

AFRICAN DEVELOPMENT BANK

T U N I S I A
COMPLETION REPORT
PROJECT FOR RURAL ELECTRIFICATION IN THE
GABES. GAFSA. MEDENINE AND TOZEUR GOVERNORATES
ELECTRICITY II

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DOC. REF. N° 0677s

EQUIVALENTS. ACRONYMS AND ABBREVIATIONS

CURRENCY EQUIVALENTS

(4th quarter 1991)

	<u>On Completion</u>	<u>At Appraisal</u>
UA 1	= Tunisian Dinar 1.28940 (DT)	0.529937
TD 1	= UA 0.77600	1.8870167
TD 1	= 1000 millimes	
UA 1	= US\$ 1.36800	

UNITS OF MEASURES

1 A	=	Ampere	
1 kV	=	kilovolt	= 1000 volts
1 kVA	=	kilovolt-ampere	= 1000 volt amperes
1 MVA	=	Megavolt-ampere	= 1000 kilovolt-amperes.
1 kW	=	kilowatt	= 1000 watts
1 MW	=	Megawatt	= 1000 kilowatts
1 kWh	=	kilowatt-hour	= 1000 watt-hour
1 MWh	=	Megawatt-hour	= 1000 kilowatt-hour
1 GWh	=	Gigawatt-hour	= 1000 megawatt-hour
1 GWh	=	283 TOR	
1 TOE	=	Ton of oil equivalent	
1000 m3 gaz	=	0.990 TOE	
1 T	=	Ton	
1 T oil	=	1.030 TOE	

ACRONYMS AND ABBREVIATIONS

ADB	=	African Development Bank
DAN	=	Decanewton
TD	=	Tunisian Dinar
GDP	=	Gross Domestic Product
GNP	=	Gross National Product
STEG	=	Société Tunisienne d'Electricité et du Gaz (Tunisian Electricity and Gas Board)
HVW	=	High Voltage Works
GT	=	Gas Turbine
ST	=	Steam Turbine
LV	=	Low Voltage
HV	=	High Voltage
MV	=	Medium Voltage

FISCAL YEAR

1st January-31 December

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BASIC PROJECT DATA

1.	COUNTRY	.	Tunisia
2.	PROJECT	:	Project for Rural Electrification in the Gab&s, Gafsa, Medenine & Tozeur Governorates
3.	N° OF LOAN	:	CS-TN.SP-81-014
4.	BORROWER	:	Government of the Republic of Tunisia
5.	EXECUTING AGENCY	:	The Tunisian Electricity and Gas Board

	<u>Appraisal</u>	<u>Actual</u>	
1.	Loan request	:	
2.	Amount	:	10,0 millions UC UA 10.00 million
3.	Interest rate	:	7%
4.	Repayment period	.	17 yrs
5.	Grace period	:	6 yrs
6.	Date of approval	.	24/02/81
7.	Date of loan negotiation	:	February 1981
8.	Date of loan signature	:	03/04/81
9.	Date of loan effectiveness	:	12/03/82
10.	Deadline for first disbursement	:	30/06/82
11.	Actual date of first disbursement	:	15/06/82.
12.	Deadline for last disbursement	:	31.12.87 December 1991

	B.	<u>PROJECT DATA</u>	<u>Appraisal</u>	<u>1st completion in 1987</u>	<u>Final completion in 1990 after utilization of the balance</u>
1.	Total Cost (UA million)		21.617	16.456	22.504
2.	Financing Schedule (UA million)				

	F.E.	L.C.	TOTAL	F.E.	L.C.	TOTAL	F.E.	L.C.	TOTAL
ADB	9.98		9.98	7.570	-	7.570	10.082	-	10.082
Government	-	6.596	6.596	-	5.101	5.101	-	6.976	6.976
STEG	_____	5.041	5.041	-	3 . 785	3 . 785	-	5 . 446	5.446
Total	9.98	11.647	21.617	7.570	8.886	16.456	10.082	12.422	22.504

		<u>Appraisal</u>	<u>Actual</u>
3.	Start-up of project implementation	March 1981	
4.	Completion of works		Dec. 1990

C. PERFORMANCE INDICATORS

1.	Cost overrun ()		none
2.	Time overrun ()		none
	- Overrun on scheduled date for effectiveness		6 months
	- 'I- -" - for 1st disbursement		none
	- 'I- -" - for last disbursement		none
	- N° of extensions of last disbursement		two
	- Overrun on completion date		none
3.	Cu-r-rent status of project implementation		
	- Start-up date		March 1981
	- Completion date		Dec. 1990
4.	Institutional performance		satisfactory
5.	Performance of enterprises		satisfactory
6.	IRR	7.63%	8.30%

D. <u>Missions</u>	<u>Date</u>	<u>N° of Persons</u>	<u>Man/Weeks</u>
- Identification	NA	NA	NA
- Preparation	NA	NA	NA
- Appraisal	December 1980		
- Supervision and follow-up	Nov. 85, Jan. 87	2 each	8 m/weeks
- PCR	July 1988	2 persons.	4 m/weeks
- PCR	December 1991	3 persons	6 m/weeks

Appraisal Actual

(UA million)

E. DISBURSEMENT (ADB Loan)

- Total disbursed	10.009
- Amount cancelled	
- Balance	
- Annual disbursements (in UA million)	

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Appraisal	600	1.500	1.800	2.400	2.900	780		
Actual	-	1.323	1.298	0.368	1.110	2.830	568	-
	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>TOTAL</u>				
Appraisal	-	-	-	9.980				
Actual	1.070	1.224	218	10.009				

1. INTRODUCTION

1.0.1 The rural electrification project in the Medenine, Gabès, Gafsa and Tozeur Governorates is in keeping with the social and land use planning policy of the Tunisian Government. Rural electrification is indeed one of the priorities of the 5th national development plan whose overriding objective is the improvement of the people's living conditions through the attainment of food self-sufficiency, job creation in the industrial sector and the availability of electricity in the rural areas. The Tunisian authorities meant thereby to highlight their resolve to consolidate the favourable trends of the economy and ensure a fair geographic and social distribution of the fruits of growth.

1.0.2 The rural electrification project falls therefore into line with the overall land use planning policy defined by the Tunisian Government with a view to correcting the regional differences which characterize the country's economy. In that respect, a rural electrification project was placed in the regionalized development plan and the Tunisian Electricity and Gas Board (STEG) was entrusted with its implementation. On the basis of the 1975 population census, STEG identified electrifiable villages. The results so obtained; enabled it, in concert with the Governorates, to define two rural electrification programmes, the first for the 1977-81' period and the second for 1982-86. The ADB took part in the implementation of the first programme, financing in part the project to supply 7600 rural households with energy and the sinking of 450 wells in the Sfax and Gafsa Governorates, completed in 1990.

1.0.3 The subject of this completion report (PCR) was implemented in the context of the second rural electrification project. Its purpose is to electrify the rural areas of Governorates in Southern Tunisia: Gabès, Gafsa, Medenine, Kebili, Tataouine and Tozeur; the Kebili and Tataouine Governorates result from a split of the Gabès and Medenine Governorates following project implementation. The project was to enable the extension of the existing KV supply network to provide 15,750 rural homes with electric energy, to drill 360 shallow wells and 12 tubewells all equipped with electric motorpumps for irrigation.

1.0.4 This project is the third Bank Group operation in Tunisia's energy sector and the second in the electricity sub-sector. The first loan in the sector, of an amount of UA 3.75 million was granted in 1975 and involved the strengthening of the El Borma Gasoduc. The second loan and the first in the electricity sub-sector of an amount of UA 8.00 million was granted in 1979 and used to finance the first electrification programme. With this project (1981, UA 10.00 million), two other operations followed in 1984 and 1989 concerned the urban electrification project (1984, UA 20.67 million) and rural electrification (1989, UA 28.44 million), the Bank's overall commitment in the energy sector amounted to UA 70.86 million in 1990, including 67.11 million in the electricity sub-sector.

1.0.5 The STEG was the project's executing agency. It carried out all designs and engineering studies and prepared the bidding documents. It also provided all inspection and supervision works and the trial runs of the structures.

1.0.6 This project completion report (PCR) was thus written on the basis of documents prepared by STEG (works progress and completion reports, among others) and the findings of missions conducted in that respect to this executing agency.

1.1. The Energy Sector 1/

1.1.1 The energy sector occupies an important place in Tunisia's economy and its contribution to the country's growth effort over 1982-1986, that of the second rural electrification programme into which this project falls, can be schematized in five main points as follows:

- a> the sector's value added contributes 11.5% to the formation of the national gross domestic product at constant 1980 prices, and 32% to the gross industrial production still at 1980 prices;
- b) investments into the sector represent more than 16.3% of the total annual package, i.e. nearly 291 million dinars, including 194 million dinars for hydrocarbon and 97 million dinars for electricity;
- c) the sector's net export at current prices, are around MD 297 on average per annum, that is more than 14.1% of the total goods and services exports;
- d) these net exports cover around 12.3% of total imports excluding energy; and
- e) the State's oil earnings contribute 21% to the Government's current budget revenues.

1.1.2 The energy sector in the country's economic growth tended to lose some of this importance because of the chronic fall of crude oil prices and the decrease in net exports of the volume of energy. Indeed, net exports fell from MD 315 in 1982 to MD 142 in 1989. The balance of primary energy exported fell from 2.7 million TOE in 1982 to 1.8 million TOE in 1989, i.e. an annual decrease of **4.2%**, over the period, for a 4.4% rise in the consumption of energy, over the same period and a stagnation of the primary energy production.

Analysis of the Energy Demand

1.1.3 The total demand for primary energy in Tunisia rose from less than 1 million TOE in 1970, to 4.28 million TOE in 1990, i.e. an average annual growth rate of **16.4%**, against 6% for the GNP and only 2% for the production of primary energy made up primarily of crude oil (**91%**) and natural gas (**9%**). Up till 1972, the quasi totality of the commercial energy demand was covered by oil products. As of 1973, gas distribution and production equipment were procured. Gas is now used by some industries and by the electric thermal stations of southern Tunisia. The percentage of gas in the overall demand thus rose from 8% in 1973, to about 2% in 1990 (see table 1.1 below>.

1/ Source : The Tunisian Energy Review, N°17, November 1990.

Table 1.1
Domestic Primary Energy Demand
(in 1000 TOE)

<u>Sources of Energy</u>	1970	%	1973	%	1980	%	1985	%	1986	%
Oil products	966	98.7	1236	90.5	2471	87.7	2552	71.4	3011	80.0
Natural gas	1	0.1	109	8.0	342	12.1	984	27.5	742	19.3
Hydraulic electricity	<u>12</u>	<u>1.2</u>	<u>21</u>	<u>1.5</u>	<u>4</u>	<u>0.2</u>	<u>32</u>	<u>1.1</u>	<u>13</u>	<u>1.7</u>
Total demand	979	100	1366	100	2817	100	3574	100	3766	100
	===	===	=====	===	=====	===	=====	===	=====	===

<u>Sources of Energy</u>	1987	%	1988	%	1989	%	1990	%
Oil products	2561	67.3	2889	73.9	2714	66.9	3035	70.9
Natural gas	1219	32.0	1016	26.0	1330	32.8	1234	28.8
Hydraulic electricity	<u>24</u>	<u>0.7</u>	<u>3</u>	<u>0.1</u>	<u>12</u>	<u>0.3</u>	<u>10</u>	<u>0.3</u>
Total demand	3804	100	3908	100	4056	100	4279	100
	=====	===	=====	===	=====	===	=====	===

1.1.4 The per capita energy consumption rose from 0.2 TOE in 1970 to 0.535 TOE in 1990 i.e. an average growth of 8.4% per annum between 1970 and 1990. Two economic sectors, i.e. industry and transport absorb more than two thirds of the total commercial energy consumption equivalent to 3.482 million TOE and 78% of the total uses of oil products which are 2.71 million of TOE. Table 1.2 below gives the trend of the final commercial energy consumption since 1984.

Table 1.2
Final Energy Consumption
(in 10³ TOE)

SECTORS	1984	%	1986	1987	1988	%	1989	%	1990	%
Industry	1285	41.0	1190	41.3	1241	41.6	1299	41.8	1364	41.9
Transport	813	25.9	897	31.1	892	29.9	912	29.3	956	29.4
Residential	470	15.0	380	13.2	401	13.4	422	13.6	446	13.7
Tertiary	399	12.7	247	8.6	252	8.4	257	8.3	274	8.4
Agriculture	169	5.4	169	5.8	<u>199</u>	<u>6.7</u>	<u>219</u>	<u>7.0</u>	217	6.6
TOTAL	3136	100	2883	100	2985	100	3109	100	3257	100

SOURCES OF ENERGY

Coke			67	2.4	77	2.6	67	2.1	74	2.3	70	2.1
Gas	163	5.2	211	7.3	205	6.9	268	8.6	295	9.1	329	9.4
Oil products	2148	68.5	2324	80.6	2398	80.3	2452	78.9	2545	78.1	2710	77.8
Electricity	<u>825</u>	<u>26.3</u>	<u>281</u>	<u>9.7</u>	<u>305</u>	<u>10.2</u>	<u>322</u>	<u>10.4</u>	<u>343</u>	<u>10.5</u>	<u>373</u>	<u>10.7</u>
TOTAL	3136	100	2883	100	2985	100	3109	100	3257	100	3482	100

1.2 The Electricity Sub-Sector

1.2.1 The electricity sub-sector is almost exclusively under the responsibility of the STEG which controls the quasi-totality of electricity energy, production, transmission and supply. However, some large consumers such as the chemical industries with recovered energy, produce electricity for their own consumption.

1.2.2 STEG is a public establishment of an industrial and commercial nature endowed with a legal status and financial autonomy; it is responsible for producing, transmitting, supplying, importing and exporting electricity and fuel gas. STEG does not have the monopoly over electricity production in Tunisia; it provided about 88% in 1990 and the balance i.e. 12%, was self-produced by some large industries for their own consumption.

1.2.3 As at December 1990, STEG ran an electricity production yard representing a total installed power of 1406 MW, comprising 65 MW in hydraulics, i.e. 5% and 1.341 MW in thermal i.e. 95%. The thermal equipment are made up of steam thermal stations (848 MW i.e. 60%); gas turbines (489 MW, i.e. 35%) and diesel stations (4 MW, i.e. 0.3%). In 1981, the total installed power was only 896 MW; and in 1990 it was virtually 1.6 times more.

1.2.4 Total energy production in Tunisia was about 5.535 GWh in 1990, STEG accounting for 4.898 GWh and the other auto-producers' mentioned in paragraph 1.2.2 accounting for 637 GWh. Total electricity consumption was 4.973 GWh, of which, 4.336 GWh was covered by STEG, barely 2.296 GWh in 1981, was therefore estimated at 4.336 GWh in 1990, i.e. an annual growth of 11%. The peak demand for STEG was 393 MW in 1981 and 637 MW in 1990. During the same period, the number of consumers rose from 758,282 to 1,362,925. Average annual per capita consumption was between 362 KWh in 1981 and 539 KWh in 1990.

