ph.Holzmann	Taunusanlage 1 Frankfurt a.R. (RFA)
	<u>Italy</u>		
8		Cogefar	Bastioni di Porta Nuova 21 Milan (Italie)
9		Impresa Astaldi Estero	13-15 via Po Rome (Italie)
10		Italstrade Spa	Piazza Valasco 2 Milan (Italie)
	<u>Sweden</u>		
11		Skanska	S.182.25 Danderyd (Suède)
	<u>Brazil</u>		
12		Contructora Mendes Junior SA	Avenue Joao Pinheiro 146-180 Belo Horizonte (Brésil)

NANGBETO HYDROELECTRIC DAM PROJECTPreselection of Firms

## Package II

PACKAGE II - SUB-PACKAGE N° 1

TITLE: TURBINES, REGULATION, PIVOTS

## LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	VOITH GmbH	J.M. VOITH GmbH Postfach 1940 7920 HEIDENHEIM (RFA)
2	England	ECVING & Co Ltd	Villiers House 41/47 Strand London WC 2N 5IB
3	Austria	VOEST ALPINE AG	VOEST ALPINE Aktiengesellschaft Postfach 2 A-4010 LINZ
4	France	NEYPIC Groupe ALSTHOM-SCHNEIDER	75, rue Général Mangin 38100 GRENOBLE
5	Japan (agency: England)	TOSHIBA	TOSHIBA INTERNATIONAL Co Ltd Audrey House Ely Place London, ECL (England)
6		MARUBENI (HITACHI)	CPO Box 595 TOKYO 100-91 (Japan)
7	Italy	GIE (avec HYDROART)	3, via S. Caboto Corsico 20094 MILANO
8	Sweden	KAMEWA AB	EP 1010 S 66101 KRISTINEFLAMN (Suède)
9	Switzerland	ESCHER WYSS	ESCHER WYSS Aktiengesellschaft CH-8023 ZURICH/SCHWEIZ
10		VEVEY	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA CH-1800 VEVEY
11	Canada	ATELIERS d'INGENIERIE DOMINION Ltd	Case Postale 220, Succursale A MONTREAL (Québec) H3C 2S5 (Canada)

LIST 3

PACKAGE II - SUB-PACKAGE N° 2

TITLE: ALTERNATORS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	B.B.C.	BROWN BOVERI & Cie Aktiengesellschaft Kallstadler Strass 1 6800 MANNHEIM (RFA)
2		SIEMENS AG	SIEMENS Aktiengesellschaft M.KRESS - EIII Wasserkraft Works, Wasserwerke 3520 ERLANGEN (RFA)
3	England	G.E.C. MACHINES Ltd	Mill Road RUGBY, England CV21 1BD
4	Belgium	A.C.E.C	Boîte postale 4 6000 CHARLEROI (Belgique)
5	France	ALSTHOM-ATLANTIQUE Groupe ALSTHOM-SCHNEIDER	38, avenue Kléber 75795 PARIS CEDEX 16
6		JEUMONT-SCHNEIDER	31/32, quai de Dion-Bouton 92811 PUTEAUX
7	Italy	GIE Ansaldo et Ercole Marelli	GIE 3 via S. Caboto 20094 CORSICO (Milano)
8	Japan (agency: England)	TOSHIBA	TOSHIBA INTERNATIONAL Co. Ltd. Audrey House Ely Place London, ECL (England)
9	Japan	MARUBENI CORP (HITACHI)	4-2 Ohtemachi 1 - Chome CHIYODA-KU, TOKYO
10	Sweden	ASEA	ASEA AB Kopparhergsvagen 2 VASTERAS

List 4

PACKAGE II - SUB-PACKAGE N° 3  
TITLE: MACHINERY, SLUICE VALVES, HANDLING  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	M.A.N.	MAN MASCHINENFABRIK AUGSBURG Nürnberg Aktiengesellschaft Postfach - D6095 GINSHEIM-GUSTAVESBURG 1 (RFA)
2		NOELL GmbH	NOELL GmbH Schweinfurter Str. 28 8700 WUERZBURG (RFA)
3	France (Germany)	KRUPP GmbH STRASBOURG ENTREPRISE SA	STRASBOURG ENTREPRISE 101, rue du Rhin Napoléon Boîte Postale 108 67028 STRASBOURG CEDEX (France)
4	Austria	VOEST ALPINE	VOEST ALPINE Aktiengesellschaft Postfach 2 A4010 LINZ (Autriche)
5	France	NEYRPIC Groupe ALSTHOM-SCHNEIDER	75, rue Général Mangin 38100 GRENOBLE
6	Italy	A.I.B. BRESCIA	
7		GIE (Riva Calzoni Magrini Galileo)	3 via S. Caboto 20094 CORSICO (Milano)
8	Portugal	SOREFAME	SOCIEDADES REUNIDAS DE FABRICACOES METALLICAS SARL Apartado n° 5 2701 AMADORA CODEX (Portugal)
9	Switzerland	VEVEY	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA 1800 VEVEY (Suisse)
10		Consortium VEVEY ZSCHONKE WARIMAN GIOVANOLA	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA 1800 VEVEY (Suisse)

List 5  
PACKAGE II - SUB-PACKAGE N° 4  
TITLE: ELECTRICAL EQUIPMENT AND ANNEX  
LIST OF SELECTED CANDIDATES

No	Country	Firm or group or firms	Address
1	Germany	B.B.C.  SIEMENS	BROWN, BOVERI & Cie Aktiengesellschaft Kallstadter Strasse 1 68000 MANHEIM 1 (RFA)  SIEMENS Aktiengesellschaft Wasserkraft Werke, Wasserwerke D8520 ERLANGEN (KFA)
3	France	C.E.M.	C.E.M 12, rue Portalis 75008 PARIS (France)
4		CGEE-ALSTHOM Groupe ALSTHOM-SCHNEIDER	38, avenue Kléber 75795 PARIS CEDEX 16
5		CLEMESSY	CLEMESSY SA 18, rue de Thann 68057 MULHOUSE CEDEX (France)
6		MERLIN GERIN	MERLIN GERIN Rue Henri Tarze 38050 GRENOBLE CEDEX (France)
		SPIE BATHIGNOLLES	202, Quai de Clichy 92111 CLICHY CEDEX (France)
8		TRINDEL	44, rue de Lisbonne 75008 PARIS (France)
9	Italy	GIE (MAGRINI INDUSTRIE ELECTRICHE ANSALDO)	3, via S. Caboto 20094 CORSICO (Milano)
10		SADEMI COGEPI	Via G.B. Pergolesi, 25 20124 MILANO (Italie)

List 5  
PACKAGE II - SUB-PACKAGE N° 4  
TITLE: ELECTRICAL EQUIPMENT AND ANNEX  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group or firms	Address
1	Germany	B.B.C.	BROWN, BOVERI & Cie Aktienges Kallstadter Strasse 1 68000 MANHEIM 1 (RFA)
		SIEMENS	SIEMENS Aktiengesellschaft Wasserkraft Werke, Wasserwerk D8520 ERLANGEN (KFA)
3	France	C.E.M.	C.E.M 12, rue Portalis 75008 PARIS (France)
4		CGEE-ALSTHOM Groupe ALSTHOM-SCHNEIDER	38, avenue Kléber 75795 PARIS CEDEX 16
5		CLEMESSY	CLEMESSY SA 18, rue de Thann 68057 MULHOUSE CEDEX (France)
6		MERLIN GERIN	MERLIN GERIN Rue Henri Tarze 38050 GRENOBLE CEDEX (France)
7		SPIE BATHIGNOLLES	202, Quai de Cléchy 92111 CLICHY CEDEX (France)
8		TRINDEL	44, rue de Lisbonne 75008 PARIS (France)
9	Italy	GIE (MAGRINI INDUSTRIE ELECTRICHE ANSALDO)	3, via S. Caboto 20094 CORSICO (Milano)
10		SADELMI COGEPI	Via G.B. Pergolesi, 25 20124 MILANO (Italie)

List 5  
PACKAGE II - SUB-PACKAGE N° 4  
TITLE: ELECTRICAL EQUIPMENT AND ANNEX  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group or firms	Address
1	Germany	B.B.C.	BROWN, BOVERI & Cie Aktiengesellschaft Kallstadter Strasse 1 68000 MANHEIM 1 (RFA)
		SIEMENS	SIEMENS Aktiengesellschaft Wasserkraft Werke, Wasserwerke D8520 ERLANGEN (KFA)
3	France	C.E.M.	C.E.M 12, rue Portalis 75008 PARIS (France)
4		CGEE-ALSTHOM Groupe ALSTHOM-SCHNEIDER	38, avenue Kléber 75795 PARIS CEDEX 16
5		CLEMESSY	CLEMESSY SA 18, rue de Thann 68057 MULHOUSE CEDEX (France)
6		MERLIN GERIN	MERLIN GERIN Rue Henri Tarze 38050 GRENOBLE CEDEX (France)
7		SPIE BATIGNOLLES	202, Quai de Cléchy 92111 CLICHY CEDEX (France)
8		TRINDEL	44, rue de Lisbonne 75008 PARIS (France)
9	Italy	GIE (MAGRINI INDUSTRIE ELETTRICHE ANSALDO)	3, via S. Caboto 20094 CORSICO (Milano)
10		SADELMI COGEPI	Via G.B. Pergolesi, 25 20124 MILANO (Italie)

