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Report No. 1747-SYR

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Syria
Regional Electrification Project

March 2, 1978

Projects Department
Europe, Middle East and North Africa
Regional Office

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CURRENCY EQUIVALENTS
(as of January 31, 1978)

Currency unit	=	Syrian Pound (LS)
Syrian Piaster (ps)	=	LS 0.01
LS 3.95	=	US$1.00
LS 1.00	=	US$0.253
LS 1,000,000	=	US$253,000
US$1,000,000	=	LS 3,950,000
Financial Year	=	Calendar Year

WEIGHTS AND MEASURES

1 kgce (kilogram coal equivalent)	=	5,700 kilocalories
1 square kilometer (km^2)	=	0.386 square mile (mi^2)
1 cubic meter (m^3)	=	35.315 cubic feet (ft^3)
1 ton (1,000 kg)	=	1.102 short ton (sh ton)
		0.984 long ton (lg ton)
1 kilowatt (kW)	=	1,000 Watts (W)
1 Megawatt (MW)	=	1,000 kW
1 Gigawatt (GW)	=	1,000,000 kW = 1,000 MW (= 10^6kW)
1 kilowatthour (kWh)	=	1,000 Watthours (Wh)
1 Gigawatthour (GWh)	=	1,000,000 kWh = 1,000 MWh (= 10^6kWh)
1 kilovolt (kV)	=	1,000 Volts (V)
1 kilovolt ampere (kVA)	=	1,000 volt amperes
1 Megavolt ampere (MVA)	=	1,000 kVA
1 Hertz (Hz)	=	1 cycle/second
per annum	=	/a
1 kilocalorie (1,000 calories)	=	1.163 x 10^{-3} kWh

GLOSSARY OF ABBREVIATIONS

AYC	-	Arthur Young & Co. (US)
CDP	-	Caisse de la Dette Publique
EPE	-	Etablissement Public dè l'Electricite
OCS	-	Overseas Consultancy Service of British Electricity International, Ltd. (UK)
SOFRELEC	-	Societe Francaise d'Etudes et de Realisations d'Equipment Electrique
USAID	-	United States Agency for International Development

SYRIA

REGIONAL ELECTRIFICATION PROJECT

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This report was prepared by Messrs. A. Roa (Engineer), W.G. Hamlet (Financial Analyst), and I.I. Elwan (Economist).

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SUMMARY

i. This report appraises a Regional Electrification Project for the Government of Syria. The Project is the first stage of the recently approved ten-year (1978-1987) National Rural Electrification Plan aimed at extending service from Etablissement Public d'Electricite (EPE) to all villages with 100 or more population. The Project consists of about 5,000 km of 20-kV and 380/220-V distribution lines and related equipment, about 70 MVA of distribution transformer capacity, and technical assistance, to serve approximately 900,000 people in 1,200 villages in 11 of the country's 14 mohafazat (administrative districts). Total cost of the Project is estimated at US$157.1 million of which US$74.2 million would be foreign exchange costs.

ii. A Bank loan of US$40 million to EPE is proposed to cover 54% of the foreign exchange cost of the Project. The remaining 46% would be covered by a USAID loan through the Government. Local costs would be provided by the Government and EPE. This loan would be the Bank's third loan for power in Syria. The first was made in 1974 for the first 150-MW steam electric Mehardeh unit. A second loan was made in 1975 for the second 150-MW unit at Mehardeh. Both projects are progressing satisfactorily.

iii. The project would extend electric service from the national grid to several rural regions not yet supplied with central station electricity. Project engineering and management will be by USAID-financed consultants to be engaged before March 31, 1978. The consultants would also assist EPE in developing adequate extension policies for new customer services in the National Rural Electrification Plan. They would also develop detailed construction schedules to be reviewed periodically by EPE with the Bank in connection with project reporting requirements.

iv. Contracts for the supply of equipment and materials financed from the Bank loan would be awarded through international competitive bidding (ICB). Because of wide geographical dispersion of project facilities and the labor intensive nature of the work, it is unlikely that foreign contractors would be interested in bidding on contracts for installation and erection. Nevertheless these would be awarded through international competitive bidding (ICB), except for about 20% to be done by EPE's own service crews (mostly service drops and customer connections). Minor quantities of standard distribution equipment and materials not to exceed a sum total of US$1,000,000 would be procured under international shopping.