1.2.5 STEG's main electricity production plants are *interconnected by a high voltage conveyor network, of 225 kv, 150 kv and 90 kv. This network was 2.416 km long in 1985, including 111 km of interconnection lines with Algeria linking: Fernana - Hajjar in 90 kv, Tajerouine - Aouinet in 90 kv and 225 kv and Metlaoui - Djebel Onk in 150 kv. To ensure a reliable and economic exploitation of means of production and transmission, as well as interconnection with Algeria, STEG is equipped with a national dispatching system relying on two regional main centres.

1.2.6 Electric energy is supplied to consumers through a medium voltage network, 30 kv, 15 kv and 10 kv and low voltage lines of 380/220V. In 1985, the medium voltage network was 15.283 km long, whereas medium-voltage lines were 24.793 km long. At the end of this electricity supply project, the national territory was largely electrified reaching in particular, a 98% rate in the urban areas and 56% in the rural centres.

1.2.7 The electric energy sub-sector development plan in Tunisia was formulated on the basis of demand estimates made in relation to a growth rate of between 6 and 8%, with an average assumption of 7% taken as basic scenario for the medium-term trend. Therefore, the consumption, covered by STEG rose from 3.320 GWh in 1986, to 4.650 GWh in 1991 and the peak power from 710 MW to 1000 MW. The electrification objective compatible with this assumption for growth in demand was 85% overall by 1991, with 100% for the urban area and 70% for the rural centres.

1.2.8 To meet these requirements and objectives, a medium-term equipment programme had been drawn in the context of the VIIth Energy Sector Plan which covers the 1986-1991 period. In the area of electricity production, provisions are made under this plan, to build a steam thermal station of 2 x 150 MW installed power to be commissioned between 1991 and 1993, depending on the trend of demand. The transmission programme concerns the connection of new stations to the interconnected network, the strengthening of some stations and lines which are reaching saturation point and the development of the distribution network. The distribution programme aims at reaching the above-mentioned electrification rates through the connection of 250,000 new consumers in the urban area and 100.000 in the rural area. In addition, it should enable the continuation and intensification of efforts towards the rehabilitation of the network and an improvement of the quality of services.

1.2.9 The Bank Group's role in the energy sector in' general and the electricity sub-sector in particular, is: to back the Government of Tunisia in attaining its energy development policy objectives. It is in this context that the ADB's continued effort in the energy sector, 'which goes back to 1975, should be situated, through its contributions to the' financing of five (5) projects including one (1) gas and four (4) electricity: (cf paragraph 1.0.4).

1.3 Sources of Information

1.3.1 This report was prepared with information from: i) the appraisal report on the project for rural electrification in the Medenine, Gabès, Gafsa and Tozeur Governorates; ii) the project completion report written by the executing agency (STEG); iii) quarterly reports on the status of works; iv) ADB archives; and v) results of discussions on the field with various authorities of STEG departments involved in the project.

1/ Source: The Tunisian Energy Review, N°6, October 1986.

2. PROJECT PREPARATION AND APPRAISAL

2.1 Origin

2.1.1 This rural electrification project originates from the overall land use planning policy defined by the Tunisian Government in 1975-1976, with the aim of correcting the regional differences which characterize the Tunisian economy, through a fair geographic and social distribution of the fruits of growth. In the context of the application of this policy, electrification of rural areas had become one of the priorities of the various economic and social development plans implemented in succession since 1977.

2.1.2 The Tunisian Electricity and Gas Board (STEG) was entrusted with the formulation and implementation of rural electrification programmes that were part of the Government's various regionalized development plans. To that end, STEG used the 1975 population census the findings of which were consolidated with field enquiries conducted by its districts, to identify electrifiable villages, revealing in the process that 2.9 million inhabitants i.e. 52% of the population were grouped in 4,000 villages and the distinction between the "dispersed rural" and the "rural centre" which is a village comprising at least 10 houses built in concrete, at least 200 metres, one from the other.

2.1.3 These factors enabled STÉG to define in agreement with the Government, two rural electrification programmes in 1976. The first for the 1977-1981 period was to supply electric energy to 7600 rural households and to sink 450 shallow wells in the Sfax and Gafsa Governorates. It was provided with an ADB financing of a total of UA 8.00 million. This project concerns the second rural electrification programme, which was one of the priority components of Tunisia's 1982-1986 economic and social development plan. It was submitted for ADB financing in 1980, appraised in December 1980 and approved by the ADB's Board of Directors on 27 February 1981.

2.2 Preparation. Appraisal. Negotiation and Approval

2.2.1 Following the decision taken by the Tunisian Government in 1973 to step up electrification in the rural areas and following the mandate assigned STEG to that effect, the latter decided in 1975 for an optimal realisation of this decision, to adopt the single-phase supply by means of a three-phase neutral earthed and distributed system (MALT System) for its 30 kV electric energy distribution networks. Adopting this new technology meant design engineering and technical and economic feasibility studies supported by the formulation and implementation of an adaptation programme for existing MV/LV networks and by the training of required technical operations staff. Moreover, STEG was to help through direct participation, in the installation of structures imported for production and marketing and after-sales-service of single-phased appliances such as pumps and other engines for current use in rural engineering (mills, oil refineries, crafts etc...>.

2.2.2 All these preparatory activities had'already been very satisfactorily concluded by STEG, at the time of the Government's request for financing of the first project in 1979. The engineering design submitted therefore to the ADB in support of the request for financing of the second project, subject of this completion report, did not raise any particular technical problem and consequently, any specific preparation on the part of the Bank. It was used as a basic working document by the appraisal mission which went to Tunisia in December 1980. In two months the ADB Board of Directors had approved the loan following the various working groups and negotiations with the country.

2.3 Long-Term Project Role

2.3.1 This project is the second phase of the rural electrification programme which is in keeping with the overall land use planning policy defined by the Tunisian Government. By deciding to implement a vast rural electrification programme, which has always been one of the priorities of the various development plans since 1977, the Tunisian authorities aim primarily at improving the living conditions of rural dwellers, and thereby decelerate exodus towards urban centres and create small economic zones. Thus, through this programme the rural electrification rate which was only 13% in 1976, increased to 74% in 1990 on completion of this project.⁸

2.4 Project Description

A/ AT APPRAISAL

2.4.1 The project's main components at appraisal were:

- A. extension of 30 KV lines to cover a distance of 860 km;
- B. construction of 3 auto-transformer stations 30/30 KV of 5 MVA power;
- C. construction of 616 transformer stations, of 30/0.4 KV on a power post of between 10 and 125 KVA;
- D. construction of 605 km of low voltage line;
- E. 16,110 connections;
- F. construction of 6 diesel micro-stations with auxiliaries; and
- G. engineering designs, works inspection and supervision.

B/ ON COMPLETION

2.4.2 Works implemented in the context of the project for rural electrification in the Gabes, Gafsa, Kebili, Medenine, Tataouine and Tozeur Governorates involved the components mentioned below:

- extension of 30 KV lines covering 1293 km;
- construction of 3 posts equipped with 30/30 kV auto-transformers of 5 MVA each;
- construction of 1114 MV/LV transformation posts;
- construction of 1531 km of LV ligne;
- construction of 1531 km of LV line;
- 28,640 connections;
- Engineering designs, works inspection and supervision.

2.4.3 These achievements contributed to the development of the electricity supply network and enabled a wide coverage of the six Governorates concerned and consequently, a marked improvement in the rural electrification rate of these regions and of the country as a whole.

PROJECT IMPLEMENTATION, COMMISSIONING AND COST3.1 Loan Effectiveness and Project Start-up

3.1.1 The loan agreement on this project was signed on 3/04/1981, i.e. less than two months after the Board's approval of the loan. On the other hand, the loan became effective only on 12/03/82 i.e. almost a year after the signing of the loan agreement. The reasons for this long delay were not given in the project documents. It seems obvious however, that they stem from the difficulties encountered in the fulfilment of the conditions for loan effectiveness, particularly those relating to the conditions for the on-lending of the loan to STEG, to the list of goods and services which was submitted to the ADB only in March 1982 and the time it took the Government to ratify the loan.

3.1.2 The long delay in the effectiveness of the loan did not however, affect the project's start-up and implementation started in March 1981 by the continued preparation of engineering designs and the invitations to bid. The loan having been approved on 24112181, it seems therefore that project start-up was not delayed in any significant way as compared with the provisional schedule, if one considers that obviously activities undertaken in 1980 involving the launching of bids and the award of contracts could not and were not taken into account in this project.

3.2 Revision

3.2.1 At its initial completion in 1987, the project could be described as follows:

- i) construction of 30 kv line of 1018 km instead of 860 km scheduled at appraisal i.e. 158 km longer;
- ii) construction of 728 MV/LV transformer posts against the 616 initially planned, that is to say, 112 additional posts;
- iii) establishment of a 948 km of LV line instead of 605, i.e. and additional 335 km;
- iv) connection of 20.810 consumers instead of the 16.110 initially planned, i.e., 4.700 additional connections.

3.2.2 In 1987, at the initial completion, although there were supplementary works, the financing schedule was as follows:

(in UA million>

	<u>Appraisal</u>	<u>Completion</u>	<u>Balance</u>
ADB	9.980	7.570	2.410
Government	6.596	5.101	1.495
STEG	<u>5.041</u>	<u>3.785</u>	<u>1.256</u>
Total	21.617	16.456	5.161

3.2.3 In 1987, the balance represented 24% of the project's total cost at appraisal. In December 1991, this balance was fully utilized and considerable works were carried out with a slight cost overrun of almost 4% of the total. This was due primarily to the favourable fluctuation of the UA as opposed to the Tunisian dinar and to the works conducted by STEG. These changes concern:

- i) the construction of a 30 KV line 1,293 km long, instead of the 860 km planned at appraisal, i.e. an additional 433 km;
- ii) the construction of 1114 MV/LV transformer posts against the initially scheduled 616, i.e. 498 additional posts;
- iii) the establishment of a LV line 1,531 km long, against the scheduled 605 km i.e. an additional 926 km;
- iv) the connection of 28,640 consumers instead of the scheduled 16,110, i.e. an additional 12,530 connections; and
- v) STEG's procurement of 5 micro stations instead of 6.

3.2.4 These developments were due primarily to the fact that between the prospection studies, engineering designs and engineering designs of a given village, the time lapse varied from 2 to 7 years during which, people around the village learnt about STEG's intention to electrify, settle around the village building a rural dwelling. This rural dwelling concentration phenomenon explains why under the project, there were more consumers to connect, more MV and LV lines to build and additional MV and LV transformer posts to install.

3.3 Implementation Schedule

3.3.1 Project implementation actually started in March 1981 that is to say, within the deadline prescribed at the time of loan agreement negotiations, when it was decided that contrary to the provisions of implementation schedule in the project appraisal report, the actual launching of bids was possible only in the first quarter of 1981 and that consequently, all assignments carried out in 1980 and relating to bids launched and contracts awarded could not be covered by the project.

3.3.2 Works were fully carried out in all the villages concerned, between 1981 and 1990, i.e. over a period of 9 years, as **scheuled** in the appraisal report. After 9 years, all project components had been implemented with for some, a rather significant overrun on scheduled quantities as mentioned in paragraph 3.2.1. Thanks to the favourable trend of the UA exchange rate, as compared with the Tunisian dinar throughout project implementation, and to **STEG's** implementation of some operations (consumer connections **etc**), initially scheduled for the enterprises, these quantity overruns led to only a slight cost overrun.

3.3.3 Quarterly progress reports were written regularly and sent to the Bank in two **(2)** copies. Twenty-four **(24)** in all, they were generally well written, gave details on the project's physical implementation, village by village, -with indications on the exact number of **MV/LV** lines and the **MV/LV** transformer posts installed. Progress reports indicated moreover, the project's precise financial performance, village by village, showing the **ADB's** financing percentage. In short, these reports gave sufficient information on the various aspects of works implementation and thereby made the proper follow-up of the project possible.

3.3.4 Throughout its implementation, two **(2)** project-related missions, technical supervision and follow-up, were conducted in November 1985 and January 1987. No major technical problem was pointed out by these two missions which took note of the satisfactory physical implementation of works. Both missions however, stated that the project's physical implementation was well ahead of the disbursements level because of the disbursement procedure adopted by **STEG**, i.e. that of repayment. Indeed, given the exchange measures taken by the Bank of Tunisia, **STEG** encountered huge difficulties in paying for materials imported under the project. To address the issue, direct payment and account opening methods were adopted in agreement with the **ADB**.

3.4 Procurement of Goods and Services

3.4.1 Supply materials to be covered by the entire **ADB** package were procured through international competition in compliance with **ADB** procedures. Orders were made for **STEG's** annual requirements per type of supply material for better prices. Materials used to implement the project were individualized on separate statements and addressed to the Bank with receipts and payment notices. The list of the main suppliers is appended to this report (Annex **4**)

3.4.2 Works contracts were awarded on the basis of national competition for those costing more than TD 20,000. Contracts of less than TD 20,000 were awarded to enterprises selected by STEG and with which it has an annual call order contract. It should be pointed out in that connection, that every year, STEG launches bids for small-scale MV and LV connections, following which and depending on the bids of enterprises, it establishes a single priced bill of quantities with firm and non-revisable unit prices.' A list of these enterprises is given as Annex 5.

3.4.3 Connection works were carried out exclusively by STEG teams. STEG also responsible for engineering designs, as well as works inspection and supervision. These services were carried out in a decentralized way by the studies and works department of the various districts, concerned.

3.5 Costs and Disbursements

A. Project Costs

3.5.1 Thanks to the positive trend of the UA exchange rate in comparison with the Tunisian dinar, there was no significant overrun after the project's final completion in 1990. It should also be pointed out that the inclusion of project material purchases in the overall orders representing STEG's annual requirements had a very positive effect on the final cost of supplies. Table 3.1 below makes a comparison of these costs. Annex 3 gives a comparative table of the cost breakdown in foreign exchange and local currency.