List 4

PACKAGE II - SUB-PACKAGE N° 3  
TITLE: MACHINERY, SLUIÇE VALVES, HANDLING  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	M.A.N.	MAN MASCHINENFABRIK AUGSBURG Nürnberg Aktiengesellschaft Postfach - D6095 GINSHEIM-GUSTAVESBURG 1 (RFA)
2		NOELL GmbH	NOELL GmbH Schweinfurter Str. 28 8700 WUERZBURG (RFA)
3	France (Germany)	KRUPP GmbH STRASBOURG ENTREPRISE SA	STRASBOURG ENTREPRISE 101, rue du Rhin Napoléon Boîte Postale 108 67028 STRASBOURG CEDEX (France)
4	Austria	VOEST ALPINE	VOEST ALPINE Aktiengesellschaft Postfach 2 A4010 LINZ (Autriche)
5	France	NEYRPIC Groupe ALSTHOM-SCHNEIDER	75, rue Général Mangin 38100 GRENOBLE
6	Italy	A.I.B. BRESCIA	
7		GIE (Riva Calzoni Magrini Galileo)	3 via S. Caboto 20094 CORSICO (Milano)
8	Portugal	SOREFAME	SOCIEDADES REUNIDAS DE FABRICACOES METALLICAS SARL Apartado n° 5 2701 AMADORA CODEX (Portugal)
9	Switzerland	VEVEY	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA 1800 VEVEY (Suisse)
10		Consortium VEVEY ZSCHOKKE WARIMAN GIOVANOLA	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA 1800 VEVEY (Suisse)



## List 4

PACKAGE II - SUB-PACKAGE N° 3  
TITLE: MACHINERY, SLUICE VALVES, HANDLING  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	M.A.N.	MAN MASCHINENFABRIK AUGSBURG Nürnberg Aktiengesellschaft Postfach - D6095 GINSHEIM-GUSTAVESBURG 1 (RFA)
2		NOELL GmbH	NOELL GmbH Schweinfurter Str. 28 8700 WUERZBURG (RFA)
3	France (Germany)	KRUPP GmbH STRASBOURG ENTREPRISE SA	STRASBOURG ENTREPRISE 101, rue du Rhin Napoléon Boîte Postale 108 67028 STRASBOURG CEDEX (France)
4	Austria	VOEST ALPINE	VOEST ALPINE Aktiengesellschaft Postfach 2 A4010 LINZ (Autriche)
5	France	NEYRPIC Groupe ALSTHOM-SCHNEIDER	75, rue Général Mangin 38100 GRENOBLE
6	Italy	A.T.B. BRESCIA	
7		GIE (Riva Calzoni Magrini Galileo)	3 via S. Caboto 20094 CORSICO (Milano)
8	Portugal	SOREFAME	SOCIEDADES REUNIDAS DE FABRICACOES METALLICAS SARL Apartado n° 5 2701 AMADORA CODEX (Portugal)
9	Switzerland	VEVEY	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA 1800 VEVEY (Suisse)
10		Consortium VEVEY ZSCHOKKE WARTMAN GIOVANOLA	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA 1800 VEVEY (Suisse)

## LIST 3

PACKAGE II - SUB-PACKAGE N° 2

TITLE: ALTERNATORS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	B.B.C.	BROWN BOVERI & Cie Aktiengesellschaft Kallstadler Strass 1 6800 MANHEIM (RFA)
2		SIEMENS AG	SIEMENS Aktiengesellschaft M.KRESS - EIII Wasserkraft Works, Wasserwerke 3520 ERLANGEN (RFA)
3	England	G.E.C. MACHINES Ltd	Mill Road - RUGBY, England CV21 IBD
4	Belgium	A.C.E.C	Boite postale 4 6000 CHARLEROI (Belgique)
5	France	ALSTHOM-ATLANTIQUE Groupe ALSTHOM-SCHNEIDER	38, avenue Kléber 75795 PARIS CEDEX 16
6		JEUMONT-SCHNEIDER	31/32, quai de Dion-Bouton 92811 PUTEAUX
7	Italy	GIE Ansaldo et Ercole Marelli	GIE 3 via S. Caboto 20094 CORSIGO (Milano)
8	Japan (agency: England)	IOSHIBA	IOSHIBA INTERNATIONAL Co. Ltd. Audrey House Ely Place London, ECL (England)
9	Japan	MARUENI CORP (HIACHI)	4-2 Ohtemachi 1 - Choe CHIYODA-KU, TOKYO
10	Sweden	ASEA	ASEA AB Kopparhergsvagen 2 VASTERAS

LIST 3

PACKAGE II - SUB-PACKAGE N° 2

TITLE: ALTERNATORS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	B.B.C.	BROWN BOVERI & Cie Aktiengesellschaft Kallstadler Strass 1 6600 MANHEIM (RFA)
2		SIEMENS AG	SIEMENS Aktiengesellschaft M.KRESS - EIII Wasserkraft Works, Wasserwerke 3520 ERLANGEN (RFA)
3	England	G.E.C. MACHINES Ltd	Mill Road RUGBY, England CV21 IBD
4	Belgium	A.C.E.C	Boîte postale 4 6000 CHARLEROI (Belgique)
5	France	ALSTHOM-ATLANTIQUE Groupe ALSTHOM-SCHNEIDER	38, avenue Kléber 75795 PARIS CEDEX 16
6		JEUMONT-SCHNEIDER	31/32, quai de Dion-Bouton 92811 PUTEAUX
7	Italy	GIE Ansaldo et Ercole Marelli	GIE 3 via S. Caboto 20094 CORSICO (Milano)
8	Japan (agency: England)	TOSHIBA	TOSHIBA INTERNATIONAL Co. Ltd. Audrey House Ely Place London, ECL (England)
9	Japan	MARUBENI CORP (HITACHI)	4-2 Ohtenachi 1 - Chome CHIYODA-KU, TOKYO
10	Sweden	ASEA	ASEA AB Kopparhergsvagen 2 VASTERAS

List 2

PACKAGE II - SUB-PACKAGE N° 1  
TITLE: TURBINES, REGULATION, PIVOTS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	VOITH GmbH	J.M. VOITH GmbH Postfach 1940 7920 HEIDENHEIM (RFA)
2	England	ECVING & Co Ltd	Villiers House 41/47 Strand London WC 2N 5IB
3	Austria	VOEST ALPINE AG	VOEST ALPINE Aktiengesellschaft Postfach 2 A-4010 LINZ
4	France	NEYRPIC Groupe ALSTHOM-SCHNEIDER	75, rue Général Mangin 38100 GRENOBLE
5	Japan (agency: England)	TOSHIBA	TOSHIBA INTERNATIONAL Co Ltd Audrey House Ely Place London, ECL (England)
6		MARUBENI (HILACHI)	CPO Box 595 TOKYO 100-91 (Japan)
7	Italy	GIE (avec HYDROART)	3, via S. Caboto Corsico 20094 MILANO
8	Sweden	KAMEWA AB	EP 1010 S 68101 KRISTINEFLAEN (Suède)
9	Switzerland	ESCHER WYSS	ESCHER WYSS Aktiengesellschaft CH-8023 ZURICH/SCHWEIZ
10		VEVEY	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA CH-1800 VEVEY
11	Canada	ATELIERS d'INGENIERIE DOMINION Ltd	Case Postale 220, Succursale A MONTREAL (Québec) H3C 2S5 (Canada)

List 2

PACKAGE II - SUB-PACKAGE N° 1

TITLE: TURBINES, REGULATION, PIVOTS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	VOITH GmbH	J.M. VOITH GmbH Postfach 1940 7920 HEIDENHEIM (RFA)
2	England	ECVING & Co Ltd	Villiers House 41/47 Strand London WC 2N 5IB
3	Austria	VOEST ALPINE AG	VOEST ALPINE Aktiengesellschaft Postfach 2 A-4010 LINZ
4	France	NEYFFIC Groupe ALSTHOM-SCHNEIDER	75, rue Général Mangin 38100 GRENOBLE
5	Japan (agency: England)	TOSHIBA	TOSHIBA INTERNATIONAL Co Ltd Audrey House Ely Place London, ECL (England)
6		MARUBENI (HITACHI)	CPO Box 595 TOKYO 100-91 (Japan)
7	Italy	GIE (avec HYDROART)	3, via S. Caboto Corsico 20094 MILANO
8	Sweden	KAMEWA AB	EP 1010 S 68101 KRISTINEFLANN (Suède)
9	Switzerland	ESCHER WYSS	ESCHER WYSS Aktiengesellschaft CH-8023 ZURICH/SCHWEIZ
10		VEVEY	ATELIERS DE CONSTRUCTIONS MECANIQUES DE VEVEY SA CH-1800 VEVEY
11	Canada	ATELIERS d'INGENIERIE DOMINION Ltd	Case Postale 220, Succursale A MONTREAL (Québec) H3C 2S5 (Canada)

NANGBETO HYDROELECTRIC DAM PROJECTPreselection of Candidates

## Package III

## List 2

PACKAGE III - SUB-PACKAGE N° 1

TITLE: NANGBETO POWER TRANSFORMERS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	BROWN, BOVERIE & CIE	Kallstadler Strasse 1 D6800 MANNHEIM (RFA)
2	France	CEM	12 rue Portalis 75008 PARIS (France)
3		JEUMONT SCHNEIDER	31/32 Quai de Dion-Bouton 92811 PUTEAUX (France)
4		ALSTHOM ATLANTIQUE	38, avenue Kléber 75795 PARIS CEDEX 16 (France)
5	Japan	TOSHIBA	Audrey House Ely Place LONDON ECL (England)
6		MARUBENI (HITACHI)	4-2 Ohtemachi 1 - Chome CHIYODA-KU - TOKYO (Japon)
7	Italy	GIE	Via Sebastiano Caboto 3 20094 CORSICO (Milano)