v. The EPE interconnected system makes up almost the entire public power sector in Syria. The recent rapid expansion of the transmission network has virtually eliminated all previously isolated systems. The average annual load growth rate for 1973-1976 was 20%/a. Load growth is estimated at 25%/a

for 1976-1982, most of it coming from rapid development of Government industry and agriculture. Peaking capacity is adequate up to 1985. An additional steam electric generating station (2 x 150-MW at Banias) is scheduled for 1982 to keep up with energy demands. In addition to the Project facilities, the 1977-1982 construction program also includes 1,900 km of 230-kV lines, 2,000 MVA of substation capacity, 2,800 km of 66-kV transmission, and 8,000 km of urban and rural distribution lines.

vi. EPE's accounting system is inadequate for an electric utility and the first Bank loan to EPE (Loan 986-SYR) financed consultants (Arthur Young & Co.) to study the accounting problems, and a uniform utility accounting system was recommended. The recommended accounting system would be implemented beginning July 1, 1978. EPE contracted an independent audit firm as agreed in Loan 1144-SYR to audit the 1974 and 1975 financial statements. EPE has appointed the same firm to audit the 1976 and 1977 financial statements and the previous covenant regarding auditing arrangements would be repeated in the proposed loan. Pre-1973 municipal accounts owed to EPE remain on the balance sheet along with a large amount of overdue accounts receivable from Government-owned organizations and the public sector. Agreement has been reached with the Government to eliminate the debts and arrears and reduce receivables to no more than 90 days billing by December 31, 1978.

vii. Covenants in Loans 986-SYR and 1144-SYR provided that the Thawra hydroelectric assets be transferred to EPE in the year in which generation reached 1,000 GWh; this occurred in 1976. However, subsequent agreement was reached to postpone the transfer of these assets to EPE to 1978 to allow time to establish a reasonable value for these assets and to develop adequate revaluation procedures. A rate of return of 9% on revalued assets as of 1978 was also included in the covenants of Loans 986-SYR and 1144-SYR. During negotiations for the proposed loan, the Bank agreed, at the request of the Syrian Government, to defer implementation of the 9% rate of return requirement until 1981. In the meantime the Government would pay EPE a cash contribution to compensate it for the loss of revenue through deferring the 9% requirement. In 1978, the subsidy would be 100% of the difference between EPE's revenues from 1977 tariffs and the amount EPE would have obtained had it raised its tariffs to a level necessary to obtain a 9% rate of return. In 1979 such subsidy will not be more than 70% of the difference between 1977 and required tariff levels; in 1980 no more than 40%. In 1981 and thereafter, EPE would be required to earn 9% without the recourse to cash subsidies from the Government.

viii. EPE's construction program for 1978-1982 is estimated at LS 4.3 billion (US$1.1 billion). With annual revaluation of assets to reflect the recommended procedure for revaluing assets based on replacement costs, and to include effects of inflation, increases in tariffs will be required in 1979, 1980, 1981 and 1982. The estimated earnings of EPE would provide 27% of the construction program from internal cash generation, 8% would be financed by Government operating subsidy, an estimated 29% would be financed by long term borrowings, Government equity contributions would amount to 35%, and customer contributions would provide the remaining 1%. The Syrian economy is severely strained, and will be under pressure to reduce the large outlay

for Government grants to all sectors. Agreement was reached with the Government that it will supply or cause to be supplied to EPE, under arrangements acceptable to the Bank, all necessary funds to carry out EPE's 1978-1982 construction program.

ix. The estimated rate of return on investment for the Project is 8.5%. This is based upon an average revenue per kWh of 0.24 LS, the current tariff paid by the customers of the isolated systems, which was used as a proxy for the measurable benefits.

x. Subject to agreement on the issues set forth in this report, the Project is suitable for a Bank loan of US$40 million to EPE, on standard terms for Syria -- 17 years including 4 years of grace. The establishment and adequate staffing of a Project Unit and the appointment of consultants to start implementing the recommended utility accounting system (including revaluation of assets) and related organizational changes are conditions of loan effectiveness.

SYRIA

REGIONAL ELECTRIFICATION PROJECT

I. INTRODUCTION

1.01 The Government of Syria on behalf of the Etablissement Public d'Electricite (EPE) has asked the Bank to finance a Regional Electrification Project which constitutes the first phase of Syria's ten-year National Rural Electrification Plan. The Project consists of about 5,000 km of 20-kV and 380/220 volt distribution lines, about 70 MVA of distribution transformer capacity, and technical assistance, to serve approximately 900,000 people in 1,200 villages in 11 of the country's 14 mohafazat (administrative districts). The total estimated cost is US$157.1 million comprising a foreign exchange component of US$74.2 million and US$82.9 million of local currency costs. The foreign costs would be financed by a proposed Bank loan of US$40 million and a USAID loan of US$34.2 million. The Government and EPE would cover the local currency costs to complete the Project's financing plan.