Table 3.1

Cost Comparison Table

(in UA thousand)

	Costs	Actual			Actual			
	estimates	at Implement.			Implementat.			
	<u>Apprai</u>	<u>Sal</u>	<u>costs</u>	<u>Diff.</u>	<u>%</u>	<u>Cost in 1990</u>	<u>Diff.</u>	<u>%</u>
A.	Extension							
	of 30 kV	8 393	7 648	- 945	11	10 608	+ 2 015	+23.4
8.	Construction of							
	auto-transform. stations	365	325	- 40	11	325	- 40	-11.0
C.	Construction							
	MV/LV stations	1 440	1 281	- 159	11	1 761	+ 321	+22.3
D.	Construction							
	of LV lines	4 860	4 326	- 534	11	6 019	+ 1 159	+23.8
E.	Instalation of LV	2 273	2 023	- 250	11	2 809	+ 536	+23.6
F.	Construction of							
	diesel stations	589	524	- 65	11	524	- 65	-11.0
G.	Studies, inspection							
	and supervision	<u>3 497</u>	<u>329</u>	<u>93165</u>	1	<u>4 5 8</u>	<u>- 3 039</u>	-86.9
	TOTAL	21 617	16 456	-5161		22 504	+ 887	

3.5.2 From an analysis of the cost **comparision** table above and in Annex 3, the following conclusions can be drawn:

- i) with the exception of components B and F which remained within the limits of the project appraisal estimates and component G, the base foreign currency cost of the other components registered an overrun of over 20% end 1990. This difference is not due to a price escalation but rather to the fluctuation of the UA exchange rate as compared with the Tunisian dinar. Moreover, the appraisal cost estimates were based on the actual prices applied by STEG then on similar current projects;
- ii) component G (studies, inspection and supervision) registered a fall of 86.9% in 1990 and 91% in 1987. This component is entirely in local currency and borne by STEG. The significant drop in costs stems from the fact that all services were provided by STEG itself, whereas at the time of appraisal, the possibility of the participation of other consulting engineers had been explored and the costs evaluated consequently;
- iii) the overall difference of UA 889,000 including UA 102,000 in foreign exchange and UA 775,000 in local currency is due to the modifications mentioned in paragraph 3.2.1. Limited to **4%**, this statement could have been higher if STEG itself had not implemented part of the project operations.

B. Disbursements

3.5.3 The various sources of finance which' took part in the project's financing are indicated in the table below:

Table 3.2
Sources of Finance
(in UA thousand>

Sources	On completion of works after use of balance				Completion of works in 1987				At Appraisal			
	<u>F . E .</u>	<u>E.E. Total</u>	<u>%</u>		<u>L.C.</u>	<u>Total</u>	<u>%</u>		<u>F.E.</u>	<u>L.C.</u>	<u>Total</u>	
A D B	10 009	-	10 009	44.5	7 570	-	7 570	'46	9'980		9 980	46.2
Government		6 976	6 976	31.0	-	5 101	5 101	21	-	6.596	6 596	30.5
S T E G	73 5	446	5 519	24.5	-	3 785	3 785	23	-	5 . 041	5 041	23 . 3
TOTAL	10 082	12 442	22 504	100.0	7 570	8 886	16 456	100	9 980	11 647	21 617	100.0
	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####

3.5.4 Table 3.2 shows that given the percentages, the financial contributions of the various sources remained virtually -the same. Compared to the ADB loan amount of UA 10 million, there was a balance of UA 2,430 in 1987. As to the Government and STEG, actual, savings on their budgets are UA 1,495 and UA 1,256 million, respectively. In 1990, there was an overrun of UA 9,000 due to the UA conversion rate variation as compared with the currencies of payment.

3.5.5 Table 3.3 below gives the expenditure **schedule** by source of finance. It shows that expenditures were halted in 1987 i.e. in the seventh year of project implementation and not after six years as planned at appraisal, because works were implemented, the last equipment handed over, and commissioned in the first term of 1987, i.e. a negligible time lag of three (3) months out of six years of implementation. Already at the time, component limits had been overshoot, on an average of nearly 30%, but considering the rather high level of the ADB loan balance (UA 2.4 million) and with the agreement of our Institution, given during 1988, works resumed in 1987 to end in 1990. It should be pointed out as well that annual expenditure amounts were rounded to the thousand at the time of appraisal, which means that the Government and STEG's contributions are different from those given in table 3.2 above.

Table 3.3
Expenditure Schedule
(in UA thousand>

A. Actual

Sources	1981	1982	1983	1984	1985	1986	1987	<u>1989</u>	<u>1990</u>	<u>TOTAL</u>
A D B	537	1236	1058	1445	1943	1022	329	1070	1369	10009
Government	362	833	712	974	1039	689	222	802	1073	6976
S T E G	269	618	529	722	972	511	<u>164</u>	712	1022	5519
TOTAL	1168	2687	2299	3141	4224	2222	715	2584	3464	22504
	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====

B. Extimates

Sources

A D B	<u>1981</u>	<u>1982</u>	<u>1.800</u> 1983	<u>2.400</u> 1984	<u>2.900</u> 1985	<u>1986</u> 780	TOTAL 9.980
Government	390	980	1.190	1.580	1.910	530	6.580
S T E G	310	<u>7 6 0</u>	<u>9 1 0</u>	1 220	1 460	<u>4 0 0</u>	<u>5.060</u>
TOTAL	1.300	3.240	3.900	5.200	6.270	1.710	21.620
	=====	=====	=====	=====	=====	=====	=====

3.5.6 Owing to the repayment method used for loan disbursement, and because STEG purchases its supply material in packages corresponding to its annual requirements, loan disbursement was delayed leading to inconsistencies as shown in table 3.4 below:

Table 3.4
ADB Loan Disbursements
(in UA thousand)

<u>Exp./Disburs.</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>Total</u>
Expend. estimates	600	1500	1800	2400	2900	780	-				9980
Actual expendit.	537	1236	1058	1445	1943	1022	329	1070	1442	-	10082
ADB disbursement	-	1323	1298	368	1110	2830	568	1070	1224	218	10009
% of loan disbursed	-	13	13	4	11	28	6	11	12	2	100

3.5.7 The exact situation of disbursements is given as Annex 9. Table 3.4 gives a difference of less than UA 73,000 between the expenses incurred by STEG and disbursements from the Bank. This difference represents the gap between the time bills are actually paid by STEG and when they are reimbursed by the ADB.

3.6 Operations

3.6.1 Equipment was handed over and commissioned gradually village by village, as works were completed, and prior to project completion deadline. Both ADB supervision missions had to visit the villages already electrified under the project and check on the proper working order of equipment. During the project completion mission, we noticed **that** electricity in the villages was supplied by means of reliable and well-adapted equipment, a guarantee to good quality service.

3.7 Performance of Suppliers, Entrepreneurs and the Executing Agency

3.7.1 Supplies were procured from manufacturers of electricity supply materials. No specific problem either in the quality of material delivered or in the delivery deadlines was pointed out. Orders were usually respected and material specifications in conformity with those stipulated in the bidding documents. In conclusion, suppliers respected the terms of their contracts with the Executing Agency and delivered good quality materials.

3.7.2 Enterprises are all national and were generally 'selected locally. Indeed, as pointed out in paragraph 3.4.2, STEG has approved a number of local enterprises in each region and district with which it has signed an order contract renewable every year. In view of the works carried out, it seems that all enterprises provided very satisfactory services. Structures were built in accordance with specifications and norms applicable for the installation of the public electricity supply networks."

3.7.3 Very good works implementation and a proper working order of equipment are also to be attributed to STEG, the executive agency which provided all engineering designs, prepared on bidding documents inspected and supervised works and handed over and commissioned structures. STEG provided very good quality services showing proof of great competence, laying the groundwork for general success of the operation.

4. OPERATING PERFORMANCE

4.1 The Market

4.1.1 The project's objective as defined at appraisal was the electrification of rural areas in three STEG districts: Gafsa, Gabes and Tozeur, in Southern Tunisia. The estimated demand to be met by the project had been based on data gathered by STEG in the project area; the target population was defined as being made up of 15,700 rural homes. 372 irrigation pumps were also to be installed.

4.1.2 Energy sales from the project structures were estimated on the basis of an average of 350 kwh per annum and per family for domestic needs and about 1,500 kwh per annum and per pump for agriculture requirements.

4.1.3 The average of 350 kwh per annum and per family was to cover all household needs i.e., lighting (in replacement of the oil lamp), supply for previously battery-operated household appliances and some needs met in part by fire wood.

4.1.4 For irrigation pumps, the average consumption of 1,500 kwh per annum was established on the basis of similar pumps used in the country.

4.1.5 The table below makes it possible to compare appraisal estimates and the demand registered between 1982 and 1990.

Years	Estimated Dem. GWh	Registered Demand GWh	Diff. GWh	%
1982	0.5	0.8	0.3	t 60 %
1983	1.8	3.3	1.5	t 83 %
1984	3.5	4.7	1.2	t 34 %
1985	5.4	6.5	1.5	t 20 %
1986	7.2	7.2	—	
1987	7.5	8.4	0.9	t 12 %
1988	7.8	8.7	0.9	t 11.5%
1989	8.1	9.8	1.7	t 21%
1990	8.5	11.6	3.1	t 36.5%

As can be seen, the differences are positive and their analysis shows that they stem both from the actual number of consumers which was higher than appraisal estimates and the average consumption itself.

4.1.6 An analysis of Annex 7 shows that the number of consumers connected to the project structures reached 26,640 at the end of 1991, whereas the project's objective at appraisal was to supply a total of 16,122 consumer points.

4.1.7 One of the possible reasons for this is the growth of the villages to have benefited from project facilities, rural dwellers from surrounding areas converged to the villages in order to benefit from the new economic and social possibilities brought about by the project.

4.1.8 Through its branches in the districts, STEG was able monitor project implementation and be close enough to its customers, providing adequate solutions, information and points to pay bills. This explains why on the date of preparation of the project completion report, STEG was able to provide an accurate summary statement of its customers and their bills.

4.2 Project Achievements and Repercussions

4.2.1 According to preliminary indications provided by STEG, the introduction of electric energy to the rural areas which have benefitted from this project, has had a positive effect on their economic and social development. Irrigated areas, wells and tube wells are noticeable thanks to the supply of electric power used in agriculture, small industrial and crafts units, dispensaries, bakeries, cultural and religious centres with electricity all with a catalysitic effect on the daily activities of the peoples concerned. Lastly modes of production, exchange and consumption have also been affected.

4.2.2 As to the objective of a reduction of rural depopulation, it is still premature to evaluate the achievement since there are no reliable demographic data to assess such a reduction.

4.3 Other Factors

4.3.1 This rural electrification project has contributed to the attainment of the objectives fixed by the Tunisian Government with regard to the country's electrification rate. For rural centres, the objective of the VIth Plan was to obtain a 54% electrification rate in 1986. This project made it possible to bring this rate from its level of around 28% in 1982, to 74% in 1990, at the end of project implementation,, i.e. 20% more than the estimates of the VIth Plan.

4.3.2 From the point of view of economic activities, mentioned in paragraph 4.2.1 above, the supply of wells and tubewells in electric power and, the supply of electricity to rural homes for their lighting and other domestic uses, will have contributed to the decrease in costs; borne by all economic agents in the conduct of their daily activities.

5. FINANCIAL ANALYSIS

5.1 STEG's Financial Performance

5.1.1 **STEG's** provisional income as prepared at appraisal are given as Annex 8. Table 5.1 below makes it possible to compare the summary of current incomes with appraisal estimates.

Table 5.1
STEG's Provisional and Current Incomes
(in TD thousand)

	<u>A l'évaluation</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>
Sales (GWh)	3,070	3,440	3,850	4,310	4,700	5,100	5,600	6,000
Average selling price (millime/kWh)*	32.30	35.53	35.53	35.53	35.53	35.53	35.53	35.53
1, OPERATING INCOME								
a. Total proceeds	114,010	137,180	151,020	167,900	181,770	197,520	216,140	231,270
b. Total expenses	<u>71,980</u>	<u>86,680</u>	<u>95,630</u>	<u>104,510</u>	<u>118,780</u>	<u>135,020</u>	<u>153,440</u>	<u>174,400</u>
c. Gross operating income	42,030	50,500	55,390	63,390	62,990	62,500	62,700	56,870
d. Financing charges	7,770	9,540	12,940	14,580	16,460	14,450	12,510	10,630
e. Depreciation cost	21,468	24,310	28,370	32,558	32,550	32,550	36,130	36,130
Provisions	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
net operating income	12,800	16,650	14,080	16,260	13,980	15,500	14,060	10,110
<u>Performance</u> <u>Indicators</u>								
Operating ratio	63%	63%	63%	62%	65%	68%	71%	75%
Capital costs/ Total production	6.8%	7.0%	8.6%	8.7%	9.1%	7.3%	5.8%	4.6%
Depreciation allowance/ Total proceeds	18,8%	17,7%	18,8%	19,4%	17,9%	16,5%	16,7%	15,6%
Self-financing	34,268	40,960	42,450	48,810	46,530	48,050	50,190	46,240

* TD 1 = 1000 millimes

	<u>Actuals</u>						
	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
. Sales (GWh)	2.896	3.113	3.279	3.547	3.740	4.015	4.371
. Average selling price (millime/kWh)	48,143	48,809	48,767	49,835	51,122	50,920	50,890
1. OPERATING INCOME							
a. Total proceeds	189.780	219.236	223.872	251.028	268.365	294.466	334.721
b. Total expenses	<u>133.184</u>	<u>149.820</u>	<u>145.431</u>	<u>161.707</u>	<u>172.298</u>	<u>181.773</u>	<u>218.670</u>
c. Gross operating income	56.596	69.416	78.441	89.321	96.067	112.693	116.051
d. Financing charges	21.689	28.243	33.953	35.145	34.345	31.854	27.476
e. Depreciation cost	24.678	28.685	37.267	65.280	70.131	73.398	76.875
f. Provisions	<u>1.261</u>	<u>639</u>	<u>532</u>	<u>1.434</u>	<u>2.342</u>	<u>2.268</u>	<u>2.284</u>
g. Net operating income	8.968	11.849	6.689	(12.538)	(10.251)	4.564	9.914

2 - Performance Indicators

. Operating ratio	70%	68%	65%	64%	64%	62%	65%
. Financing charges/ Total proceeds	11,4%	12,9%	15,2%	14,0%	12,8%	10,3%	8,2%
. Depreciation allowance/ Total proceeds	13,0%	13,1%	16,6%	16,0%	26,1%	24,9%	23,0%
. Self-financing	33.646	40.534	43.956	52.742	59.880	77.962	86.789

5.1.2 From the table above, one can see that current proceeds are constantly higher than the appraisal estimates; this positive difference in the electricity activity, can be explained **by the** higher level of current average prices, whose difference with the constant average price used at appraisal, was 48.2% in 1990. However, the volume of **GWh sales** was lower than that (13%) anticipated at project appraisal when the growth rate for the electricity demand was estimated at 9%.

5.1.3 Table 5.1 also shows a deterioration in **STEG's** current income, which meant an operating deficit of TD 12.5 million in 1987 and TD 10.25 million in 1988. These incomes were possible despite the marked improvement of the operating ratio which rose from its level of 70% in 1984 to 64% in 1987 and 1988. In 1989 and 1990, there was a slight improvement and the net operating income was positive again.

5.1.4 The above incomes can be explained by the increasing proportion of financing and depreciation costs which accelerated during the period to reach approximately twice the levels estimated at appraisal. Indeed, financing costs rose from their level of TD 13.5 million in 1983 to TD 35.2 million in 1987 and TD 10.6 million in 1990. Depreciation costs increased from TD 21.2 million in 1983 to 65.3 million in 1987 and TD 76.9 million in 1990. The drop in financing costs the following years and the rather significant increase in the total proceeds gave STEG an interesting operating level.