List 3

PACKAGE III -- SUB-PACKAGE N° 2  
TITLE: NANGBETO AND MOMEHAGOU HP STATIONS  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	BROWN, BOVERIE & CIE	Kallstadler Strasse 1 BP 351 6800 MANHEIM 1 (RFA)
2		STARKSTROM-ANLAGEN GmbH	BP 4289 Guillettstrasse 44-46 6000 FRANKFURT/MAIN (RFA)
3	France	CGEE-ALSTHOM (COGEX)	Courcellor II 33-35 rue d'Alsace 92531 LEVALLOIS-PERRET
4		GIM INTERNATIONAL	61, avenue Jules Quentin BP 326 92003 NANTERRE CEDEX
5		ALFRED HERLICO & FILS	35, rue de Bassano 75008 PARIS
6		SPIE BATIGNOLLES	Tour Winterthur 92065 PARIS LA DEFENSE CEDEX 18
7		TRINDEL	44, rue de Lisbonne 75008 PARIS
8		CEM	12, rue Portalis 75008 PARIS
9		✓ CLEMESSY SA	18, rue de Thann 68057 MULHOUSE CEDEX
10		MERLIN GERIN	Rue Henri Tarze 38050 GRENOBLE CEDEX

## List 3 (contd.)

PACKAGE III - SUB-PACKAGE N° 2

TITLE: NANGBETO AND MOMEHAGOU HP STATIONS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
11	Italy	SOCIETA ANONIMA ELECTRIC (S.A.E. SPA)	Via Gustavo Fara 26 MILANO (Italie)
12		SADELM COGEPI	Via G.B. Pergolesi 25 20124 MILANO (Italie)
13		SOCIETA IMPIANTI ELECT	SIETTE SPA Viale Belfiore 26 CAP 50144 FIRENZE (Italie)
14		GIE	Via Sebastiano Caboto 3 20094 CORSICO (Milano)
15	Yugoslavia	ENERGOINVEST	P.O. Box 158 SARAJEVO (Yugoslavia)



## List 4

PACKAGE III -- SUB-PACKAGE N° 3  
 TITLE: NANGBETC-MOMEHAGOU 161 kv LINE  
 LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	SIEMENS AG	SIEMENS Aktiengesellschaft Wasserkraft Works, Wasserwerke D8520 ERLANGEN (RFA)
2		STARKSTROM ANLAGEN GmbH	Postfach 4289 D-6000 FRANKFURT/Main (RFA)
3		BROWN, BOVERI & CIE	Kallstadler Strasse 1 D-6800 MANNHEIM (RFA)
4	France	CGEE ALSTHOM Groupe LEX	Courcelles II 33-35, rue d'Alsace 92531 LEVALLOIS-PERRET (France)
5		GIM INTERNATIONAL	61, avenue Jules Quentin BP 326 92003 NANTERRE CEDEX (France)
6		ALFRED HERLICQ & FILS	35, rue de Bassano 75008 PARIS (France)
7		SPIE BATIGNOLLES	Tour Winterthur 92085 PARIS LA DEFENSE CEDEX 18 (France)
8		TRINDEL-LINELEC	44, rue de Lisbonne 75008 PARIS (France)
9		TRANSEL	19, rue Joseph Bertrand 76220 VIROFLAY (France)

## List 4 (contd.)

PACKAGE III - SUB-PACKAGE N° 3

TITLE: NANGBETO-MOMEHAGOU 161 kV LINE

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
10	Italy	S.A.E SPA	Via Gustavo Fara 26 20124 MILANO (Italie)
11		SADEMI COGEPI	Via G.B. Pergolesi, 25 20124 MILANO (Italie)
12		SIETTE SPA	Viale Belfiore 26 CAP 50144 FIRENZE (Italie)
13	Canada	SINIRA-TRANSELEC-BELT	4984 Place de la Savane Suite 200 MONTREAL Québec H4P 2M9 (Canada)
14	England	JAMES SCOTT	Valley Street North DURHAM (England)
15	Yugoslavia	ENERGO INVESTI	P.O. Box 158 SARAJEVO (Yugoslavia)

## List 4 (contd.)

PACKAGE III - SUB-PACKAGE N° 3

TITLE: NANGBETO-MOMEHAGOU 161 kv LINE

## LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
10	Italy	S.A.E SPA	Via Gustavo Fara 26 20124 MILANO (Italie)
11		SADEMI COGEPI	Via G.B. Pergolesi, 25 20124 MILANO (Italie)
12		SIETTE SPA	Viale Belfiore 26 CAP 50144 FIRENZE (Italie)
13	Canada	SINTRA-TRANSELEC-BELT	4984 Place de la Savane Suite 200 MONTREAL Québec H4P 2M9 (Canada)
14	England	JAMES SCOTT	Valley Street North DURHAM (England)
15	Yugoslavia	ENERGO INVESTI	P.O. Box 158 SARAJEVO (Yugoslavia)

List 4 (contd.)  
PACKAGE III - SUB-PACKAGE N° 3  
**TITLE: NANGBETO-MOMEHAGOU, 161 kV LINE**  
**LIST OF SELECTED CANDIDATES**

N°	Country	Firm or group of firms	Address
10	Italy	S.A.E SPA	Via Gustavo Fara 26 20124 MILANO (Italie)
11		SADEMI COGEPI	Via G.B. Pergolesi, 25 20124 MILANO (Italie)
12		SIETIE SPA	Viale Belfiore 26 CAP 50144 FIRENZE (Italie)
13	Canada	SINTRA-TRANSELEC-BELT	4984 Place de la Savane Suite 200 MONTREAL Québec H4P 2M9 (Canada)
14	England	JAMES SCOTT	Valley Street North DURHAM (England)
15	Yugoslavia	ENERGO INVEST	P.O. Box 158 SARAJEVO (Yugoslavia)

## List 4

PACKAGE III - SUB-PACKAGE N° 3  
 TITLE: NANGBETC-MOMEHAGOU 161 kV LINE  
 LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	SIEMENS AG	SIEMENS Aktiengesellschaft Wasserkraft Works, Wasserverke D8520 ERLANGEN (RFA)
2		STARKSTROM ANLAGEN GmbH	Postfach 4289 D-6000-FRANKFURT/Main (RFA)
3		BROWN, BOVERI & CIE	Kallstadler Strasse 1 D-6800 MANNHEIM (RFA)
4	France	CGEE ALSTHOM Groupe LEX	Courcellor II 33-35, rue d'Alsace 92531 LEVALLOIS-PERRET (France)
5		GTM INTERNATIONAL	61, avenue Jules Quentin BP 326 92003 NANTERRE CEDEX (France)
6		ALFRED HERLICQ & FILS	35, rue de Bassano 75008 PARIS (France)
7		SPIE BATIGNOLLES	Tour Winterthur 92085 PARIS LA DEFENSE CEDEX 18 (France)
8		TRINDEL-LINELEC	44, rue de Lisbonne 75008 PARIS (France)
9	IRANSEL	19, rue Joseph Bertrand 78220 VIROFLAY (France)	

## List 4

PACKAGE III - SUB-PACKAGE N° 3  
 TITLE: NANGBETC-MOMEHAGOU 161 kV LINE  
 LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	SIEMENS AG	SIEMENS Aktiengesellschaft Wasserkraft Works, Wasserwerke D8520 ERLANGEN (RFA)
2		STARKSTROM ANLAGEN GmbH	Postfach 4289 D-6000 FRANKFURT/Main (RFA)
3		BROWN, BOVERI & CIE	Kallstadler Strasse 1 D-6800 MANNHEIM (RFA)
4	France	CGEE ALSTHOM Groupe LEX	Courcellor II 33-35, rue d'Alsace 92531 LEVALLOIS-PERRET (France)
5		GEM INTERNATIONAL	61, avenue Jules Quentin BP 326 92003 NANTERRE CEDEX (France)
6		ALFRED HERLICO & FILS	35, rue de Bassano 75008 PARIS (France)
7		SPIE BATIGNOLLES	Tour Winterthur 92085 PARIS LA DEFENSE CEDEX 18 (France)
8		TRINDEL-LINELEC	44, rue de Lisbonne 75008 PARIS (France)
9		TRANSEL	19, rue Joseph Bertrand 76220 VIROFLAY (France)

## List 3 (contd.)

PACKAGE III - SUB-PACKAGE N° 2  
 TITLE: NANGBETO AND MOMEHAGOU HP STATIONS  
 LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
11	Italy	SOCIETA ANONIMA ELECTRIC (S.A.E. SPA)	Via Gustavo Fara 26 MILANO (Italie)
12		SADEMI COGEPI	Via G.B. Pergolesi 25 20124 MILANO (Italie)
13		SOCIETA IMPIANTI ELECT	SIETI SPA Viale Belfiore 26 CAP 50144 FIRENZE (Italie)
14		GIE	Via Sebastiano Caboto 3 20094 CORSICO (Milano)
15	Yugoslavia	ENERGOINVEST	P.O. Box 158 SARAJEVO (Yugoslavia)