1.02 The proposed loan would represent the third Bank lending operation for power in Syria. The first loan (986-SYR) was made in 1974 for the first stage (150-MW) of the Mehardeh steam electric generating plant, with co-financing by the Kuwait Fund for Arab Economic Development. The second loan (1144-SYR) made in 1975 financed a second 150-MW unit at Mehardeh. Both projects are progressing satisfactorily. The first unit is expected to go on line in 1978, and the second in 1979. Loan 1144-SYR also financed additional substation capacity to allow better utilization of Thawra hydro generation.

1.03 EPE is making progress in changing from a Government agency to an autonomous entity. Although slowly, gains have been made through the institution-building components of the two previous Bank loans. The transition for the transfer of full responsibility to EPE for its own efficiency has still some time to go.

1.04 The Project has been prepared following a feasibility study by SOFRELEC (France) and an appraisal mission in May/June 1977 by Messrs. A. Roa (Engineer), W.G. Hamlet (Financial Analyst), and I.I. Elwan (Economist). Mr. W.F. Kupper (Engineer) also participated in the appraisal mission, as well as Mr. E. Chittleburgh (Training Advisor) who contributed the sections on training.

II. THE POWER AND ENGERY SECTOR

A. Power and Energy Resources

2.01 Oil, gas and hydropower are Syria's main indigenous energy resources. Crude oil reserves amount to about 1,200 million tons, of which about one quarter could be economically recovered under present technology and prices. Oil exploration and development is progressing satisfactorily. Production of

crude oil reached 10.5 million tons in 1976. The oil production target for 1976-1980 is set at 52 million tons. Local processing of crude oil is also being increased from 2.7 million tons/a (Homs refinery) to 8.7 million tons/a with the start-up of a new refinery at Banias scheduled for 1978.

2.02 The Euphrates river is Syria's most important source of hydropower and irrigation, comprising 88% of the country's water resources. Development of the Euphrates Basin started with the construction of the Thawra Dam and hydropower station near Tabqa, completed with USSR assistance in 1974. Installed generating capacity at Thawra is 8 x 100 MW, and available annual generation is expected to be 2,360 GWh until 1980. After 1980, water will be pumped out of the reservoir for irrigation in increasing amounts every year, thereby reducing the available energy by about 40 GWh/a. Aside from Thawra, no other significant hydro development has been identified. A preliminary study evaluated the merits of constructing a dam and a power station on the Khabour river (a Euphrates tributary). However, up to the present, firm plans have not been formulated.

2.03 Gas has been discovered in the Northeast near Souedie and in Jbesse, directly to the South. Proven reserves are estimated at 14,000 million m3 (6,000 million m3 associated gas and 8,000 million m3 non-associated). Recoverable reserves are estimated at up to 80,000 million m3. Gas has been produced in association with crude oil in the Souedie fields since 1967. Although at present this gas is flared, in the future most of it will be used for production of petrochemicals and power generation. As part of an overall power development study, SOFRELEC is currently conducting a gas utilization study under the Second Mehardeh Project to help establish guidelines for optimum utilization of gas resources. Preliminary results of the study support establishing a gas transmission network to supply petrochemical industries in Western Syria in preference to power generation uses at the fields themselves. No data is available on consumption of non-commercial fuels (animal dung, waste wood, etc.). The UN World Energy Supply Statistics 1/ for 1971-1975 show 477 kilogram coal equivalent (kgce) as the per capita apparent consumption of commercial fuels for Syria in 1975. Figures shown for comparable neighboring countries are: Jordan, 408 kgce, and Turkey, 630 kgce. Heavy fuel oil and light distillate (diesel) are the main fuels used at present for generation of electricity. Some non-associated gas is also used for power generation at the Souedie fields.

B. The Power and Energy Sector

History

2.04 Up to 1951 the electric power sector was in the hands of private, local and foreign electric utility companies. Despite the fact that all private holdings were nationalized in 1951, the sector lacked organization and remained fragmented. It was not until 1965 that the sector was consolidated

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1/ United Nations, New York, 1977.

under EPE. At first EPE was under the control of the Ministry of Petroleum, Electricity, and Industrial Projects. In 1974 EPE was made an agency of the then newly created Ministry of Electricity under Decree No. 94 of that year.