5.1.5 The above analysis of the main aggregates of STEG's operating account gives rise to the following main comments:

- i) consumed purchases and other structural operating expenses (personnel and works) incurred by STEG, followed a normal trend, running parallel to the development of the activity. This indicates that during the period under reference, STEG was able to control the direct production, transmission and supply costs of its main products. This fact is confirmed by the constant decrease of the operating ratio, from 70% in 1984, to 65% in 1990; and
- ii) the size of the financial costs and depreciation allowances had a negative impact on STEG's capacity to attain the profit levels anticipated at appraisal. This testifies to the fact that price revisions **occurring** during the period under review, did not take into **account** the total costs of providing services and particularly the entire financing and depreciation expenses for STEG's plant and equipment.

5.2 Financial Performance of the Rural Electrification Project

5.2.1 The operating account of table 5.2 below gives details of the income STEG obtained gradually as the facilities of this project were commissioned:

Table 5.2
Operating Account of the Rural Electrification Project
(in TD thousand)

	<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>
Sales (GWh)	0.8	3.3	4.7	6.5	7.2	8.4	8.7	9.8	11.6
Average price (millime/kWh)	<u>45.0</u>	<u>47.0</u>	<u>47.0</u>	48.0	<u>49.0</u>	<u>50.0</u>	<u>57</u>	57	57
Turnover	36.0	155.1	220.9	312.0	345.6	420.0	495.90	558.60	661.81
Operating cost									
Cost service energy	24.0	99.0	151.3	210.6	219.6	274.7	313.15	357.00	407.00
Cost of managing distr.	6.1	<u>24.1</u>	<u>35.7</u>	<u>48.8</u>	<u>53.3</u>	62.2	69.66	<u>78.02</u>	87.39
Total operating cost	30.1	123.1	187.0	259.4	272.3	336.9	382.81	435.02	494.39
Operating margin	5.9	32.0	33.9	52.6	72.7	83.1	113.09	123.58	166.81

5.2.2 The incomes above highlights the positive trend of STEG's turnover in the beneficiary villages. Sales expressed in GWh, were valued at the average sale price in the area concerned by the project. The operating costs comprise those of power supplied, calculated on the basis of cost accounting data, determining the cost of the kWh by the nature of the expenses and comprising the costs of fuel, production capital depreciation, materials and various operating expenses. As to management costs, they represent those borne in the districts responsible for the implementation of project facilities.

5.2.3 On the whole, operating the project network has been satisfactory since the turnover has made it possible for STEG to secure increasing operating margins, parallel to the growth in energy sales.

5.2.4 In comparison with the provisional income anticipated during project appraisal, it should be pointed out that differences', are slight. The provisional operating account of the appraisal report had taken into account other operating proceeds from sales of small household electrical appliances, which STEG subsequently stopped marketing. On the other hand, the average selling price used in the preparation of the provisional operating account had been maintained constant at 35.53 millimes/kwh, whereas this average price has in reality changed from its level of 32 millimes/kwh in 1982, to 50.89 millimes/kwh in 1990. The few differences above explain those registered between estimates and achievements.

5.2.5 It should also be noted that in comparison with STEG's overall operation, the impact of the above-mentioned energy sales are insignificant because the project's primary objective was to introduce electricity into rural areas where services and industries, large consumers are virtually inexistent. It is however expected that at full development, when the agglomeration effect seen in the recipient village 'sites would have stabilized, the energy sales will be 76% for domestic lighting requirements, 12% for the pumps and the remaining 12% for drilling.

5.3 The Project's Internal Rate of Return

5.3.1 The project's rate of return was again calculated on the basis of real investment costs in accordance with the project's recorded implementation schedule. These were the actual costs account taken of price escalation. In compliance with the provisions of the loan agreement, grants include the ADB loan to the Tunisian Government, and the latter's extraordinary budget and investment appropriations.

5.3.2 Sales were calculated on the assumption that 'average consumption would increase from their current level of 350 kwh/year/household to 400 kwh/year/household in the ensuing five years. This assumption is realistic since it is based on currently registered sales data. For pumps and drilling it was impossible to obtain reliable statistics on the number of consumers in the districts who have subscribed for these uses, nevertheless, it has been confirmed that on average, pumps and drilling register an average annual consumption which varies from 1,400 to 1,500 kwh and that their maximum number has already been connected to project structures. Lastly, the average sale price used to recalculate the internal rate of return was the average price applicable at project completion. The economic life chosen was 25 years and maintenance expenses corresponding to 1% of the investment as of the second year. In these conditions the rate arrived at i.e. 8.30% is very close to the 7.63% appraisal estimate. Annex 2 shows how the rate estimate was calculated.

5.4 Financial Conditions and their Fulfilment

5.4.1 A total of four conditions precedent to first disbursement were laid down in the project appraisal report presented to the Bank Group's Board of Directors during its February 1991 session. Under these conditions the of the Borrower (the Government) was to:

- 1) undertake in writing to make regular budget 'appropriations in respect of its contribution to the project and in accordance with the financing schedule;
- 2) undertake in writing to seek complementary' sources of finance in the event of current cost overruns;
- 3) undertake in writing to on-lend the loan to the beneficiary (STEG) in conditions acceptable to the ADB;
- 4) undertake to secure from STEG regular, appropriations in its annual budget as its contribution to the project in accordance with the financing schedule.

5.4.2 These conditions were all met through 'a letter' from the Ministry of Planning, binding the borrower on the above four conditions. Concerning the condition relative to the on-lending of the loan, the letter specified that in line with the spirit of the loan negotiations, that the borrower had decided to grant the loan proceeds to STEG in the form of a grant. The summary record of the negotiations between the ADB and the representatives of the Borrower, indicates that the Tunisian party had informed the ADB of the Government's intention. The ADB did not object to this decision, which seems based on the fact that rural electrification falls under the State's social responsibilities.

5.4.3 As mentioned in paragraphs 3.1.1 and 3.1.2, **the** Borrower fulfilled to the letter, conditions precedent to first disbursement: The other loan conditions were the following:

- a) all disbursement requests were to **be** accompanied by records on completed works and suppliers' bills justifying the unit price of material purchased and used; and
- b) the Borrower was to undertake to assist' STEG in activating the recovery of debt owed by administrations, local Governments and State companies.

5.4.4 These two conditions **were** also fulfilled by the Borrower. Indeed, **STEG's** disbursement request, of which the list, respective amounts as well as the currency of disbursement are given as Annex 9, **were** all backed by suppliers bills justifying the unit purchase prices of materials used. Furthermore, in an attempt to assist STEG in recovering its debt, the Government applied a decree gradually widening the **municipal** surcharge in 1986; this rose from 1.5 millimes per kwh to 2.0 millimes per kwh and meant to increase the resources of the communes which are among STEG's largest debt holders.

5.4.5 At the same time, the Government had programmed at fixed fiscal dates, the payment of annual power consumptions of Government departments. State companies and other parastatal institutions'. The mechanism in force obliges the afore-mentioned institutions to pay 80% of their actual consumption not later than the first quarter of the year; compensation on actual consumption comes up only at the end of the year, on STEG's presentation of the annual bill.

5.4.6 Other than the fact that provisions above are an answer to the Borrower's financial commitments made under the loan granted by the ADB to finance this project, these provisions made it possible for STEG to reduce its debts on consumption from 48 days of sales in 1986 to 30 days of sales in 1990, i.e. a reduction of 18 days on its revolving fund requirements.

6. PERFORMANCE OF STRUCTURES

6.1 Legal and Institutional Framework

6.1.1 The Tunisian Electricity and Gas Board (STEG) was established in application of decree-law number 62.8 of 3 April 1962. It is a public institution of an industrial and commercial nature endowed with a legal status and financial autonomy. Its purpose since its establishment has been the same namely "to produce, transmit, supply, import and export fuel gas for the exclusive purpose of developing Tunisia's entire energy sector in the national interest.

6.1.2 In 1980, when the project was appraised, STEG was supervised by the Ministry of Economy. At the time of completion it was supervised administratively by the State Secretariat for Energy and Mines and subject to the system of provisions authorizing official financial audit of firms recipient of Government financial assistance.

6.1.3 Since its establishment to date has been administered by the Board of Directors, to which the Chairman and Managing Director are responsible. The latter is entrusted the daily management of STEG's activities. The Board of Directors is currently made up of 13 members instead of the 11 at appraisal, of varying backgrounds: ministries (the Prime Minister's Office, the ministries of Agriculture, National Economy, Finance and Planning, Equipment and Housing); from the Central Bank and STEG staff. It still has wide-reaching powers to act on behalf of STEG and particularly, to examine and authorize STEG's annual programme and budget. A financial comptroller appointed by the Ministry of Finance and Planning and a Technical Comptroller appointed by the Secretary of State for Energy and Mines take part in the Board with consultative voices.

6.1.4 STEG's financial autonomy, like that of all public industrial and commercial-type institutions in Tunisia which enjoy the monopoly to exploit and supply, is statutorily limited; thus although STEG can take the initiative to adjust prices, it should at all times obtain the promulgation of the new prices, the level and structure of which are proposed by the Firm from the Government.

6.2 Organization and Management

6.2.1 The Chairman and Managing Director of STEG is still appointed by presidential decree, issued on the proposal of the firm's supervisory ministry. Other than his daily activities, he is responsible for implementing decisions taken by the Board of Directors to whom he reports on his management. He is assisted by a Deputy Managing Director and ten Directors responsible each for a functional directorate. The organization charts at project appraisal in 1980 and during the preparation of the completion report are given in Annex 6. The ten directorates share the technical duties (4 directorates) design and planification (3) and administrative, financial and supply (3) covering STEG's two main activities: electricity and gas.

6.2.2 In their turn, these directorates are sub-divided into departments with regional branches when the nature of their assignment so demands. To these which are STEG's central units should be added other units directly attached to the General Directorate, such as the Control and Management Department, the Internal Audit, the Technical Audit etc, which are entrusted with duties in line with the prerogatives of the General Directorate. This new structure, set up in 1988 is becoming decentralized with the establishment of regional units both with regard to electricity and gas. Concerning electricity, three operating and six supply regions were created, each headed by a Regional to coordinate the actions of the 32 districts under their responsibility and covering the entire national territory. STEG's new organizational structure enables it to coordinate and manage its activities satisfactorily.

6.3 Personnel and Training

6.3.1 Since project appraisal in 1980, the workforce rose from 5,726 to 8,664 in 1990, i.e. an average annual increase of nearly 5%. In these last three years, STEG has had to strengthen its technical and supervisory staff, by recruiting, training and confirming engineers and administrative and financial officers. Thus, instead of 444 departures on retirement, resignation, dismissal, termination of contract and death, there were 1,132 new recruits, maintaining the current workforce structure - professionals: **19.4%**, supervisory staff: 49% and line staff: 31.6%. The contribution of this staff to the satisfactory management of the firm's activities is noteworthy, especially as foreign technical assistance is virtually inexistent. Moreover, STEG benefits from **its** staff's excellent qualifications, providing other Arab countries with technical assistance.

6.3.2 STEG has a training centre in Kledia with a full board capacity of 230 persons. This centre is responsible for training new recruits from high schools and technical colleges, who wish to train as technicians in electricity or as administrative or financial agents. Lectures are given by a faculty of nearly 50 permanent lecturers who for **the most part** have worked for STEG and whose experience, training and knowledge of the firm's activities is a solid guarantee to the relevance of the courses taught. The centre has 9 classrooms, 15 workshops and 8 equipped laboratories: this infrastructure of a rather good quality makes it possible for the centre to provide training in the best technical and economic conditions. As the table, below shows, on average, more than 20% of **STEG's** overall workforce are trained every year.

Table
Trend of Staff Trained at STEG

<u>Nature of Training</u>	1987	1988	1989	1990
Further training	1451	1450	1443	1775
including: abroad	57	11	67	15
Initial training	121	73	114	129
Continuous training	14	18	25	51
Total of agents trained	1586	1541	1582	1995
% of overall workforce	22	21.4	20.7	25.1

6.3.3 Each year STEG invests between 2.5 and 3% of its wage bill into training. The capitalization of experience and its opening on to the academic and industrial circles enables it to carry out its training programme in the best conditions. 50% of the new agents follow long training courses prior to their recruitment and 15 to 20% of active workers **participate** in further training activities every year. In addition, STEG remains a technical support factor for industrialists in the fields of operation and maintenance of electricity and gas facilities. It takes part in the training of agents of counterpart Magrebin and African firms, particularly in the area of high voltage supply and works. In June, 1990, during the UPDEA congress held in Tunis, STEG was selected to train senior technicians in electricity network supply for all African countries.

6.3.4 The supervisory staff also benefits from training activities. They may take part in training courses abroad or in some cases, in national training programmes on management and team leadership. On the whole, training is very well organized in STEG contributing thus to the effectiveness of its operations.

6.4 Accounting and Auditing

6.4.1 STEG's accounting system is based on the Tunisian accounting programme adopted in 1968 and applied by the Firm as of 1971. It keeps a detailed general accounts system and a cost accounting system which distinguishes between electricity and gas activities. Accounting is fully computerized and data computer processed. All accounting operations are centralized in Tunis despite the strong trend towards decentralization which has already started.

6.4.2 STEG's accounting year coincides with the calendar year, running from 1st January to 31st December. At the end of each fiscal year, the accounting department produces a production account, a general operating account, an income account and a balance sheet. These accounts are subject to a double audit. Indeed, all STEG's accounting documents are subject to the control of a comptroller appointed by the Ministry of Planning and Finance. The latter should prepare a report addressed to STEG's Board of Directors to which he takes part and entitled to a consultative vote. It is on the basis of the comptroller's report and on the examination of the accounting documents presented by the Financial Directorate that the Board of Directors approves the company's accounts. Moreover, all STEG's accounts are audited yearly by independent auditors. Since project appraisal, the opinions expressed by the external auditors have always been favourable.

6.5 Tariffs

6.5.1 STEG's tariffs policy on electricity services has not changed since project appraisal; it's general objectives have remained the same and they are:

- energy conservation;
- a genuine price practice;
- maintaining the basic financial balances of the activity; and
- tariffs simplification.

6.5.2 The tariffs in force represent three voltage levels: high, medium and low. HV tariffs comprise two sections: a general and an emergency section; each section is subdivided into three distinct periods (day, peak and night). This tariff concerns only about fifteen consumers. On the medium voltage there exists a time shift price, a uniform price shift, an emergency price and special prices for agricultural purposes waived at peak periods. The low voltage price comprises a general tariff made up of economic and normal time frames. There are no shifts and special rates for public lighting, agriculture, but hourly shifts and peak periods waivers for oil refineries, mounts and water heaters.