## List 3 (contd.)

PACKAGE III - SUB-PACKAGE N° 2

TITLE: NANGBETO AND MOMEHAGOU HP STATIONS

LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
11.	Italy	SOCIETA ANONIMA ELECTRIC (S.A.E. SPA)	Via Gustavo Fara 26 MILANO (Italie)
12		SADELMI COGEPI	Via G.E. Pergolesi 25 20124 MILANO (Italie)
13		SOCIETA IMPIANTI ELECT	SIETTE SPA Viale Belfiore 26 CAP 50144 FIRENZE (Italie)
14		GIE	Via Sebastiano Caboto 3 20094 CORSICO (Milano)
15	Yugoslavia	ENERGOINVEST	P.O. Box 158 SARAJEVO (Yugoslavia)



## List . 3

PACKAGE III - SUB-PACKAGE N° 2  
TITLE: NANGBETO AND MOMENAGOU HP STATIONS  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	BROWN, BOVERIE & CIE	Kallstadler Strasse 1 BP 351 6800 MANHEIM 1 (RFA)
2		STARKSTROM-ANLAGEN GmbH	BP 4289 Gutleutstrasse 44-46 6000 FRANKFURT/MAIN (RFA)
3	France	CGEE-ALSTHOM (COGELEX)	Gourcellor II 33-35 rue d'Alsace 92531 LEVALLOIS-PERRET
4		GTM INTERNATIONAL	61, avenue Jules Quentin BP 326 92003 NANTERRE CEDEX
5		ALFRED HERLICO & FILS	35, rue de Bassano 75008 PARIS
6		SPIE BATIGNOLLES	Tour Winterthur 92085 PARIS LA DEFENSE CEDEX 18
7		TRINDEL	44, rue de Lisbonne 75008 PARIS
8		CEM	12, rue Portalis 75008 PARIS
9		✓ CLEMESSY SA	18, rue de Thann 68057 MULHOUSE CEDEX
10		VERLIN GERIN	Rue Henri Tarze 38050 GRENOBLE CEDEX

List 3

PACKAGE III - SUB-PACKAGE N° 2  
TITLE: NANGBETO POWER TRANSFORMERS  
LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	BROWN, BOVERIE & CIE	Kallstadler Strasse 1 BP 351 6800 MANHEIM 1 (RFA)
2		STARKSTROM-ANLAGEN GmbH	BP 4289 Guillettstrasse 44-46 6000 FRANKFURT/MAIN (RFA)
3	France	CGEE-ALSTHOM (COGELEX)	Courcellor II 33-35 rue d'Alsace 92531 LEVALLOIS-PERRET
4		GIM INTERNATIONAL	61, avenue Jules Quentin BP 326 92003 NANTERRE CEDEX
5		ALFRED HERLICO & FILS	35, rue de Bassano 75008 PARIS
6		SPIE BATHIGNOLLES	Tour Winterthur 92065 PARIS LA DEFENSE CEDEX 18
7		TRINDEL	44, rue de Lisbonne 75008 PARIS
8		CEM	12, rue Portalis 75006 PARIS
9		✓ CLEMESSY SA	18, rue de Thann 68057 MULHOUSE CEDEX
10		MERLIN GERIN	Rue Henri Tarze 38050 GRENOBLE CEDEX

## List 2

PACKAGE III - SUB-PACKAGE N° 1  
 TITLE: NANGBETO POWER TRANSFORMERS  
 LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	BROWN, BOVERIE & CIE	Kallstadter Strasse 1 D6800 MANNHEIM (RFA)
2	France	CEM	12 rue Portalis 75008 PARIS (France)
3		JEUMONT SCHNEIDER	31/32 Quai de Dion-Bouton 92811 PUTEAUX (France)
4		ALSIHOM ATLANTIQUE	38, avenue Kléber 75795 PARIS CEDEX 16 (France)
5	Japan	TOSHIBA	Audrey House Ely Place LONDON ECL (England)
6		MARUBENI (HITACHI)	4-2 Ohtemachi 1 - Chome CHIYODA-KU - TOKYO (Japon)
7	Italy	GIE	Via Sebastiano Caboto 3 20094 CORSICO (Milano)

## List 2

## PACKAGE III - SUB-PACKAGE N° 1

## TITLE: NANCBETO POWER TRANSFORMERS

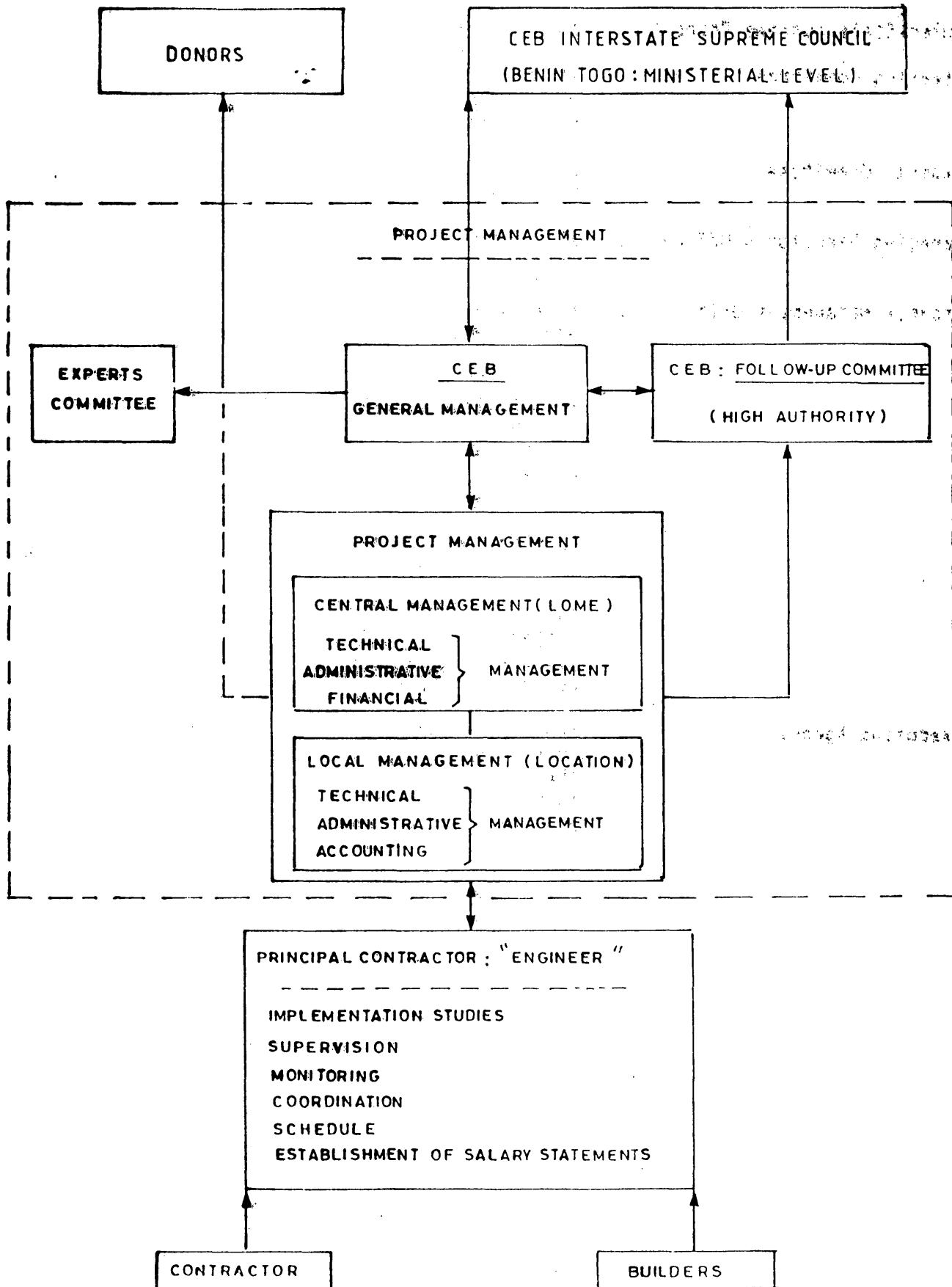
## LIST OF SELECTED CANDIDATES

N°	Country	Firm or group of firms	Address
1	Germany	BROWN, BOVERIE & CIE	Kallstadter Strasse 1 D6800 MANNHEIM (RFA)
2	France	CEM	12 rue Portalis 75008 PARIS (France)
3		JEUMONT SCHNEIDER	31/32 Quai de Dion-Bouton 92811 PUTEAUX (France)
4		ALSTHOM ATLANTIQUE	38, avenue Kléber 75795 PARIS CEDEX 16 (France)
5	Japan	TOSHIBA	Audrey House Ely Place LONDON ECL (England)
6		MARUBENI (HITACHI)	4-2 Ohremachi 1 - Chome CHIYODA-KU - TOKYO (Japon)
7	Italy	GIE	Via Sebastiano Caboto 3 20094 CORSICO (Milano)