Organization

2.05 The Ministry of Electricity is still in the process of consolidation. In principle, the Minister would be assisted by two Deputy Ministers, one for Technical Affairs and the other for Legal and Financial. So far only the Technical Affairs section of the Ministry is fully operational, although still short of being completely organized and staffed. The Deputy Minister for Technical Affairs serves as a close link to EPE, following EPE activities on a day-to-day basis. Under this Deputy Ministry come training and research departments still in their infancy. A construction company for transmission and distribution lines and substations is planned also under the Deputy Minister for Technical Affairs, but no definite timetable has yet been established. Recommendations by Arthur Young & Co. (AYC), US, the consultants for the Management Study financed by the Bank under Loan 986-SYR, are aimed at establishing a more effective relationship between the Ministry and EPE (para. 4.02).

Existing Facilities

2.06 For all practical purposes, EPE represents the whole electric sector in Syria (Annex 1) since continued extension of EPE's transmission and distribution lines has progressively integrated most isolated loads. The average annual growth of total sales for the EPE interconnected system for 1966-1976 was 15.4%/a. The 1976 peak demand was 327 MW and the total generation 1,459 GWh. Sales were 1,259 GWh, made up as follows: Domestic and Commercial, 500 GWh (40%); Private Industry, 350 GWh (28%); Government Industry and Services, 394 GWh (31%), and Irrigation, 15 GWh (1%). Average past growth rate for the first three categories for 1966-1976 were: 13.5%/a, 17.5%/a, and 17.2%/a respectively. Irrigation loads began in 1974 with 7 GWh and reached 15 GWh (more than double) in 1976. Estimates for 1977 are 428 MW peak demand and 1,914 GWh generation. System expansion and development has been primarily aimed at meeting the industrial load growth. Effective installed capacity in the interconnected system in 1977 is 1,275 MW (Annex 2) not including captive industrial plants (about 100 MW, mostly pipeline pumping). Taking into account dry years, maintenance requirements, and other applicable contingencies, the available generation is about 3,802 GWh (Annex 3). For 1977, hydropower is expected to cover 85% of the total generation while steam 11%, and combustion turbines and diesel sets for the remaining 4%. Additions of substation capacity (mostly financed from Loan 1144-SYR) during 1977 will allow better utilization of the available Thawra energy. In 1978, hydro generation is expected to reach 89% of the total, with steam generation making up the rest. Recently-completed construction increased the length of 230-kV lines to about 1,800 km. The system also has about 1,500 km of 66-kV, 4,000 km of 20-kV lines, and 11,500 km of low voltage distribution lines. Standard low voltage distribution is 3-phase, 4-wire, 380/220 V (except for older circuits, rated 127/220 V).

Rated frequency is 50 Hz. In 1976, the number of consumers in EPE's interconnected system reached 783,186 including 232,469 Latakia and Tartous consumers transferred in bulk to the central system. Map IBRD 13059R shows the EPE interconnected system.

Access to Electricity

2.07 Approximately 47% of the population had access to electricity in 1975 with an average per capita consumption of 160 kWh/a. This compares with 164 kWh/a in Jordan and 331 kWh/a in Turkey. The intense system expansion in progress is aimed at making electricity available to 65% of the population by 1980. Meanwhile, the average per capita consumption was estimated to have increased to 250 kWh/capita in 1977. According to the 1970 Housing Census, 84% of the urban population and 10% of rural population had access to electricity. The mission estimates these figures are now 80% and 20% respectively, due to internal migration and continuing expansion of electric service to the rural areas.

Training

2.08 The Ministry of Electricity and EPE are conscious of the need to train additional manpower to keep up with system expansion plans. A significant step toward meeting those needs is the construction of a specialized training center, "Institut Moyene d'Electromecanique", being established at Adraa northwest of Damascus with Bank financial assistance (Loans 986/1144-SYR). When fully operational in 1978, the Institute will be the focal point of all sector training activities for lower and middle level technical and administrative EPE personnel. The Institute is fully described in Annex 4. USAID and other international agencies also assist in training programs for higher level sector personnel, providing overseas training and wider choice of subject matter than the Adraa training center. To improve manpower planning and personnel development in EPE, the Project includes 2 man-years of consultant services to assist EPE's Assistant General Director for Engineering and Planning (also in charge of manpower development) in establishing suitable policies for personnel selection and training.