6.5.3 As can be seen, STEG's electricity rate 'structure remains complex although since project appraisal and in the context of the application of findings of the price survey already carried out; efforts have been made to simplify the structure. Thus the irrigation and air-conditioning price tends to disappear and is not quoted to new consumers, since old consumers with time will be dissuaded by the rapid trend of the kwh rate. Currently, one of STEG's primary objectives is to apply a price structure that takes into account the activity's long-term marginal costs.

6.5.4 An analysis of the average cost and sale prices per kwh and per voltage level is given in the table below for 1990.

T a b l e
Electricity Activity
Comparison of Average Cost and Selling Prices in 1990

<u>Voltage Level</u>	<u>Volume (GWh)</u>	<u>Turnover (DT)</u>	<u>Average Price millimes/kWh</u>	<u>Average Costs millimes/kWh</u>
High voltage	842	30 164 449	35.8	
Medium voltage	2 028	100 475 883	49.5	
Low voltage	1 466	91 790 668	62.6	
Total	4 336	222 431 000	51.30	57.43

6.5.5 This table shows that the average selling price' applied by STEG is not enough to cover the cost price of the service. The Government was requested to revise the selling price of electricity,, i.e.. 4.3% on average. The Government accepted for 2.9% i.e. 3.3% for HV, 3.0% for MV and 2.8% for LV. Currently, a project for an average 5% increase is being studied. Owing to the rapid growth of financing and amortization expenses, in 1984, the cost price of the kwh rose to 40.1% in 1988, then to 39.9% in 1989 and 35.4% in 1990. As a result of the interconnection of the entire network, STEG applies uniform rates nationwide. Considering this table and in order to cover STEG's expenses incurred to meet the national demand, periodic changes of the price structure and royalty are necessary. Current rates in force applied since January 1991 are shown in Annex (Annex 11).

Trend of Average kwh Distributed Cost Price
by Expenditure Category

Nature of Expenses	1984		1985		1986		1987		1988		1989		1990	
	Price	%	Price	%	Price	%	Price	%	Price	%	Price	%	Price	%
Fuel	20.60	45.3	21.10	44.7	18.90	38.7	21.30	37.4	23.17	40.0	22.10	39.0	24.06	41.9
Financial charges	6.00	13.2	6.90	14.6	8.30	17.0	8.30	14.6	7.74	13.3	6.80	12.0	5.07	8.8
Depreciation	7.30	16.0	7.90	16.7	10.00	20.5	15.90	27.9	15.57	26.8	15.80	27.9	15.30	26.6
Personnel expenses	7.60	16.7	7.50	15.9	7.40	15.2	7.40	13.0	6.88	11.9	8.00	14.1	9.20	16.0
Other charges	4.00	8.8	3.80	8.0	4.20	8.6	4.00	7.0	4.00	8.0	4.00	7.0	4.00	8.0
TOTAL	45.50	100.0	47.20	100.0	48.80	100.0	56.90	100.0	57.99	100.0	56.70	100.0	57.43	100.0

6.6 Billing and Recovery

6.6.1 In STEG's organization chart, there is a Distribution Directorate made up of a central organization and a regional organization. The first comprises 4 departments (Budget and Programme, Studies, Technical Operation, Consumers Management) and the second covers 6 supply regions (Tunis, North, North-West, Centre, South, South West). These regions cover 32 districts which are responsible for works implementation. Each region assists the districts in their day-to-day management and with the four Head Office departments are responsible for designs, the preparation of texts and procedures and the monitoring of computer application in the management of consumers. It is also responsible for the distribution of computer software, monitoring and controlling their use in the districts and the respect of procedures that it defined.

6.6.2 To manage consumers, all 32 districts are responsible for billing and recovery activities. Meters are read once every four months for LV and an "intermediary" bill estimate issued in the middle of this four month cycle. The intermediary bill is calculated on the basis of the average consumer consumption. This system of quarterly bills does not apply to public administrations, agricultural pumps (seasonal consumption dependent on the climate and rainfall), for which the meters are read every two months, and MV and HV consumers whose meters are read every month. Since July 1991, half-yearly reading has been introduced in rural areas (about 400,000 consumers) The reason is economic: low bills mean high reading cost. Every two months, during the first four months, two half-yearly bill estimate are issued followed by the bill of the reading on the sixth month although consumers pay every two months.

6.6.3 Bills are distributed over a two-month cycle, to the tune of approximately 35,000 bills per day from door to door by STEG agents. Bills are sent on the two days following billing to individual consumers. Bills for administrations are grouped on a monthly basis and sent either directly or through the post office. Currently, postal distribution is being tested for at least 1000 consumers in the rural areas.

6.6.4 The consumer has a three week period to pay his bill either:

at one of STEG's counters located nationwide;
at the counters of the Post Office and some banks;
by bank or postal domiciliation.

6.6.5 In the event of non-payment within the above prescribed deadlines, STEG allows an additional three week deadline without notice. After this deadline, the computer orders a power cut. On the following day the power-cut order is brought by STEG agent for on the spot payment by the consumer, if that fails, the consumers power supply is cut. For the individual consumer, this cut is followed by a termination of contract, the establishment of a default file to be investigated by the Disputes Department of the district and legal action is taken the last resort. For public administrations, negotiations are followed by a power cut in the official residence and a letter to the authorities, if need be.

6.6.6 The performance of the billing and recovery system is determined through the time lapse of bill recovery as against that of suppliers in relation to the deadline fixed by the Board to recover current bills. In the case of STEG, this deadline is fixed at three weeks, whereas unpaid bills in 1988, 1989 and 1990 represented 29 days for the first two years and 30 days for 1990, respectively. Consequently, efforts are still to be made by STEG to bring this level to 21 days.

7. PROJECT JUSTIFICATION

7.1 Project Achievement

7.1.1 Under the project, a reliable public electricity supply system has been established in the process of providing electricity to 300 villages in six (6) Governorates. Electricity is being supplied to 28,640 households, thanks to the construction of 1,293 km of MV lines, 1,531 km of LV lines, 1,114 MV/LV transformer posts, 5 diesel micro-stations, 3 anti-transformers of 30/30 KV and the 28,640 connections.

7.1.2 At the time of appraisal, the project's technical justification was based on its capacity to meet, in the best technical conditions of reliability and quality of service, present and future electric power demands in the rural areas concerned. No doubt, the project meets and will go on meeting fully these technical demands. Indeed, the MV and LV network system of public supply is perfectly in conformity with technical and internationally acknowledged norms. The system is strong and simple to operate and maintain. In addition, it provides a good quality of service from all points of view: continuity of service, level of voltage output in conformity with point of view the norms generally acknowledged for these networks. Lastly, the various operating departments concerned, in STEG's districts have the adequate material means and a qualified and competent technical personnel.

7.1.3 On the financial front and according to sale statistics provided by STEG for the 1982-90 period, it seems that the incomes are more than satisfactory. Indeed, paragraph 4.1.5 shows that electric energy sales were much higher than the appraisal estimates, with for 1993, a positive difference of up to 83% of estimates. The project's financial rate of return is around 8.30% for STEG and considering the subsidies granted by the Tunisian Government against the appraisal estimate of 7.63%, which is very satisfactory for a project of this nature.

7.1.4 It is without doubt on the socio-economic plane that the project rose above the objectives set at appraisal. Its implementation made it possible to appreciably develop the economic activity of the regions concerned through: i) the creation of new pumps for irrigation and as such the extension of irrigated areas; ii) the creation of small industrial and craft units including flour-mills and oil-refineries which can employ about ten workers each; iii) the decrease in the costs of inputs covered by all economic agents in their daily pumping, oil flour, bread etc production activities.

7.1.5 On the socio-cultural plane, the purchase of more television sets by rural dwellers (the operating of the sets by batteries is much more expensive and less reliable than electricity) and by providing dispensaries, health centres, schools, cultural and religion centres with electricity, this rural electrification project has had a very positive impact on the areas of health, education and culture (better knowledge of cultural specificities of the country's various regions through television).

7.1.6 Lastly, and even if it is premature to assess the project's impact on the desired reduction of rural-urban migration, nonetheless, the electrification programme in the rural centres had a significant effect on the progressive decrease of the dispersed nature of the rural area bringing about a population concentration in the electrified areas. This will no doubt attenuate the rural migration to towns and facilitate a more effective implementation of programmes to equip rural areas with health, educational and socio-cultural facilities.

7.2 The Least Cost Solution

7.2.1 Comparing the quantities reached with estimates this project was implemented with low overall costs. Moreover, a first analysis of the project's economic benefits shows that it **contributed** to the decrease in the input costs of pumps, small industrial units (oil, refineries, flour mills, bakeries> thanks to the replacement of diesel oil by **electricity** as a source of energy. From a social and cultural standpoint, it seems also that, in **comparision** with other sources of energy, particularly diesel oil, the low cost of electricity, made possible through the project has enabled not only the development and a better manning of health centres, schools and cultural centres but also the promotion of the purchase of television sets by rural dwellers because of the lower operating costs **as** compared with battery operated sets. From that standpoint therefore, the project is undeniably the least costly for the supply of energy to the rural areas concerned in the context of their daily economic, social and cultural activities.

7.2.2 The other alternative to the rural electrification project is electrification by means of independent diesel micro-stations. Considering actual costs, this project which also comprises diesel' run micro-stations for some villages far-removed from the network, if electrification by the public electricity supply network costs on average is about 'UA 133,000 per village, i.e. 39% more. If one adds to that, the operating and **maintenance** cost of the diesel stations, much higher than the electrical networks (3% of 5% against 1% of the capital cost, respectively> it is also crystal 'clear that from this vantage point, the project is the least costly method to reach the set socio-economic objectives.

7.2.3 Lastly, the adoption of a single phase system instead of a three phase system, according to the findings of studies already undertaken to that effect by STEG, has made it possible to save overall; about 18 to 24% as follows: 20 to 30% for the 30 kV lines, 5% to 10% for the LV lines and 15 to 20% for the 30 kV/LV posts.

1/ Rural Centre : Group of 10 or more rural homes: **the** distance between two neighbouring homes being less than 200 m; rural electrification applies **exclusively** to rural centres.

8. PERFORMANCE OF THE BANK AND THE BORROWER

8.1 The Bank's Overall Performance

8.1.1 Generally, the Bank's performance in the implementation of this project meant regular monitoring of its implementation of various stages. The Bank carried out its project monitoring and management activities chiefly at its head office (only 2 supervision and follow-up missions were conducted>, through the examination of various project documents (works progress reports, bidding documents, bids assessment reports, contracts, disbursement documents, etc) by various experts involved. To that end, it is important to point out that despite the permanent change of project officers' (engineers, financial analysts, economists, loan officers, disbursement officers, etc) for various reasons, project management within the Bank was satisfactory. In particular, the ADB replied regularly to the various requests of the Borrower and its Executing Agency, except however for late follow-ups to bidding documents and to bid assessment reports, whose high number (an average of 30 per annum, i.e. 5 per month) raised enormous follow-up problems in the Bank.

8.1.2 Given the project's very positive results both in technical and socio-economic terms, it seems that the Bank's judgement and interpretation of the policy and priorities defined by the Borrower in the area of rural electrification on the one hand, and the objectives targeted by this project on the other, turned out to be right from all viewpoints. Thus, thanks to a proper assessment of the Tunisian Government's rural electrification programme and the ensuing constant support, the ADB contributed to the electrification of nearly 450 villages, to the supply of electric energy to more than 48,000 households (i.e. nearly 35% of the 140,000 consumers connected under the Vth and VIth Plans), to the sinking of 810 shallow wells and 12 tubewells for irrigation and to the consequent increase of the electrification rate of the rural centres from only 13% in 1976 to 74% in 1990.

8.2 The Borrower's Performance

8.2.1 The Borrower respected commitments to the ADB although it must be underscored in that connection, the 12 month delay in the effectiveness of the loan (see 3.1.1). Throughout project implementation, the Borrower ensured that the ADB was kept regularly informed of the status of implementation with twenty-two (22) quarterly progress reports.

8.3 Inspection and Follow-up

8.3.1 During project implementation, various ADB officers were sent on follow-up (loan officers> and supervision (engineers and financial analysis> missions. These missions made it possible to:

ensure that the project's physical implementation was satisfactory, that deadlines were respected; as such it was possible to assert the conclusions of the various works progress reports;

discuss and solve the different problems relating to the award of contracts for supplies in particular, group bidding documents in order to reduce their large number, as well as identify material ordered as compared with the list of goods and services, in order to facilitate the project's follow-up and financial executions;

help accelerate disbursements whose level was very low in comparison with implementation of works for reasons given in paragraph 3.5.6.

8.3 Labour Relations

8.3.1 Working relations between the ADB on the one, hand, the Borrower and the Executing Agency (STEG) on the other, were very good: Each party played its role fully and the exchange of information, comments and opinions on various aspects of project implementation were regular and permanent, making it possible to solve problems arising out of project implementation without delay. The results of these good relations between the ADB and its partners materialized not only by the quick examination and Bank approval of the use of the project loan balance, but also by the request from the Government to ADB to finance two other urban and rural electrification projects. The first is already completed and the second will be completed end'1992.

9. CONCLUSIONS

9.1 Results

9.1.1 The project to electrify rural areas in the GABES, GAFSA, KEBILI, MEDENINE, TATAOUINE and TOZEUR Governorates, which has just been completed is a very important phase in the vast electrification programme drawn by the Tunisian Government and expected to be **implemented** over three (3) of the country's successive economic and social development plans, covering the 1977-1991 period. Its implementation has enabled a large step towards the objective targeted by this programme, i.e. providing electric energy to rural areas countrywide.

9.1.2 On the physical front, the project made it possible to establish a vast public electricity supply network in all six (6) Governorates in southern Tunisia. This network covers a total length of 2,824 km, currently serves 300 villages and supplies electric power to 28,640 rural consumers and 30,000 rural homes.

9.1.3 On the financial and socio-economic fronts, the project's achievements can be considered as unparalleled. Electric energy consumption by the rural dwellers was immediate and electricity sales are significantly higher than estimates (see 4.1.5). Moreover, available electric power has contributed to the development and the redynamization of economic activities thanks to a lowering of the costs of energy inputs, the increase in irrigated surfaces, the establishment of small industrial units, which led to the creation of several jobs. Lastly, with the electrification of health centres, schools and cultural centres, the project would have enabled an improvement in the conditions of service of health and education facilities, as well as the intensification of socio-cultural activities.

9.1.4 All these factors have helped to make the electrified villages real poles of attraction for the surrounding rural populations who are attracted to the villages and consequently, the attraction of towns on the same people has decreased. The control of the rural-urban migration, one of the over-riding objectives of the Tunisian Government's rural electrification programme is a very positive project achievement.