NANGBETO HYDROELECTRIC DAM PROJECT

GENERAL ORGANIZATION OF PROJECT

SYNOPTIC ORGANIZATION CHART



**Explanatory Note**

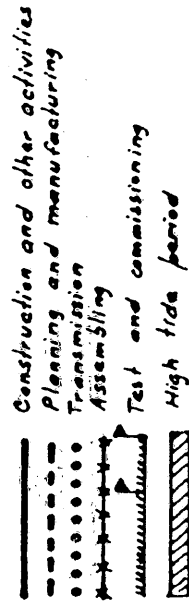
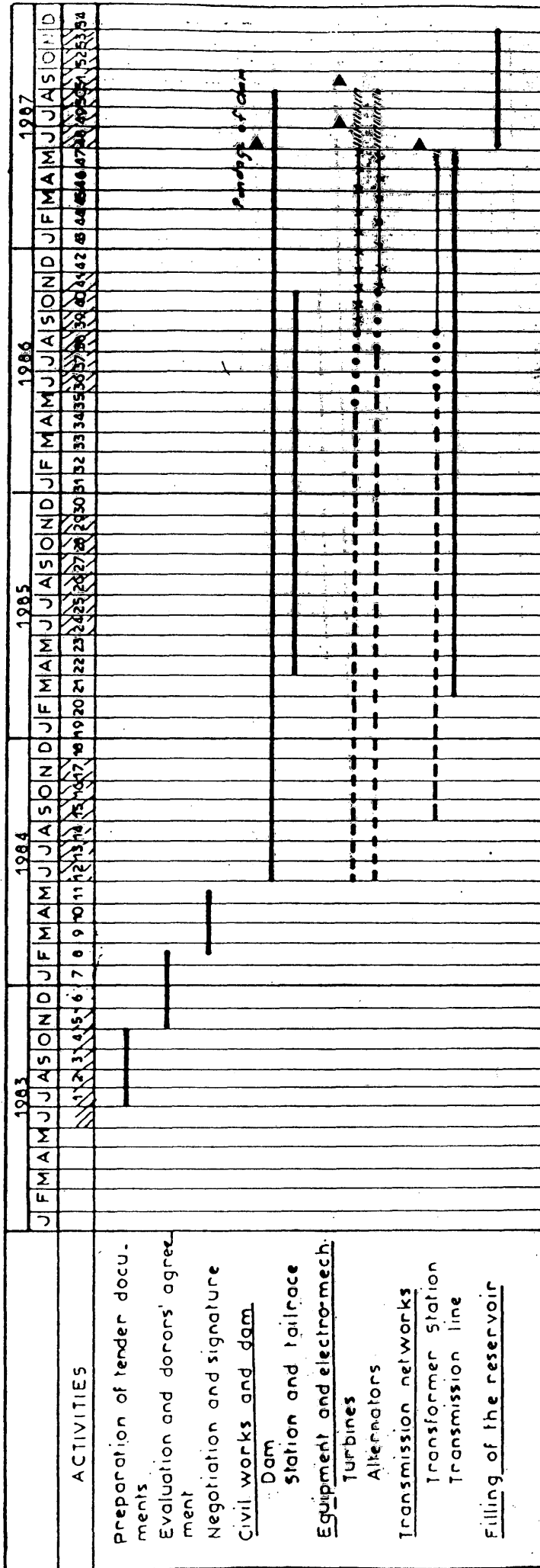
- Inter-State Supreme Council** : is the governing body of CEB.
- Steering Committee** : is an ad hoc committee, composed of members of the High Authority, set up to oversee and control project management.
- Experts Committee** : a group of international experts commissioned to assist the General Manager of CEB.
- Managing Director's Office** : already exists in the present institutional set-up.
- Project Management Unit** : to be established and will be responsible for overall project implementation including:
- construction works
  - displacement and resettlement
  - health and social problems
  - security, police.
  - etc.
- Its tasks are construction supervision, mobilization and funds management, as well as financial management of contracts.
- This unit will have a representation on the project site, and will be responsible for follow-up, technical, administrative and accounting aspects of the project.
- Executing Agency** : represented on site by the Engineer who will undertake the detailed engineering design, the control and supervision of the works, and ensure the coordination and establishment of payrolls.



**BENIN - TOGO**  
**NANGBETO HYDRO ELECTRIC DAM PROJECT**  
**WORKS IMPLEMENTATION**

ANNEX :12

( ON COMPLETION )

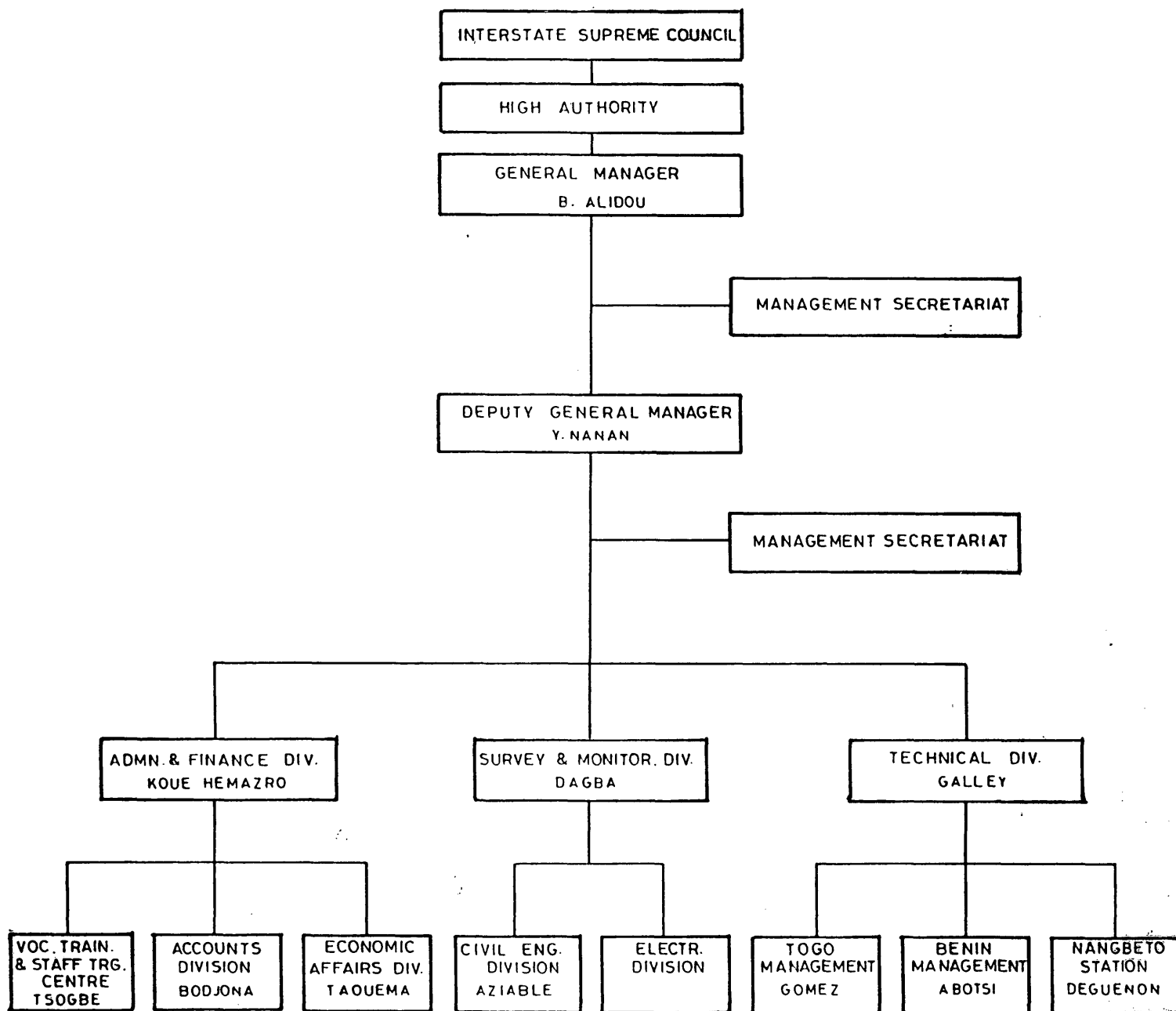


N.B. LAUNCHING OF INTERNATIONAL COMPETITIVE BIDDING FOR CIVIL ENGINEERING WORKS AND FOR THE SUPPLY OF EQUIPMENT IN JULY 1983 THE ORDER TO START WORKS WAS GIVEN IN AUGUST 1984



## NANGBETO HYDROELECTRIC DAM PROJECT

### COMMUNAUTE ELECTRIQUE DU BENIN ORGANIZATION CHART



#### NUMBER OF PERSONS EMPLOYED IN THE UNITS

- General Management	6
- Admin and Finance Division	57
- Survey and Monit. Division	5
- Technical Division	214
TOTAL	282

#### DISTRIBUTION BY CATEGORY

- Professionals	15
- Control	80
- Implementation	187
TOTAL	282

LIST OF CEB PROJECTS 1989-1993

1 - Adjarala Dam:

- Type: enrockment with an impervious core
- Turbine: 2 x Francis
- Installed voltage: 2 x 47 MW
- Production: 250 GWh
- Estimated cost: CFAF 50 billion
- Cost of KWh: CFAF 21
- Internal rate of return: 18%

Source: Feasibility study by Coyne and Belier of December 1988.

2 - Ketou Development: Prefeasibility study on the Ketou Hydroelectric Station (Oueme river valley).