Tariffs

2.09 EPE's tariffs, shown in Annex 5, differ from one area to another. Tariffs generally comprise flat kWh rates for domestic and general lighting connections, declining block kWh rates for smaller industrial and commercial consumers, and time-of-day kWh rates for the larger industrial connections. Average rates by class of customer are:

	LS/kWh	US¢/kWh
Residential and Commercial	0.192	4.86
LV Industrial	0.130	3.29
HV Industrial	0.055	1.39

Under Loan 986-SYR, EPE engaged Overseas Consultancy Services (OCS), UK, in 1975 to develop new tariffs based on marginal-cost pricing. A final report has been received and recommendations and action to be taken for implementing them have been discussed between EPE and the Bank.

Sector Finances

2.10 The present five-year development plan (1976-1980) allocates about 11% of the total plan to the electricity sector. The Government arranges the external financing for the official development plan, through an agency of the Ministry of Finance, the "Caisse de la Dette Publique" (CDP). CDP then assumes responsibility for any resulting debt service and is also required to provide all local funds as may be necessary for the Plan. This policy is expected to be continued (para. 5.08). The EPE construction program (1978-1982) would be financed by loans from the World Bank and the Arab Fund, and aid agreements with the Federal Republic of Germany, USAID and other countries. Government grants to EPE for the program would amount to 35%. EPE would finance 29% by long term borrowings and 27% by internal cash generation and 8% would be financed by Government subsidy (para. 5.13). Customer contributions would amount to 1%.

C. The Development Program

2.11 Electric power for industry and irrigation figures prominently in the Government's fourth Five-Year Plan (1976-1980). EPE had been committed to a large expansion program to keep up with the new loads projected by the State Planning Commission (Annexes 6 and 7). Government projections, however, have been consistently over-optimistic in recent times. Start-up of several large industrial loads have failed to materialize year after year since 1974. The pattern was again followed in 1977: EPE had estimated 49% load growth, against 24% actually achieved. Recent cutbacks in Government industrial expansion plans have resulted in downward revision of estimated load growth rates. Current figures submitted by EPE during negotiations (Annex 8) show an estimated average annual load growth of 18%/a for 1977-1982, compared to the 25%/a average load growth rate estimated earlier for 1976-1982. Following the Government cutbacks, EPE is also reducing its development program, as far as practicable. The modified EPE generation expansion program out to 1985 is shown in Annex 9. Only plants committed or under construction, difficult to re-schedule due to long construction lead-times, were retained in the program. Annex 10 shows the projected energy balance. The new investment figures for 1978-1982 submitted by EPE during negotiations (Annex 11) along with the modified load forecast add up to LS 4,345 million (US$1,100.0 million). The investment program includes also expansion of transmission and distribution capacity as needed by balanced system development. Provided the Government maintains and fulfills the planned investment committed to the electric sector (para. 2.10), EPE would be able to carry out the needed system expansion, although, not without project management assistance from consultants as is currently the case in Mehardeh (para. 3.10).

Generation Expansion

2.12 Aside from Mehardeh, planned for start-up in 1979, only one additional generating plant is included in current 1977-1985 EPE expansion plans. This new thermal power station (2 x 150 MW) is scheduled to start-up in 1983 at a site near the Banias refinery on the Mediterranean.

Transmission Expansion

2.13 New 230-kV lines (1,900 km) and substation capacity (2,000 MVA) will be added in 1977-1982 to ensure adequate transmission capacity, facilitate economic dispatching of hydro and thermal generation, and eliminate existing bottlenecks in substation capacity primarily at Aleppo. Ongoing expansion of the 66-kV system (2,800 km) is aimed at supporting plans for the expansion of urban and rural distribution systems (13,000 km). Interconnections with Jordan, Lebanon, Turkey and Iraq are being studied for EPE by SOFRELEC under Loan 1144-SYR. A final report favoring regional interconnection was submitted in January 1978.

Distribution

2.14 Undervoltages and frequent outages will be eliminated in planned rehabilitation and reinforcing of existing distribution in Damascus and other large urban centers. Ongoing rural electrification started in 1975 and extending to 1980 is aimed at connecting up some 800 villages near existing 20-kV lines. All other construction will be within the recently approved ten-year (1978-1987) National Rural Electrification Plan to connect the remaining non-electrified villages with 100 or more population. It will be carried out in three stages (1978-1981, 1982-1984, and 1985-1987), at a cost of about US$522 million (in constant 1977 US dollars). In the Plan, electrification construction priority was established in order of economic merit through a feasibility report prepared by SOFRELEC under Bank financing (Loan 1144-SYR). The Project covers the higher ranking 1,200 villages and is the first stage of the Plan.