9.2 Lessons to be learnt from the Project

9.2.1 The lessons to be learnt from the rural electrification project are several:

- 1) from the standpoint of technical design, the project's implementation shows that STEG is perfectly in control of the single phase medium voltage electric supply technology. Since this technology was introduced in the Tunisian public supply network only in 1977, the good quality of structures built and the very good technical operating results obtained by the project are testified to the mastering by STEG's technical staff of all aspects of design, construction, operating and servicing of a single phase medium voltage supply network.

- ii) the project has also shown that a single-phase electric supply system is more economical than the three-phase system, given the features of rural consumers and Tunisia's economic conditions. Moreover, the project has made it possible to assist that the savings made in the adoption of a single phase public electricity supply system is sufficiently high (20 to 30%) to justify the transformation of existing three-phase networks as was the case in Tunisia; and
- iii) lastly, the project has shown that the electrification of rural areas can be a profitable operation, advantageous from the economic, social and cultural points of view. On the financial plane and given its primarily social nature (more than 75% of sales come from household lighting and about 25% from pumps, etc), one cannot expect a very high financial rate of return for, the weight of investments is heavy compared with the expected income. Therefore, by subsidizing STEG for the financing of investments, the Tunisian authorities have shown that one of the important lessons to be drawn from the project is that given its undeniable socio-economic advantages, rural electrification is still an area where the Government's social and land use planning policy could be given full rein.