- Voltage to be installed: 72 MW
- Estimated cost of studies: CFAF 200 million

3 - North Togo/North Benin Supply

- Construction of line and 161 KV stations Atakpame-Kara (240 km) and Kara-Djougou-Parakou (190 km).
- Supply of Natitingou in 63 KV as from Kara (80 km).
- Estimated Cost: CFAF 14.9 billion - (Electrowatt).

and/or

- Connection by the KV 161 Yendi-Kara line (140 km).
- Total cost of the entire 161 KV Atakpame-Kara/Yendi-Kara/Kara-Djougou-Parakou and Kara-Natitingou network including stations: CFAF 20 billion.

- 4 - Line 161 KV Nangbeto-Abomey-Bohicon: 78 km with a 161/20 KV station at Bohicon
  - Cost: CFAF 2.7 million
- 5 - Dapaong Supply as from Bawku in 161 KV line, operated in 34.5KV, to begin with:
  - Length: 35 km
  - Cost: CFAF 850 million
- 6 - Tori Bossito Supply: 161/20 station
  - Cost: CFAF 600 million
7. Dispatching: Management Centre centralized at the CEB headquarters in Lome.
  - Cost: CFAF 2.9 billion
- 8 - Akpare-Nangbeto Road: Planning and tarring 25 km
  - Cost: CFAF 800 million
  - Financing: World Bank and CEB
9. Akpare-Atakpame Road: Planning and tarring 25 km
  - Cost: CFAF 1 billion
  - Financing to be sought
- 10- Hydro-agricultural Development on the Mono River:
  - Detailed study of 2 priority perimeters
  - Land and Topographic study
  - Management structure study
  - Surface 2 x 2000 ha
  - Cost: CFAF 177 million
- 11- Sakete Transformer Station to replace the second emergency transformer planned for Cotonou:
  - Cost: CFAF 700 million

NANGBETO HYDROELECTRIC DAM PROJECT  
TARIFFS TREND SINCE 1975

The table below gives the successive VRA rate increases since the CEB started activities in January 1973 up to 1st April 1988, date of the last increase.

	] Difference]	] % of Increase ]	
	\$	] Compared ]	] Compared ]
		] with ]	] with ]
		] previous. ]	] 1973 ]
] (i) <u>January 1973 to June 1976</u>	]	]	]
]- Fixed monthly charge: US\$ 24 500.	]	]	]
]- Power : US\$ 2.00/Kw/month	]	]	]
]- Energy : US\$ 0.002/Kw	]	]	]
]	]	]	]
] (ii) <u>July 1976 to June 1978</u>	]	]	]
]- Fixed monthly charge: US\$ 24 500 (unchanged)	]	]	]
]- Power : US\$ 2.50/Kw/month	]	]	]
]- Energy : US\$ 0.003/Kw	]	]	]
]	]	]	]
] (iii) <u>July 1978 to March 1982</u>	]	]	]
]- Fixed monthly charge: US\$ 24 500 (unchanged)	]	]	]
]- Power : US\$ 4.475/Kw/month	]	]	]
]- Energy : US\$ 0.00537/Kw	]	]	]
]	]	]	]
] (iv) <u>As from 1st April 1982</u>	]	]	]
]- Fixed monthly charge: US\$ 24 500 (unchanged)	]	]	]
]- Power : US\$ 6.35/Kw/month	]	]	]
]- Energy : US\$ 0.0115/Kw	]	]	]
]	]	]	]
] (v) <u>As from 1st April 1985</u>	]	]	]
]- Fixed monthly charge: US\$ 24 500 (unchanged)	]	]	]
]- Power : US\$ 6.50/Kw/month	]	]	]
]- Energy : US\$ 0.03/Kw	]	]	]
]	]	]	]
] (vi) <u>As from 1st April 1988</u>	]	]	]
]- Fixed monthly charge: US\$ 24 500 (unchanged)	]	]	]
]- Power : US\$ 7 Kw/month	]	]	]
]- Energy : US\$ 0.0343/Kw	]	]	]
]	]	]	]

**N.B:** - Average annual increase calculated up to 1st April 1991, date for next VRA tariff revisions i.e. over 220 months of CEB activity.

$$\text{Power: } \frac{250 \times 100}{220 \times 12} = 9.47\%/\text{year}$$

$$\text{Energy: } \frac{1.615 \times 100}{220 \times 12} = 61.17\%/\text{year}$$

These percentages prove that it is in the interest of the CEB to develop its own means of production in the long run.

TOGO/BENIN  
NANGBETO HYDRO-ELECTRIC DAM PROJECT  
COMPLETION REPORT

Communauté Electrique du BENIN - C.E.B.  
1900 Sales Rate

I. BENIN1. SBEE (VEDOKO)

- Fixed Monthly Charge	=	US \$ 16.667
- Power	=	US \$ 8.70 per KW monthly
- Energy	=	US \$ 0.0585 per kWh

SBEE (ONIGBOLO)

- Fixed Monthly Charge	=	US \$ 20.460 000
- Power	=	US \$ 7.865 per kW
- Energy	=	US \$ 0.0381 per kWh

SBEE (LOKOSSA)

- Power	=	US \$ 8.70 per Kw monthly
- Energy	=	US \$ 0.0585 per kWh

II. TOGO2. CEET (TOKOIN)

- Fixed Monthly Charge	=	US \$ 16.667
- Power	=	US \$ 8.70 per KVA
- Energy	=	US \$ 0.0585 per kWh

CEET (PORT)-SNS

- Power	=	US \$ 8.70 per Kw
- Energy	=	US \$ 0.0585 per kWh

CEET (TABLIGBO)

- Power	=	US \$ 8.70 per KVA
- Energy	=	US \$ 0.0585 per kWh

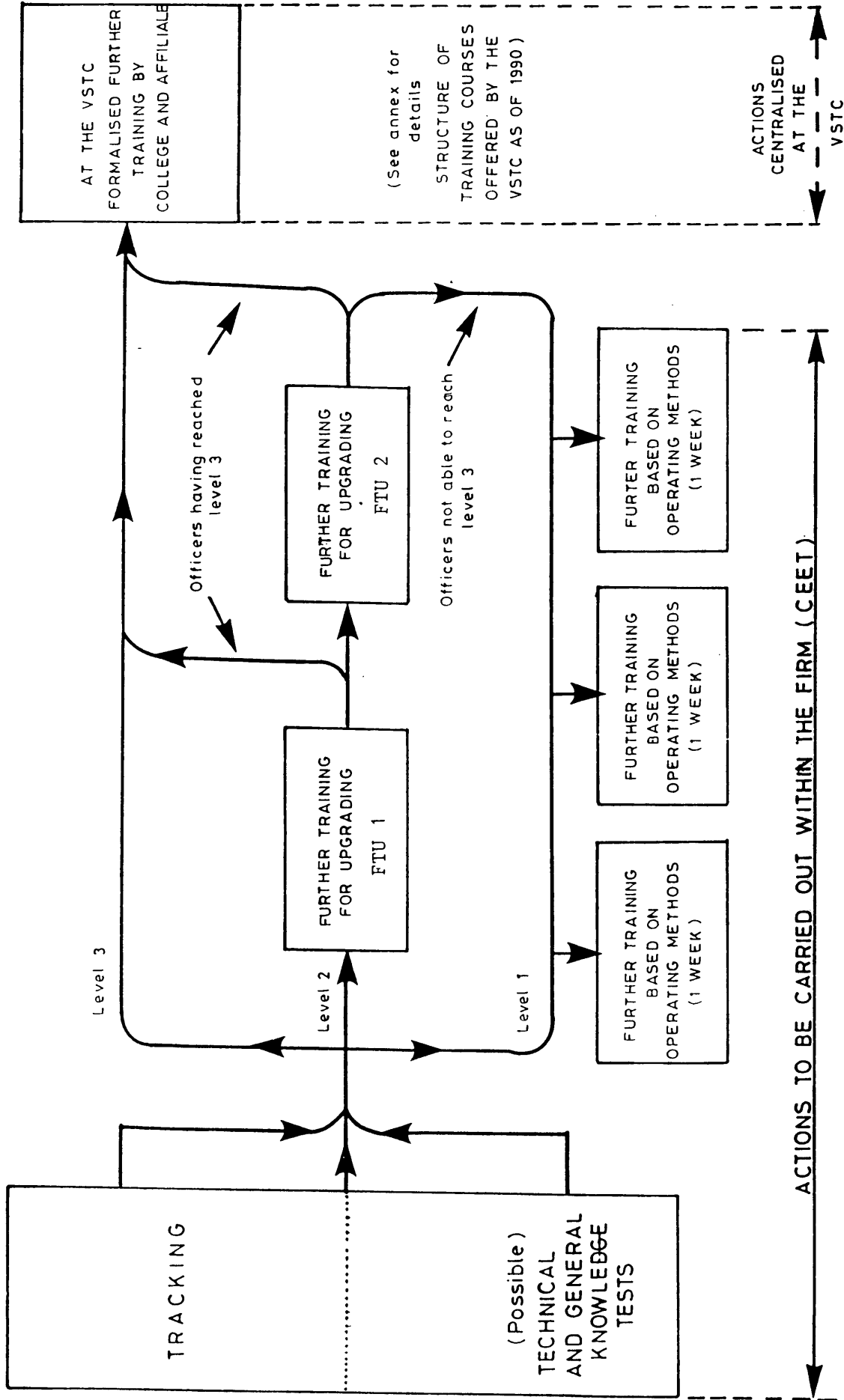
OTP

3. - Fixed Monthly Charge	=	CFA.F 8.667 000
- Power	=	US \$ 9.46 (1 - Cos $\theta$ -0.8) per KW monthly
- Energy	=	US \$ 0.0508 per kWh

III. GHANA4. AFLAO FEED BACK

- Power	=	US \$ 8.82 per KW monthly
- Energy	=	US \$ 0.046 per kWh

NANGBETO HYDROELECTRIC DAM PROJECT  
FURTHER TRAINING STRUCTURAL SYSTEM SHOWING COMPLEMENTARITY  
OF ACTIONS IN THE FIRM AND IN THE TRAINING  
CENTRE



ACTIONS CENTRALISED AT THE VSTC

BENIN/TOGO

NANGBETO HYDROELECTRIC DAM PROJECT

Annex

STRUCTURE OF THE FURTHER TRAINING SYSTEM SHOWING  
HOW TO FOLLOW UP CURRENT LOCAL ACTIONS

During on-going further training sessions, the training team prepares reports which make it possible to grade participants at the end of each course.