III. THE PROJECT

A. Objectives

3.01 The Project would extend electric service from the national grid to about 900,000 inhabitants of the rural regions across the country. Adequate supply of electricity would be made available for the first time to 150,000 rural households along with health care, education, communications, and other infrastructure as part of the Government's drive for increasing agro-industrial activity and improving the quality of life of rural Syria. The Bank's

institution building efforts initiated during the First and Second Mehardeh Thermal Projects would be continued through technical assistance to improve EPE's manpower development and training, and to develop adequate extension policies for new customer services in the National Rural Electrification Plan through the project consultants.

B. Description

3.02 The Project consists of about 5,000 km of 20-kV and 380/220 volt distribution lines and related equipment, about 70 MVA of 20/0.4-kV distribution transformer capacity, street lighting, and 31 man-years of consulting services for design engineering and project management. A training component would provide two man-years of technical assistance to strengthen EPE's capabilities in manpower planning and development. The Project facilities would be located in 11 of Syria's 14 mohafazat (administrative districts) as shown in Map IBRD 13060R.

C. Status of Engineering

3.03 Under the Second Mehardeh Project (Loan 1144-SYR), SOFRELEC completed a feasibility study covering electrification of all rural areas in Syria, arranged in order of economic merit. SOFRELEC also developed a preliminary design, cost estimates, and technical specifications. Based on this information, US engineering consultants to be engaged by EPE with USAID financing would develop detailed design and prepare bidding documents for the Project. The USAID-financed consultants would also provide project management and supervision, as well as revise the preliminary design -- which now appears over-dimensioned, particularly for the 380/220-V system -- with the thought of introducing cost reduction through design improvements consistent with international practices. The consultants would also assist EPE in developing adequate extension policies for new consumer connections in the National Rural Electrification Plan. To keep the Project on schedule, the consultants should be engaged and start work as early as possible. The Bank has sent draft Terms of Reference (Annex 12) to EPE and USAID. Appointment of the consultants would be a condition of Bank loan effectiveness.

D. Cost Estimates

3.04 The estimated cost of the Project is US$157.1 million, of which US$74.2 million would be in foreign exchange. The estimates are summarized below, excluding interest during construction but including import taxes and duties levied by the Government on EPE.

	-------LS Million-------			------US$ Million------		
	Local	Foreign	Total	Local	Foreign	Total
20-kV Distribution Lines	19.9	36.6	56.5	5.0	9.3	14.3
Distribution Transformers	3.0	15.1	18.1	0.8	3.8	4.6
380/220-V Distribution System and related Equipment	115.2	141.0	256.2	29.2	35.7	64.9
Engineering and Administration	5.2	13.0	18.2	1.3	3.3	4.6 /1
Subtotal	143.3	205.7	349.0	36.3	52.1	88.4
Import Duties	84.1	-	84.1	21.3	-	21.3
Contingencies:						
Physical	14.3	20.6	34.9	3.6	5.2	8.8
Price	85.8	66.7	152.5	21.7	16.9	38.6
Total Project Cost	327.5	293.0	620.5	82.9	74.2	157.1

/1 Includes 0.3 million for technical assistance in manpower development and planning.

3.05 The project cost is based on estimates developed by SOFRELEC and reviewed jointly with EPE and the mission. The resultant average cost per connection -- about US$1,050, based on 150,000 connections and including import duties -- is not unreasonable, given the terrain difficulties expected and the wide geographical dispersion of the project facilities. However, the mission believes that there is room for cost effective design improvements (para. 3.03). Development of project costs is shown in Annex 13; the foreign currency portion includes US$9.6 million foreign exchange content of the local expenditures. Import duties were estimated at 38% in line with data presented by SOFRELEC in the preliminary feasibility report. Physical contingency was assumed at 10% for both local and foreign components to account for uncertainties in material quantities and terrain difficulties. Price escalation was estimated by the mission to be applicable to this type of project in Syria as follows:

	Equipment and Materials	Civil Works (Installation and Erection)
1977-1979	7.5%	9%
1980-1981	7%	8%

E. Financing

3.06 The proposed loan to EPE of US$40 million, together with parallel USAID financing, would cover all foreign exchange costs of the Project. Bank financing would be used primarily for the high voltage lines (20-kV) and distribution transformers, while the USAID funds would cover engineering consultants' cost, most of the low voltage lines (380/220-V), and street lighting. The proposed Bank loan would carry standard terms for Syria -- 17 years including 4 years' grace. Local costs would be provided by the Government and EPE. The Government would make its own contribution as equity increases to EPE's capital. Interest during construction on the Bank loan (US$4.6 million) is also expected to be covered by the Government and EPE.