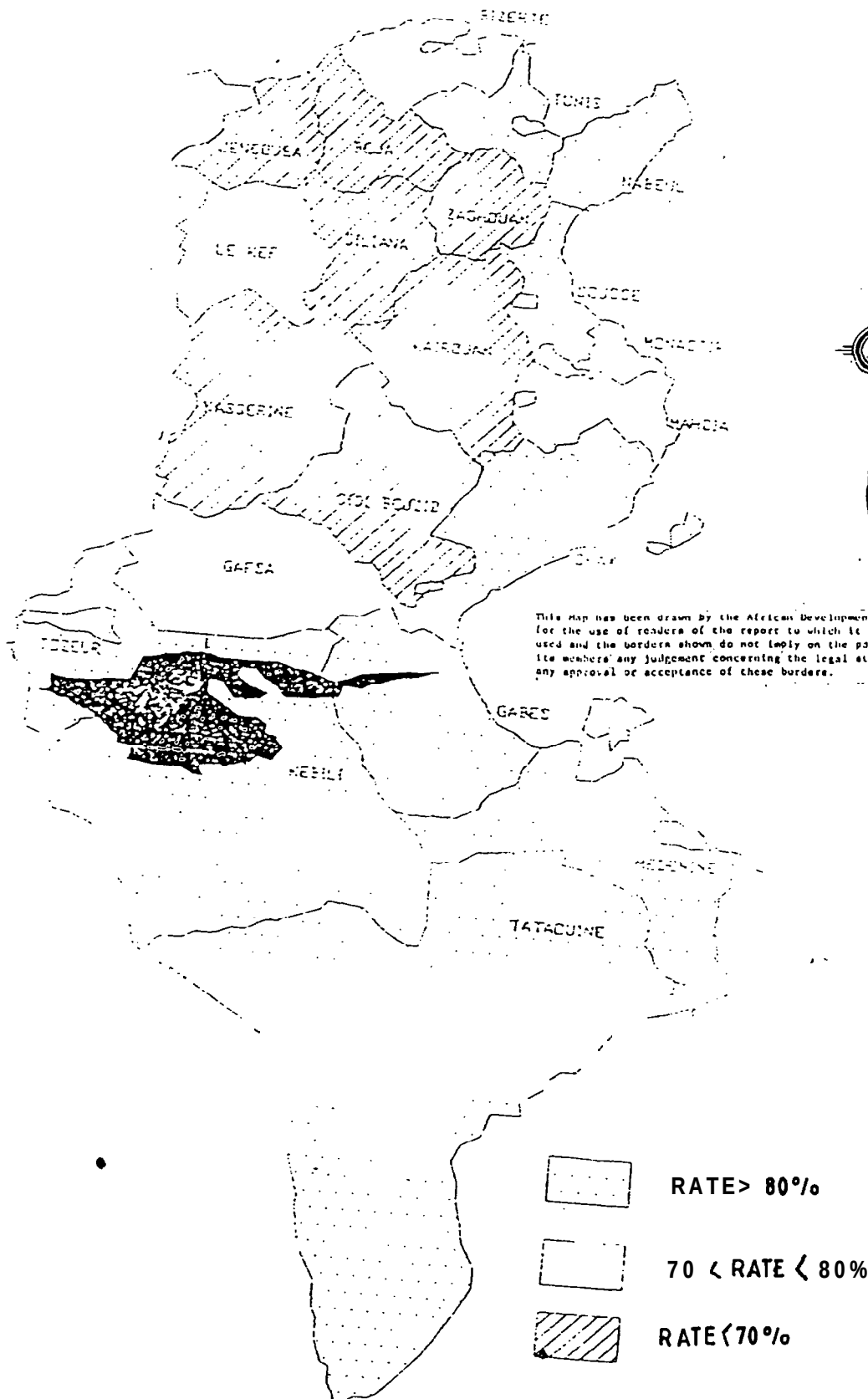
TUNISIA

RURAL ELECTRIFICATION PROJECT

GRAPHIC N°: 1

GERBA ELECTRIFICATION RATE

SITUATION 1991

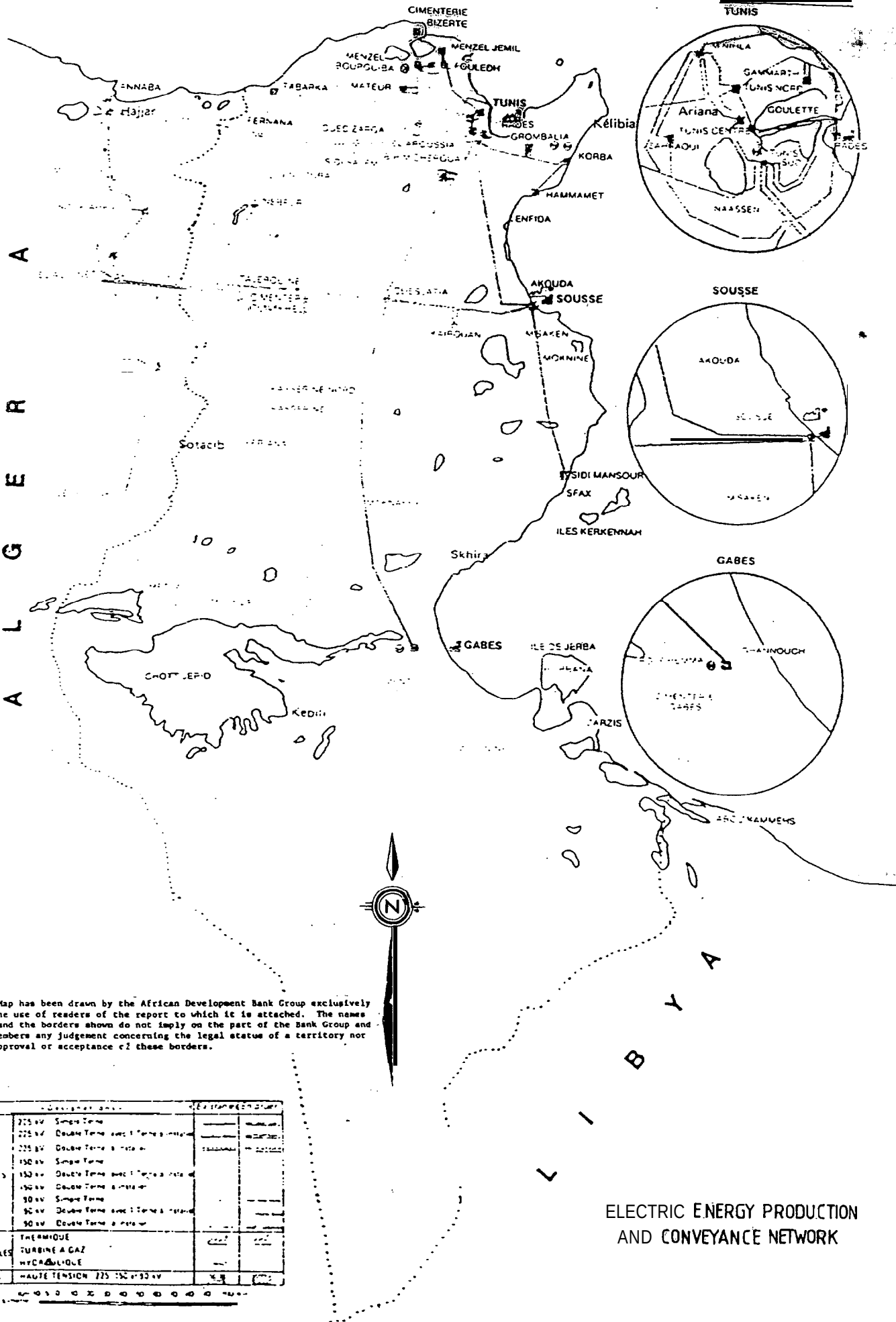


TUNISIA

RURAL ELECTRIFICATION PROJECT

SITUATION 1991

TUNIS

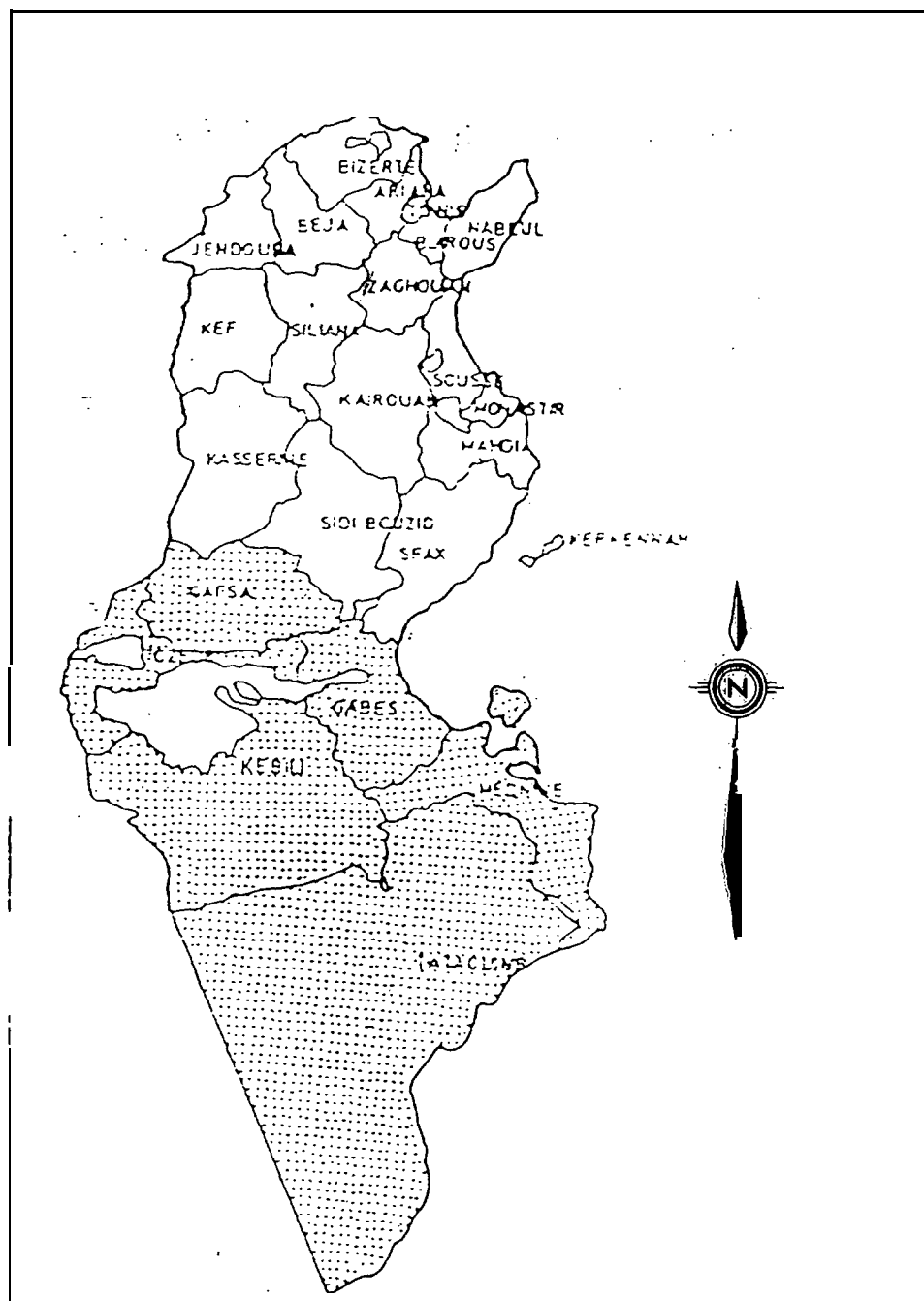


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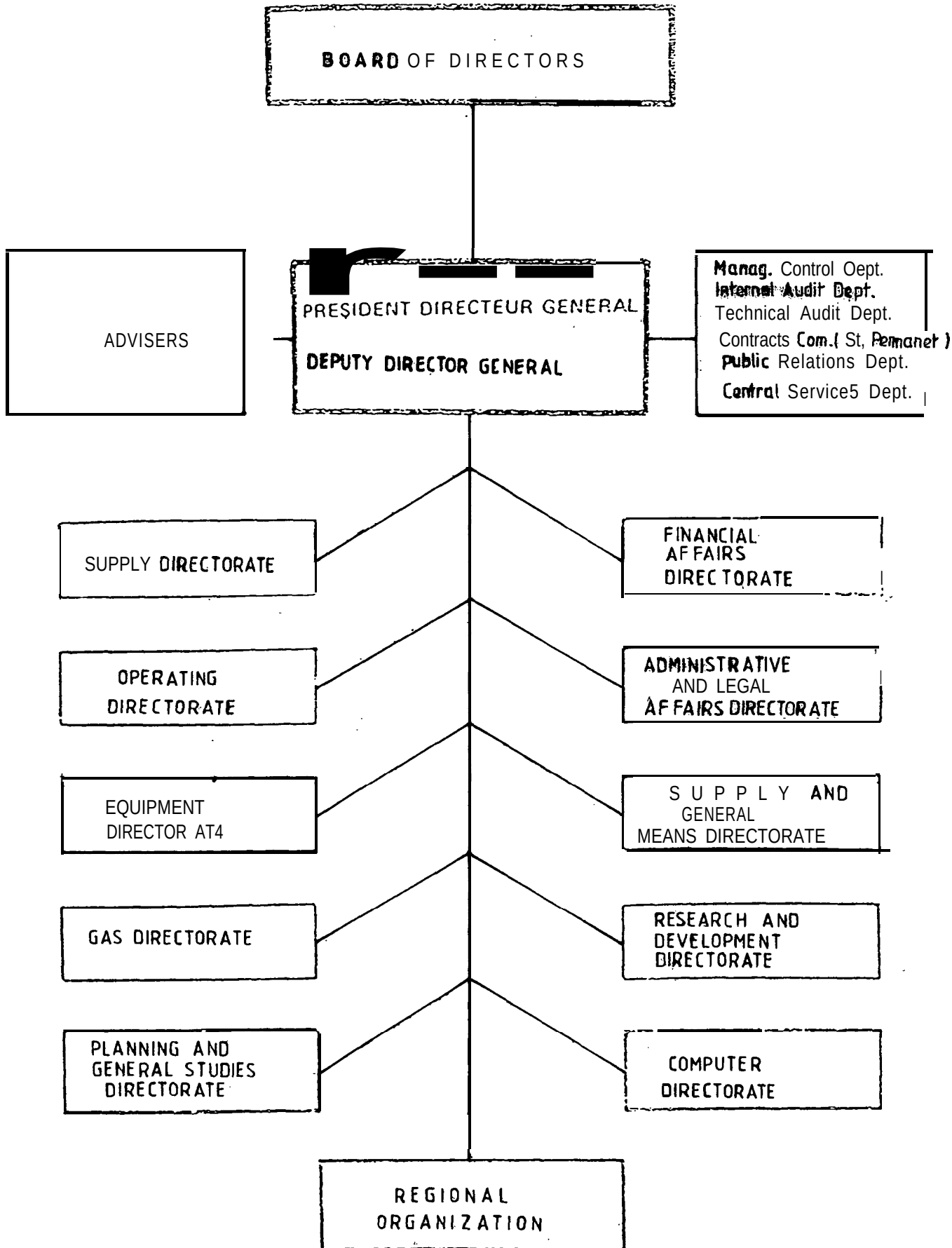
	Designation	Existant	Projet
Lignes	225 kV Simple Tension		
	225 kV Double Tension avec 1 Tension simple		
	225 kV Double Tension avec 2 Tensions simples		
	150 kV Simple Tension		
	150 kV Double Tension avec 1 Tension simple		
	150 kV Double Tension avec 2 Tensions simples		
	90 kV Simple Tension		
	90 kV Double Tension avec 1 Tension simple		
	90 kV Double Tension avec 2 Tensions simples		
	90 kV Double Tension avec 3 Tensions simples		
Centrales	Thermique		
	Turbine a Gaz		
	Hydroelectrique		
Postes	Haute Tension 225 150 90 kV		

ELECTRIC ENERGY PRODUCTION
AND CONVEYANCE NETWORK

AREA CONCERNED BY PROJECT

11. Reference: 300

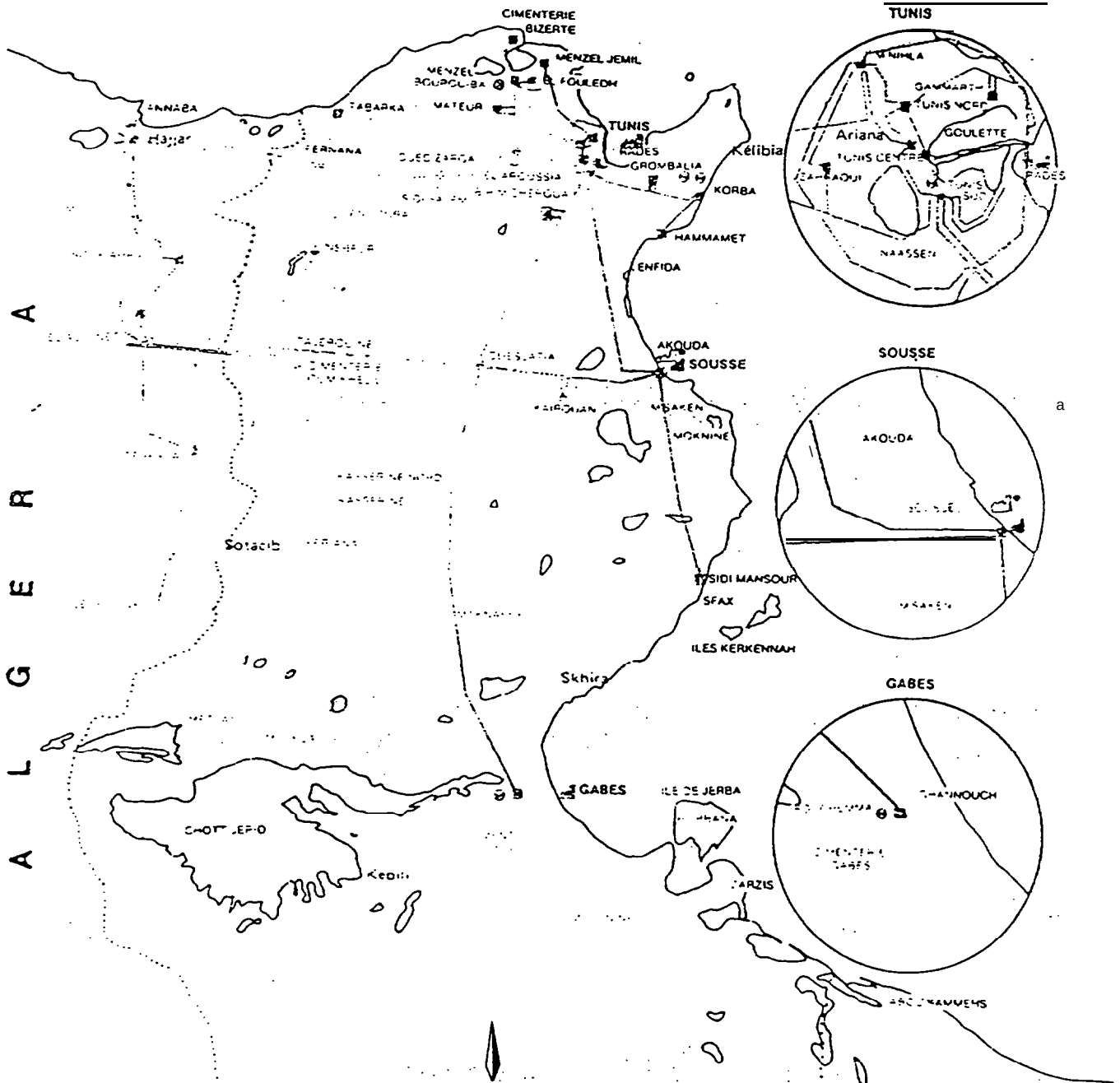
This Map has been drawn by the African Development Bank Group exclusively for the use of readers of the report to which it is attached. The names used and the borders shown do not imply on the part of the Bank Group and its members any judgement concerning the legal status of a territory nor any approval or acceptance of those borders.

RURAL ELECTRIFICATION PROJECT YEAR 91

TUNISIA

RURAL ELECTRIFICATION PROJECT

SITUATION 1991
TUNIS



This Map has been drawn by the African Development Bank Group exclusively for the use of readers of the report to which it is attached. The names used and the borders shown do not imply on the part of the Bank Group and its members any judgement concerning the legal status of a territory nor any approval or acceptance of these borders.

Production		Transmission	
225 kV	Simple Tension	225 kV	Simple Tension
225 kV	Double Tension avec 1 Tension simple	225 kV	Double Tension
225 kV	Double Tension avec 2 Tensions simples	225 kV	Triple Tension
150 kV	Simple Tension	150 kV	Simple Tension
150 kV	Double Tension avec 1 Tension simple	150 kV	Double Tension
150 kV	Double Tension avec 2 Tensions simples	150 kV	Triple Tension
90 kV	Simple Tension	90 kV	Simple Tension
90 kV	Double Tension avec 1 Tension simple	90 kV	Double Tension
90 kV	Double Tension avec 2 Tensions simples	90 kV	Triple Tension
Centrales		Postes	
Thermique		Haute Tension 225 150 90 kV	
Turbine à Gaz			
Hydroélectrique			

ELECTRIC ENERGY PRODUCTION
AND CONVEYANCE NETWORK

1. 6

AREA CONCERNED BY PROJECT



1. Problems

2

RURAL ELECTRIFICATION PROJECT YEAR 91

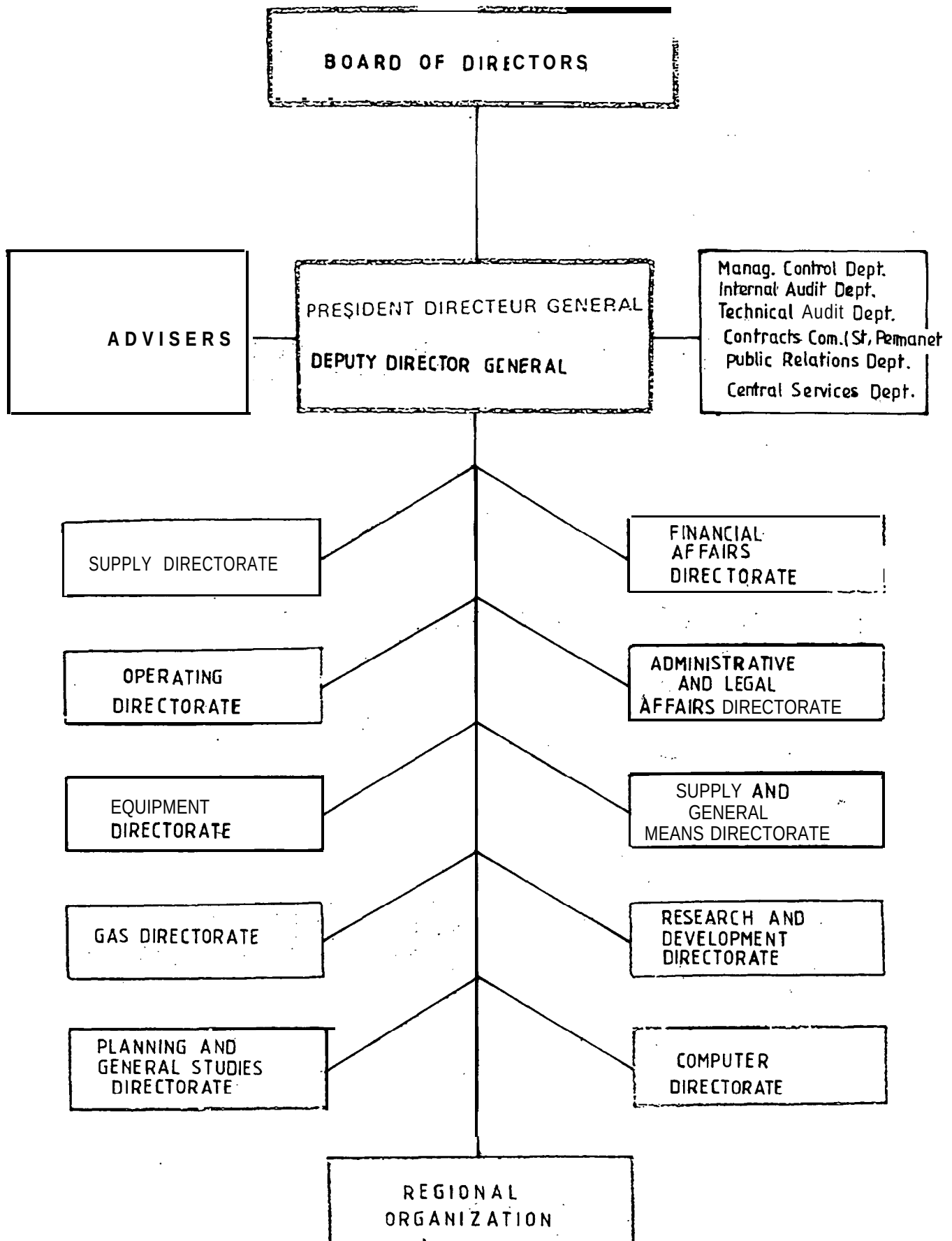


Table of Comparative Costs
(in UA thousand)

	Actual Final Cost of Implementation			Actual Project Imple- mentation Costs at Initial Completion in 1987			Cost Estimates at Appraisal		
	<u>F.E.</u>	<u>L.C.</u>	<u>Total</u>	<u>F.E.</u>	<u>L.C.</u>	<u>Total</u>	<u>F.E.</u>	<u>L.C.</u>	<u>Total</u>
A. Extension of 30 kV lines	4,847	5,761	10,608	3 590	4 058	7 648	4,688	3,905	8,593
B. Constr. of Autotransform.	152	173	325	152	173	325	206	159	365
C. Constr. of MV/LV Stations	803	958	1,761	602	679	1 281	786	654	1,440
D. Constr. LV Lines	2,750	3,269	6,019	2 030	2 296	4 326	2,646	2,214	4,860
E. Installation of LV Connections	1,284	1,525	2,809	950	1 073	2 023	1,240	1,033	2,273
F. Constr. of Diesel Stations	246	278	524	246	278	524	141	175	589
G. Studies, Inspect. & Supervision	_____	<u>4 5 8</u>	<u>458</u>	_____	<u>329</u>	<u>329</u>	_____	<u>497</u>	3.497
Total	10,082	12,422	22,504	7 570	8 886	16 456	9,980	11,637	21,617
	=====	<u>-e-e-</u>	=====	=====	=====	=====	=====	=====	=====

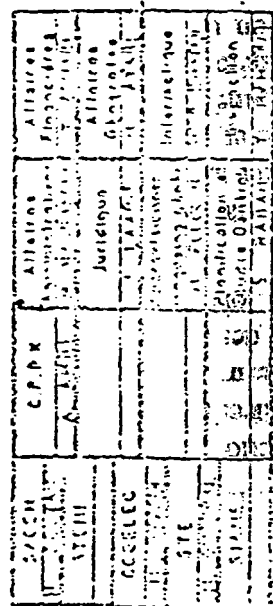
LIST OF SUPPLIERS
Main Suppliers ADB II

<u>Names</u>	<u>Country</u>
Siale	Tunisia
Carrelage tunisien	- 'I -
Siame	- " -
Tunisie câble	- 'I -
El Anabib	- " -
Sotubo	- 'I -
Saceme	- " -
El Fouledh	- 'I -
Chakira	- " -
Simet	- 'I -
so tumous	- " -
Cablerie de Gombalia	- 'I -
Tunisie Acier	- " -
Atem	- " -
Westinghouse	USA (Egypt)
CGERS	France
Vicasa	Spain
Dervaux	France
NEOVA	Italy
Rocheling et BBC	Germany
Electro VIDRO	Brazil
S et C Electric	USA
SAAE	France
Craver	- 'I -
Soule	- ? ' -
S.I.M. Electrique	- " -
B Decino	Italy
Italo Africa	- " -
Cotohaase	Austria