Three levels have been defined in terms of the worker's possibility to improve and to work towards appropriate future training actions.

Level 1: for very low level, illiterate and semi-illiterate workers with hardly the ability to improve. Further training courses for this level will entail the teaching of professional gestures and operating systems plus basic elementary notions and information, in order to improve their levels and motivate them; these activities should be carried out at local level.

A socially geared further training course (literacy education) can also be organized for the younger workers, in particular. Some workers may find themselves moving up to Level 2 from Level 1 in the event of an initial misjudgement of performance.

Level 2: intended for workers who at first sight have the potential to develop and pass on to further training courses, centralized at the Vocational Training Centre in Abomey-Calavi after a more or less thorough brushing-up.

General theoretic and technological knowledge are the main pivots on which this action swings; to make it more far-reaching at operations level, it must be supplemented by a section relative to professional gestures and operating methods.

Again, these actions are to be carried out at local level.

The length of time devoted to upgrading workers varies: workers from level 2 should normally reach level 3 but it is likely that many do not and will be redirected towards level 1 type actions.

Level 3: intended for workers recognized as being apt to join the centralized course system programmed at the Vocational Centre in Abomey-Calavi. This system comprises a multi-level range of modules which cover the main fields of activities in firms. By appropriately adapting each module to the issue in question all the usual aspects of further training are dealt with, namely:

- retraining
- upgrading
- promotion

The supervisory staff who were not involved in these local grading actions, will be chosen by the line management to participate directly in the centralized courses.



## TRAINING CENTRE DEVELOPMENT PROGRAMME

YEAR	S T A F F		NUMBER OF TRAINEES		TOTAL	TYPES OF TRAINING	OBSERVATIONS
	TRAINER	NON TRAINER	ON SITE	CENTER			
1990	5	11	192		192	- Retraining on work site:	192 trainees
1991	7	15	364	170	534	- Retraining on work site: Further training at Training Centres:	364 trainees 170 trainees
1992	11	19	364	222	585	- Retraining on work site: - Introductory training of supervisory staff:	364 trainees 24 trainees
1993	15	21	220	270	490	- Retraining on work site: Further training at Training Centres:	220 trainees 198 trainees
1994	17	21	200	270	470	- Introductory training of supervisory staff: - Retraining on work site: Further training at Training Centres:	24 trainees 200 trainees 198 trainees
1995	17	21	200	270	470	- Introductory training of supervisory staff: - Training of skilled workers: - Professional adjustment of new recruits: - Retraining on work site: Further training at Training Centre:	24 trainees 24 trainees 24 trainees 200 trainees 198 trainees
1996	17	21	200	270	470	- Introductory training for supervisory staff: - Training of skilled workers: - See 1994	24 trainees 48 trainees
1996	17	21	200	270	470	- See 1994	

BENIN/TOGO  
MANGBEIO HYDROELECTRIC DAM PROJECT  
Statement of CEB's Unpaid Bills on 14-08-1990  
(CFA.F)

TOTAL ON	1982	1983	1984*	1985	1986	1987	1988	1989	14/08/1990
<b>CUSTOMERS</b>									
1. <u>SBEE (Bénin)</u>									
. Vedoko	38 477 482						76 165 000		114 642 482
. Onigbolo	5 653 433			158 000 000	579 688 310	183 151 944	722 863 587	355 872 525	2 005 229 799
. Lokossa						6 033 546		41 892 768	47 926 314
<u>Total</u>	<u>44 130 915</u>			<u>158 000 000</u>	<u>579 688 310</u>	<u>189 185 490</u>	<u>799 028 587</u>	<u>397 765 293</u>	<u>2 167 798 595</u>
2. <u>CEET (Togo)</u>									
. Tokoin	206 413 039								206 413 039
. Anfoin						6 101 426	7 596 647		13 698 073
. Atakpamé							8 537 400		8 537 400
<u>Total</u>	<u>206 413 039</u>					<u>6 101 426</u>	<u>16 133 647</u>		<u>228 648 512</u>
3. <u>CIMAO</u>	<u>237 304 695</u>	<u>77 915 600</u>	<u>219 595 366</u>	<u>87 265 000</u>	<u>143 500 000</u>	<u>—</u>	<u>67 500 000</u>	<u>32 350 000</u>	<u>865 430 661</u>
4. <u>OIP</u>				229 341 171					229 341 171
<b>Grand Total</b>	<b>237 304 695</b>	<b>77 915 600</b>	<b>699 480 491</b>	<b>245 265 000</b>	<b>723 188 310</b>	<b>195 286 916</b>	<b>882 662 234</b>	<b>430 115 293</b>	<b>3 491 218 939</b>

\* A.Q = Above quota - CEB's bills to clients who did not meet the Akosombo electric power supply surcharge resulting from the 1984 drought (lowering of water level in hydroelectric facilities).

**BENIN/TOGO**  
**NANGBETO HYDROELECTRIC DAM PROJECT**  
**CEB BALANCE SHEET 1982-1989**  
(CFA.F 10<sup>6</sup>)

	1982	1983	1984	1985	1986	1987	1988	1989
<b>I. TOTAL ASSETS</b>	10 346.38	14 012.95	18 241.45	30 533.37	44 635.58	55 629.32	60 599.45	63 695.99
1. Fixed assets	4 535.12	6 939.98	7 165.22	6 490.15	6 259.93	7 544.68	45 842.02	46 225.34
Charges and fixed assets	-	-	182.97	129.80	86.00	1 289.60	650.06	169.91
Land	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Dam	-	-	-	-	-	-	39 104.88	38 592.56
Buildings	245.76	313.80	319.96	342.62	320.10	319.19	312.28	2 000.80
Energy transport network	2 387.04	3 669.69	3 515.94	3 343.35	3 168.44	2 993.54	3 037.40	2 850.98
Sub-stations	1 772.30	2 815.02	3 011.99	2 514.12	2 325.10	2 583.91	2 385.87	2 157.53
Tool equip. & misc. material	69.75	69.44	71.91	94.13	75.55	115.44	103.47	91.72
Auto transport material	18.30	23.54	15.04	17.98	37.19	22.19	56.18	34.50
Other fixed assets	38.22	44.74	43.66	44.40	243.40	217.07	188.13	323.59
Current fixed assets	1 556.41	1 092.81	2 987.45	14 932.34	28 094.04	37 864.86	2 117.44	1 927.02
2. Current assets	4 254.85	5 980.16	8 088.78	9 110.88	10 281.61	10 219.77	12 639.99	15 543.63
Short-term liquid assets	3 790.60	4 912.09	7 052.14	6 405.07	6 438.13	6 271.48	8 308.12	8 006.71
Suppliers	53.18	15.81	18.53	31.65	0.89	22.86	3.43	85.96
Clients	3 380.96	4 600.42	5 818.73	6 063.86	6 313.87	5 995.43	8 069.21	7 748.16
Sundry debtors	349.63	292.51	9.99	124.15	68.82	41.61	108.12	111.75
Financing to be received	-	-	1 202.41	182.52	54.49	193.01	120.03	51.71
Regularization account asset	6.83	3.35	2.48	2.89	0.07	18.57	7.33	9.13
Liquid assets	464.25	1 068.07	1 036.64	2 705.81	3 843.48	3 948.29	4 331.87	7 536.92
Banks	464.25	1 068.07	1 036.64	2 705.81	3 843.48	3 948.29	4 331.87	7 536.92
<b>II. LIABILITIES</b>	10 346.38	14 012.95	18 241.45	30 533.37	44 635.58	55 629.32	60 599.45	63 695.99
1. Capital stock	2 522.09	5 845.42	6 649.58	10 292.94	15 467.95	23 038.13	26 151.39	30 398.40
Amount carried forward	932.93	1 897.56	2 535.70	4 007.51	6 617.43	9 502.76	12 556.73	16 127.91
Reassessed special provision	-	1 511.32	1 534.63	1 439.01	1 343.38	1 247.75	1 152.13	1 056.50
Equipment grant	916.99	874.21	845.50	4 141.04	7 049.05	11 840.57	12 320.98	12 945.36
Provision for exchange losses	672.17	1 562.33	1 733.75	705.38	457.89	447.05	121.55	268.63
2. Long and medium-term debts	5 255.00	5 297.98	5 247.98	13 661.08	22 197.53	26 217.43	26 305.35	24 469.62
3. Short-term debts	1 604.66	2 031.82	5 210.71	3 996.63	3 906.27	3 753.00	4 571.53	5 812.42
Energy suppliers	724.87	773.82	1 278.96	1 206.04	941.96	724.96	878.13	872.09
Retention money supplier	-	-	-	-	-	-	9.31	9.31
Sundry suppliers	48.85	79.72	55.57	74.01	48.46	71.37	130.11	58.42
Other creditors	186.67	127.93	762.19	223.48	103.61	107.65	96.90	203.42
Regularization A/C liability	283.43	361.75	788.05	938.05	1 309.12	966.98	371.80	270.16
Borrowings for less than 1 yr.	360.84	688.91	1 123.53	1 372.53	1 448.63	1 689.45	2 967.49	4 044.92
Regularization suspense A/C	-	-	1 202.41	182.52	54.49	193.01	117.79	354.02
4. Results	964.63	837.73	1 133.18	2 582.72	3 064.03	2 620.76	3 571.18	3 015.55