F. Implementation

Responsibility

3.07 EPE would be responsible for project implementation assisted by consultants. The consultants would also provide construction management for the Project. EPE has established a Project Unit within the Rural Electrification Department -- along the lines suggested in the May 1977 SOFRELEC report, the Project Unit Manager participated in loan negotiations. Adequate staffing of the Project Unit would be a condition of loan effectiveness. Within EPE the Project Unit would coordinate with the ongoing transmission and substation expansion program (para. 2.13) to ensure the timely completion of all 66-kV lines and 66/20-kV substations related to the Project. The Bank reached agreement with EPE to have EPE complete and place in operation all 66-kV lines and substations needed to supply the Project, not later than December 31, 1980. One year lead-time (1978) would be necessary for development of detailed engineering bid processing and contracts' award. Construction would start in 1979 and be completed by the end of 1981.

Project Monitoring and Statistical Data

3.08 At present there is no comprehensive data acquisition program for EPE's rural electrification statistics. Adequate statistical data is indispensable for gauging the socio-economic impact of rural electrification and for future planning. The Bank obtained agreement from EPE to monitor the performance of the National Rural Electrification Plan along the lines shown in Annex 12, Attachment I.

Construction Schedule and Implementation

3.09 The project facilities would be installed in the period 1979-1981. Completed portions of the Project would be progressively energized from substations existing or under construction (para. 3.07). An estimated schedule

of activities is shown in Annex 14. Close coordination of deliveries of materials and equipment and field construction activities is essential. As part of project management services, the consultants would develop detailed construction schedules and suitable monitoring devices, including specifically critical path schedules. EPE has agreed to review these schedules periodically in connection with project reporting arrangements, and to inform the Bank of action taken or to be taken to make sure the schedules are observed.

Risks

3.10 With project management being provided by consultants, no special risks are foreseen in the implementation of the Project. This arrangement is being used successfully in the first and second Mehardeh Projects, Loans 986/1144-SYR, through SOFRELEC. No difficulties are foreseen in achieving the 75,000 customer connections estimated for the first three years. As in the past, adequate arrangements would be made by EPE to assist financing of new consumer connections if necessary.

G. Procurement and Disbursements

3.11 Disbursement of the Bank loan would be for the c.i.f. cost of imported items, for 100% of the foreign exchange cost of foreign consultants and 70% of the total costs of other consultants for technical assistance in manpower development, and for 35% of EPE's total expenditures for installation and erection. The estimated disbursements from the proposed loan are shown in Annex 15. The proposed closing date is June 30, 1982. Contracts for supplying equipment and materials to be financed from the proposed Bank loan would be awarded under international competitive bidding (ICB). Items would be grouped to the extent practicable to form sizeable bid packages to permit bulk procurement. Since no Syrian manufacturers are likely to submit bids, no provision for local preference is necessary. Minor quantities of standard distribution equipment and materials needed to match and line up new construction with existing facilities would be procured under "international shopping" after inviting quotations from at least three manufacturers. Total cost of contracts awarded under international shopping would not exceed US$1,000,000 equivalent. No retroactive financing is anticipated. Loan funds would be completely disbursed for the Project.

3.12 Because of the widely scattered geographical distribution of the project facilities and the labor intensive nature of the work, it is unlikely that foreign contractors would be interested in bidding for the installation contracts. Nevertheless, these contracts would be awarded under international competitive bidding (ICB). About 20% of the installation work, mostly service drops and customer connections, would be done by EPE's own service crews. Bid packages would be grouped by voltage levels -- one group for 20-kV lines and distribution transformers (US$6.2 million), and the other for 380/220-V work and street lighting (US$21.2 million). Each group could be awarded as a single contract or in two or more subgroups to allow flexibility and promote

competition thereby favoring lower costs and prompt execution of the Project. In the case of state-owned contracting companies, which under their charters are exempt from normal supervision by the employer and from posting bid or performance bonds, the Bank reached agreement with the Government and EPE to make all contractors subject to supervision by the Project consultants on behalf of EPE, and to require bidders to show the costs of bid and performance bonds separately in their bids, and to deduct the cost of such bid and performance bonds before comparing and evaluating bids.