LIST OF ENTERPRISES

<u>N°</u>	<u>ENTERPRISE</u>
1.	SOTEE MT (ELLOUMI)
2.	S.T.E. (SKANDRANI)
3.	A.T.E.M. (SIALA ALI)
4.	S.A.F.E. (MAOUIA HASSINE)
5.	S.O.G.E.T. (DOUIB SADOK)
6.	S.T.E.S. (B. HADJ MUSTAPHA)
7.	KOUBAA ET BOUZID (HASSINE)
8.	SELECT-ELECTRIQUE (B. SAID NAJIB)
9.	AKID SLAIEM
10.	LEJAI OTHMEN
11.	SOTEC (BEL GH. JABEUR)
12.	BOURAOUI BESBES
13.	TUTEL (BABOUR MOKHTAR)
14.	EL FEHRI AHMED
15.	E.M.B. (BOUCHIBA)
16.	EGESS (JERBI NOUREDDINE)
17.	SOTEM (B. KHELIFA HAMED)
18.	SALEM BEN SLIM
19.	DALY
20.	BENMNA
21.	BEN HASSINE
22.	SOCOTEL
23.	SOGERMA
24.	MAHDAOUI
25.	CHAROUEL AL1
26.	ENNOUR
27.	SOTRA
28.	ZAQUI MOHAMED
29.	HATFI AMOR
30.	BEN SLIM HASSEN
31.	ENNASR
32.	ECLAIRAGE DU SUD
33.	ELECTRO SUD
34.	AYARI HEDI
35.	MSADDAK BECHIR
36.	SEGTA
37.	BOUTALEB
38.	SALAH BOUROUHA
39.	GAMAOUN HABIB

STEG ORGANIZATION CHART

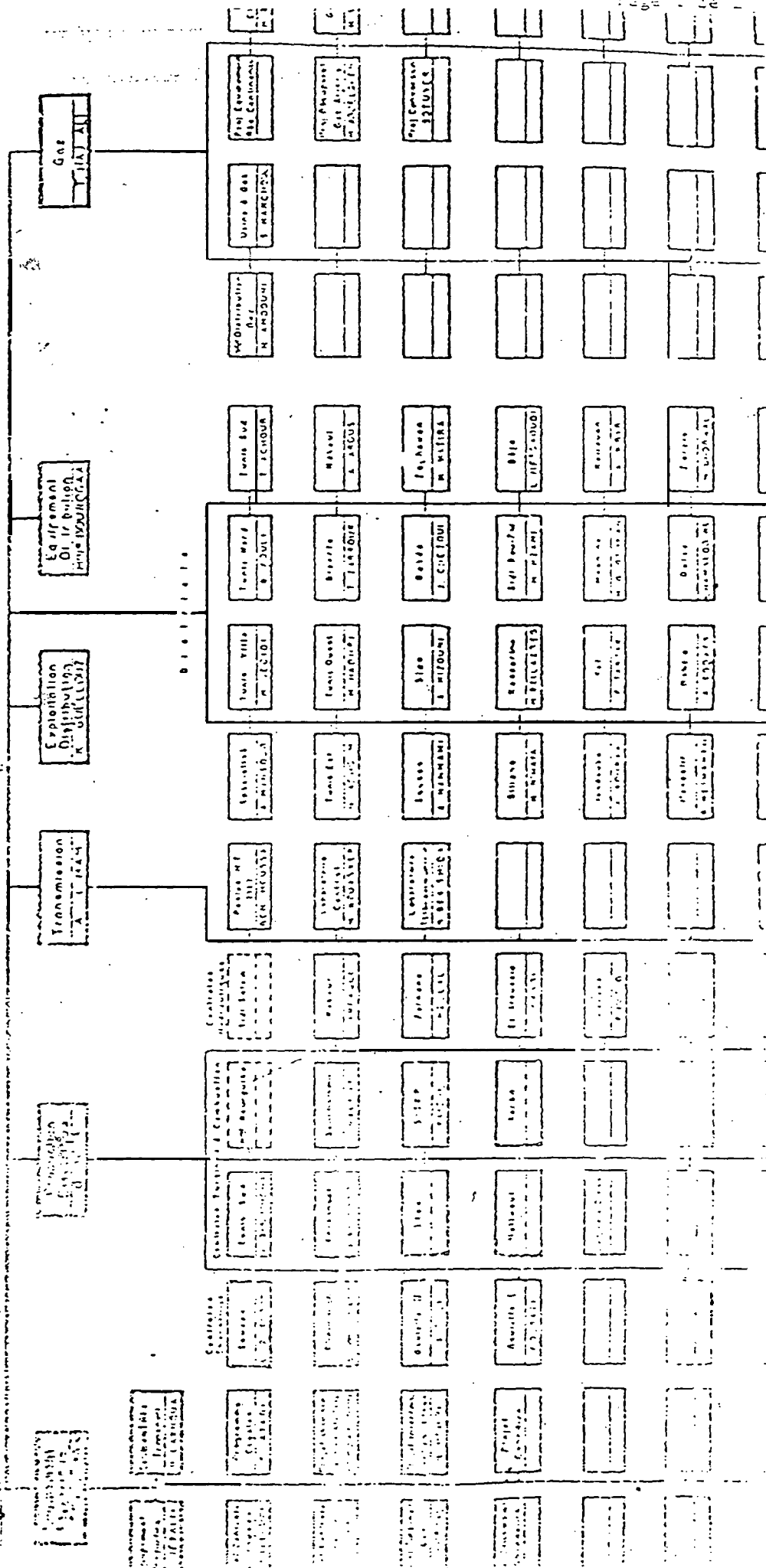


CHAIRMAN AND MANAGING DIRECTOR

M. JEBALI

199

T. SKANDHANI.

[illegible]

Consumers Connected to Project Structures

(December 1991)

<u>Governorates</u>	<u>Number of Villages</u>	<u>Connections</u>
Gabès	49	4,448
Medenine	99	12,247
Tataouine	65	5,828
Kebili	12	2,891
Gafsa	45	1,286
Tozeur	<u>30</u>	<u>1,540</u>
	300	28,640
	==	=====

SOUTHERN TUNISIAN RURAL ELECTRIFICATION PROJECT
STEG's PROVISIONAL INCOME STATEMENTS AT PROJECT APPRAISAL

Provisional Operating Accounts

(in TD million)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
GWh sales	2430	2730	3070	3440	3850	4310	4700	5100	5600	6000
Average price of kwh in million	32.30	32.30	32.30	35.53	35.53	35.53	35.53	35.53	35.53	35.53
Proceeds										
Electricity sales	78.49	88.18	99.16	122.22	136.79	153.13	167.00	181.20	198.90	213.18
Gas sales	9.80	8.27	6.81	5.69	4.33	4.41	4.49	4.57	4.65	4.73
Works	2.90	3.20	3.50	3.80	4.15	4.50	4.88	5.29	5.75	6.24
Other proceeds	<u>3.33</u>	3 3903.46 3 81	114.01 4 54	137.18 5 47	<u>5.75</u>	<u>5.86</u>	6.15	197.52 6 46	<u>6.78</u>	231727 12
Total	94.58				151.02	167.90	181.77		216.14	
Expenses										
Consumed purchases	41.36	45.17	54.11	65.59	70.34	74.62	83.57	93.60	104.83	117.42
Personnel expenses	16.40	18.95	21.80	25.07	28.95	33.30	38.29	44.04	50.64	58.24
Other expenses	10.19	11.38	12.91	14.54	16.67	18.84	21.28	24.05	27.18	30.72
In deduction										
Works completed/Enterprise	12.30	13.50	14.80	16.20	17.80	19.50	21.35	23.38	25.60	28.03
Other proceeds and taxes	1.74	1.88	2.04	2.32	<u>2.53</u>	2.75	3.01	3.29	3.61	3.95
Total	53.91	60.12	71.98	86.68	95.63	104.51	118.78	135.02	153.44	174.40
Gross operating income	40.67	43.34	42.03	50.50	55.39	63.39	62.99	62.50	62.70	56.87
Financing costs	7.65	7.35	7.77	9.54	12.94	14.58	16.46	14.45	12.51	10.63
Allowance for amortization	18.60	19.68	21.46	24.31	28.37	32.55	32.55	32.55	36.13	36.13
Allowance for reserves	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
Net operating income	14.42	16.31	12.80	16.65	14.08	16.26	13.98	15.50	14.06	10.11
Self-financing	33.02	35.99	34.26	40.96	42.45	48.81	46.53	48.05	50.19	46.24

SITUATION OF DRAWS ON THE LOAN

SECRET

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LOW VOLTAGE ELECTRICITY RATES

Nota: TD = Tunisian Diar - Mill = Tunisian millime - sus = subscription
VAT = **Value** Added Tax

GENERAL RATE LOW VOLTAGE	POWER ROYALTY (EXCL. VAT)	PRICE OF ENERGY (EXCL.VAT AND MUNICIPAL SURCHARGE)	
Economic range	100 mill kVA-month	from 0 to 50 kWh/month for subscribers of 1 or 2 kVA - 57 millimes/kWh	
Normal range	100 mill kVA-month	beyond 50 kWh/month for subscribers of 1 or 2 kVA and for all kWh for subscribers of more than 2 kVA - 70 millimes/kWh	
SPECIAL RATE LV	ROYALTY SUBSCRIPTION EXCL. VAT (1)	POWER ROYALTY EXCL. VAT	ENERGY PRICE EXCL. VAT AND MUNICIPAL SURCHARGE
For agricultural purpose	70 mill sus-month		Daily time ranges Day: 32 millimes/kWh Night: 21 millimes/kWh Peak: effacement
Waterheater	400 mill sus-month		Daily time ranges (2) Non-peak: 48 millimes/kWh Peak: effacement
Oil refineries and Moutures	300 mill sus-month	100 mill/KVA-month	Single range: 57 mill/kWh
Streetlighting		200 mill/kVA-month	Single range: 58 mill/kWh
Heating & air cond.	300 mill/sus-month		Single range: 71 mill/kWh
Irrigation	300 mill/sus-month	100 mill/kVA-month	Single range: 44 mill/kWh

(1) The VAT is applied to the following rates:
- 6% on tax free energy prices
- 17% on tax free royalties.

Energy prices of LV to be increased by 2 millimes/kWh as municipal surcharge.

(2) The time ranges are as follows: for every day of the week with the exception of Sunday, for which the consumption is billed uniformly as "Night" tariff.

<u>TIME RANGES</u>	<u>DAY</u>	<u>PEAK</u>	<u>NIGHT</u>
Summer time	from 9 a.m. to 8 p.m.	from 8 p.m. to midnight	from midnight to 9 a.m.
Winter time	from 7 a.m. to 6 p.m.	from 6 p.m. to 10 p.m.	from 10 p.m. to 7 a.m.

MEDIUM AND HIGH VOLTAGE ELECTRICITY RATES

Nota: TD = Tunisian Diar - Mill = Tunisian millime - sus = subscription
VAT = **Value** Added Tax

AVERAGE VOLTAGE RATE	POWER ROYALTY (EXCL. VAT)	PRICE OF ENERGY (EXCL.VAT AND MUNICIPAL SURCHARGE) (1)
Time ranges	200 TD/kVA-month	Daily time ranges Day: 40 millimes/kWh Peak: 80 millimes/kWh Night: 29 millimes/kWh
Uniform	0.300 kVA-month	Single range: 52 millimes/kWh
SPECIAL RATE MEDIUM VOLTAGE	ROYALTY SUBSCRIPTION EXCL. VAT (1)	ENERGY PRICE BY DAILY TIME RANGES EXCL. VAT AND MUNICIPAL SURCHARGE
For agricultural purpose	-	Day: 37 millimes/kWh Night: 26 millimes/kWh Peak: effacement
MV assistancerate	1,250 DT/kW-month	Day: 54 millimes/kWh Peak: 87 48 millimes/kWh Night: 3 1 millimes/kWh
HIGH VOLTAGE RATES (220 kV, 150 kV 90 kV)	ROYALTY SUBSCRIPTION EXCL. VAT (1)	ENERGY PRICE BY DAILY TIME RANGES EXCL. VAT AND MUNICIPAL SURCHARGE
Generalrate High Voltage	1,250 DT/kW-month	Day: 33 millimes/kWh Peak: 68 millimes/kWh Night: 25 millimes/kWh
HV assistancerate	0,500 DT/kW-month	Day: 45 millimes/kWh Peak: 77 millimes/kWh Night: 28 millimes/kWh

-
- (1) The VAT is applied to the following rates:
- 6% on tax free energy prices
- 17% on tax free royalties.

Energy prices of the HV and LV rates should be marked up 1 millimes/kWh in respect of the monophasic surcharge.

- (2) The time ranges are as follows: for every day of the week with the exception of Sunday, for which the **consumption** is billed uniformly as "Night" tariff.

<u>TIME RANGES</u>	DAY	PEAK	<u>NIGHT</u>
Summer time	from 9 a.m. to 8 p.m.	from 8 p.m. to midnight	from midnight to 9 a.m.
Winter time	from 7 a.m. to 6 p.m.	from 6 p.m. 10 p.m.	from 10 p.m. to 7 a.m.

T U N I S I A
RURAL ELECTRIFICATION PROJECT
IN THE GOVERNORATES OF: MEDENINE. GABES. GAFSA. TOZEUR
Financial IRR
(10³ TD)

<u>Year</u>	<u>Inves- tment</u>	<u>Operating cost</u>	<u>Total cost</u>	<u>Subsidies</u>	<u>Revenues</u>	<u>Cash flow</u>
1981	702.77		(702.77)	541		(161.77)
1982	1 616.73	23.20	(1 639.93)	1 245	36.0	(358.93)
1983	1 558.64	38.79	(1 597.43)	1 200	155.1	(242.33)
1984	2 518.85	63.97	(2 582.82)	1 940	220.9	(421.92)
1985	3 453.80	98.51	(3 552.31)	2 659	312.0	(581.31)
1986	2 210.95	120.62	(2 331.57)	1 702	345.6	(283.97)
1987	780.57	128.42	(908.99)	601	420.0	112.12
1988	3 043.58	158.90	(3 562.48)	2 344	495.9	(722.58)
1989	4 065.73	199.52	(4 265.25)	3 131	558.6	(575.65)
1990		199.52	199.52		661.2	461.68
1991		199.52	199.52		661.2	461.68
1992		199.52	199.52		661.2	461.68
1993		199.52	199.52		661.2	461.68
1994		199.52	199.52		661.2	461.68
1995		199.52	199.52		661.2	461.68
1996		199.52	199.52		661.2	461.68
1997		199.52	199.52		661.2	461.68
1998		199.52	199.52		661.2	461.68
1999		199.52	199.52		661.2	461.68
2000		199.52	199.52		661.2	461.68
2001		199.52	199.52		661.2	461.68
2002		199.52	199.52		661.2	461.68
2003		199.52	199.52		661.2	461.68
2004		199.52	199.52		661.2	461.68
2005		199.52	199.52		661.2	461.68
2006		199.52	199.52		661.2	461.68
2007		199.52	199.52		661.2	461.68
2008		199.52	199.52		661.2	461.68
2009		199.52	199.52		661.2	461.68
2010		199.52	199.52		661.2	461.68

IRR = 8.30%.