BENIN/TOGO  
NANGBETO HYDROELECTRIC DAM PROJECT  
1982 to 1989 Income Statement  
(CFAF Thousand)

	1982	1983	1984	1985	1986	1987	1988	1989
<u>I. PROCEEDS FROM OPERATION</u>								
• Power sales	5 841.23	7 517.19	6 537.79	11 392.65	9 766.58	9 132.34	11 701.78	12 557.25
• Accessory products	5 718.60	7 452.66	6 396.68	11 298.77	9 575.34	8 849.55	11 458.22	12 309.60
• Financial products	7.03	2.60	3.16	2.70	3.86	5.85	2.88	5.86
	115.60	61.93	137.95	91.18	187.38	276.94	240.68	241.79
<u>II. OPERATING COST</u>								
• Power purchase	4 242.97	5 156.97	4 703.04	7 669.56	6 728.57	5 907.02	5 484.31	6 420.07
• Purchase of consumable goods	3 817.57	4 620.35	4 158.93	7 100.43	6 011.49	5 053.35	4 396.80	5 338.61
• Staff expenditure	32.96	31.92	25.51	33.53	48.60	73.09	45.96	48.34
• Wks. supp. ext. service	232.74	260.62	258.66	293.83	328.19	361.71	449.00	510.60
• Transport and travels	60.34	124.40	134.28	109.17	178.16	240.95	296.94	309.14
• Training Centre expenditure	4.12	7.34	5.43	8.99	14.67	19.96	29.89	36.43
• Sundry management	41.16	51.45	51.21	56.59	73.43	72.35	66.22	54.48
• Financial charges	53.63	60.89	69.02	66.92	74.03	85.61	199.50	122.47
	109.69	203.77	386.65	630.05	616.81	354.32	1 313.49	1 567.69
<u>III OPERATING RESULTS</u>								
• Financial charges	1 598.26	2 360.22	1 834.75	3 723.09	4 307.37	3 225.32	6 217.47	6 137.18
	109.69	203.77	386.65	630.05	616.81	354.32	1 313.49	1 567.69
<u>IV. PROVISIONS FOR AMORTIZATIONS</u>								
	312.73	442.64	479.14	1 482.74	543.98	1 095.02	2 447.19	2 531.98
<u>V. NET OPERATING RESULTS</u>								
	1 175.84	1 713.81	968.96	1 610.40	1 877.22	1 775.98	2 456.79	2 037.51
<u>VI. GROSS SELF-FINANCING MARGIN</u>								
	1 488.57	2 156.45	1 448.10	3 093.14	2 421.20	2 871.00	4 903.98	4 569.49

BSO/0333M

IRR CALCULATION

(CFAF Thousand)

1. Investments

In calculating investments, account was taken of the actual project investments i.e. the various amounts disbursed from 1985 to 1989, based on the various quarterly values of the UA in CFA Francs and over the period in question.

2. Operating Costs

Operating costs are made up of expenses on staff assigned to the development operation and of maintenance and miscellaneous expenses. From 1989 to 1990 real expenditure in CFAF Francs were as follows:

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Personnel	15	43	51	52
Maintenance and miscellaneous	-	50	55	60

In 1987, the semi-industrial operation which lasted only two months (November, December 1987) did not entail any maintenance cost but rather take-off and personnel expenses. With the start of maintenance in 1988 maintenance products were needed. In 1989 and 1990, the dam started to be fully operative; owing to the 1990 drought, however, normal production was not possible. In the future and given the fact that the commitments made with the VRA for the importation of electric power should be reviewed, Nangbeto's production should increase considerably with a rather significant increase in operating costs which will mean 10% per annum for personnel expenses and 12% per annum for maintenance and miscellaneous costs from 1990 to 1995. Other than that, a 10% increase has been maintained for the former and a 12% for the latter, giving the following table in CFAF 10<sup>6</sup> :

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
<u>Personnel</u>	57	63	69	76	84	92	101	111	122	134
<u>Maintenance</u>										
<u>% miscel.</u>	<u>67</u>	<u>75</u>	<u>84</u>	<u>94</u>	<u>105</u>	<u>121</u>	<u>139</u>	<u>160</u>	<u>184</u>	<u>212</u>
<u>Total</u>	124	138	153	170	189	213	240	271	306	346

3. Income

Nangbeto's production was 46.10<sup>6</sup> Kwh in 1987; 211.106 Kwh in 1988, 180.10<sup>6</sup> Kwh in 1989 and 150.10<sup>6</sup> Kwh in 1990. This 150 GWh production will remain constant after 1990. The CEB management has projected the following annual sale prices in CFA francs on the basis of the cost price of the Nangbeto dam KWh production:

<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
20.32	23.89	24.82	23.92	24.88	27.00	28.08
<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
30.42	34.16	35.53	36.95	38.43	39.97	41.57

With the actual 1987 to 1990 figures and the projected annual sale price to consumers, when one takes into account the dam's annual production, we arrive at: 46 Gwh; 1988: 211 Gwh; 1989: 180 Gwh; 1990 and after: 150 Gwh per annum. Revenues are shown on the IRR calculation table:

<u>Year</u>	<u>Investments</u>	<u>Operating Costs</u>	<u>Revenues</u>	<u>Cash-Flow</u>
1985	13 131.26			(13 131.26)
1986	13 212.44			(13 212.44)
1987	10 553.43	15	934.72	( 9 633.71)
1988	3 933.62	93	5 040.79	1 014.17
1989	375.24	106	4 467.60	3 986.36
1990		112	3 588.00	3 476.00
1991		124	3 732.00	3 608.00
1992		138	4 050.00	3 912.00
1993		153	4 332.00	4 179.00
1994		170	4 563.00	4 393.00
1995		189	5 124.00	4 935.00
1996		213	5 329.50	5 116.50
1997		240	5 542.50	5 313.50
1998		271	5 764.50	5 271.50
1999		306	5 995.50	5 689.50
2000		346	6 235.50	5 554.50

TRI : 5.32 %

CALCULATION OF THE ERR

Investments, operating costs and revenues

A. The item "interests during construction" which are purely financial costs were deducted from the projects overall investment costs. Revenues from power sales are calculated on the basis of what is produced and actually sold to consumers on the basis of 46 GWh in 1987; 211 GWh in 1988; 190 GWh in 1989 and 150 GWh for the remaining years with actual selling prices. Regarding operating costs, they have been equalized to those fixed yearly in the IRR calculation.

B. The projects completion has meant power at more than interesting prices for some areas previously supplied by the thermal station. The towns of Atakpame in Togo, Bohicon and Abomey in Bénin have since 1988 been supplied by hydro-electricity from Nangbéto. Atakpame's annual consumption evaluated at 5 GWh is now billed at CFAF 27 per KWh instead of CFAF 57, and the other two towns at CFAF 30 per KWh instead of CFAF 80, for an annual consumption of 10 GWh. The annual consumer profit is evaluated at CFAF 1.5 billion for Togo and CFAF 5 billion for Benin making an annual total profit of CFAF 6.5 million.

C. The project is an appreciable support to agricultural development. At least 1000 ha will be developed every year and the value added per developed hectare is around CFAF 400,000 giving a minimum annual profit of almost CFAF 400 million.

D. As to fishing, production which starts soon (in 1991) is estimated at almost 800 tons and will be sold at CFAF 200 million per annum.

Calculation of economic rate of return (ERR)  
(CFAF Thousand)

Year	Investment Cost	Operating Cost	Annual Cost per KWh (F.CFA)	Power sold (KWh)	Income	Profit from consumption	Agriculture and Fishery Value Added	Cash flow
1985	12 755.14							(12 755.14)
1986	12 649.96							(12 649.96)
1987	9 825.33	15	20.32	46	934.72			( 8 905.61)
1988	3 643.62	93	23.89	196	4 682.44	6500	7 445.82	
1989	375.24	106	24.82	165	4 095.30	6500	10 114.06	
1990		112	23.82	135	3 215.80	6500	9 603.70	
1991		124	24.88	135	3 358.80	6500	9 734.80	
1992		138	27.00	135	3 645.00	6500	10 007.00	
1993		153	28.08	135	3 790.00	6500	10 137.00	
1994		170	30.42	135	4 106.70	6500	10 436.70	
1995		189	34.16	135	4 611.60	6500	10 922.60	
1996		213	35.53	135	4 796.55	6500	11 083.55	
1997		240	36.95	135	4 988.25	6500	11 248.25	
1998		271	38.43	135	5 188.05	6500	11 417.05	
1999		306	39.97	135	5 395.95	6500	11 589.95	
2000		346	41.57	135	5 611.95	6500	11 765.95	

ERR : 20.81 %