H. Environmental Impact

3.13 The work consists of extension of distribution lines in rural areas. Therefore, following conventional practices there would be no significant environmental impact.

IV. THE PROJECT ENTITY

A. Background

History

4.01 EPE was established in 1965 by Decree No. 8 to consolidate and assume overall responsibility for the entire electric power sector in Syria. Previously, the sector had been fragmented into several local and foreign electric utility companies nationalized in 1951.

B. Organization and Management

Organization

4.02 As a result of the management consultants' report (financed under Loan 986-SYR) by Arthur Young and Co., EPE is in the process of being reorganized to improve managerial performance with introduction of up-to-date electric utility accounting practices and broadened delegation of authority. The new organization has been approved by EPE and the Ministry of Electricity and is awaiting final Government approval shortly. To allow immediate implementation of urgently needed key reforms, the transition to the new EPE organization should take as short a time as possible. Accordingly the Government agreed to revise EPE's organizational structure not later than December 31, 1978.

Management and Staff

4.03 The Board of Directors is the highest authority in EPE and is presided over by the Minister of Electricity, or his Deputy for Technical Affairs. A management advisory committee made up of EPE senior staff advises the General Director on day-to-day decisions. The General Director is appointed by the Prime Minister and serves also as a member of the Board of Directors. Other Board members are appointed directly by the Ministry of Electricity. All appointments are for indefinite periods. Under the new organization, day-to-day management will be in the hands of the General Director, as it is now, but with increased delegation of authority to the next lower echelon: a Deputy General Director and five Assistant General Directors (see Annex 16).

4.04 EPE has about 13,000 employees, with a projection of 21,036 by 1980 (Annex 17). The projected increases are acceptable in view of the accelerated development planned for EPE. At the request of EPE, the Project includes the services of a manpower development advisor -- 24 man-months, US$200,000 -- to work closely with the Assistant General Director for Planning and Engineering (also in charge of manpower development) to draw up long range plans for personnel selection, training, and development. The present General Director and members of his staff soon to fill the newly created Assistant General Director positions are all well trained, capable professionals. The proposed reorganization should provide EPE with appropriate management in the face of quickly expanding activities.

Training

4.05 Intensive training for Mehardeh power plant personnel is currently being carried out with the help of the training center temporarily operating at Hameh Power Station. Once the permanent buildings are completed, all Institute activities will be moved to Adraa (para. 2.08). EPE personnel will have priority in the use of the facilities. Advanced training is also carried on overseas under other programs.

C. Operations

4.06 All repair and rehabilitation work on power stations damaged during the 1973 hostilities has been completed. Recently-added 230-kV lines and substations have made it possible for the system to take up most of the available Thawra hydro generation, allowing shutdown of costly combustion turbine generation. With the addition of Mehardeh, scheduled for 1978-1979, generating capabilities will be ample to meet system energy needs up to 1982. Because of the large amount of generation installed at Thawra (8 x 100 MW), system peaking capacity will not need reinforcing until 1985. System operation and control are well coordinated through a central dispatch unit.

4.07 Good physical progress is being maintained in both the First and Second Mehardeh Projects with the strong support from SOFRELEC. Other current transmission, substation, and distribution construction projects although

directly under EPE project management are also provided with varying amounts of external technical assistance from the donor countries (USSR and the Democratic Republic of Germany). Because of the heavy project management load already being carried out by EPE staff, project management by consultants has been recommended for the Project (para. 3.03).

4.08 A new accounting system better suited to electric utility practices than the existing system is to be implemented with the help of consultants. Billing is already partially done with modern electronic data processing (EDP) equipment and plans are underway to computerize eventually all billing and accounting. Except for Government services, collection policies are effective. Most arrears are related to Government-owned industries and other official dependencies. Quality of service is acceptable with minor problems of unscheduled outages and undervoltages occurring from time to time in Damascus and other older urban areas. However, corrective measures are underway (para. 2.14).

V. FINANCE

A. Past Performance and Present Position

Reorganization of Accounts

5.01 The present accounting records are kept in a number of centers (Damascus, Homs, Aleppo, Latakia, etc.) where the levels of accounting skills and methods vary considerably. Returns are sent only annually to the head office in Damascus and the consolidated accounts are not produced until four to six months after the close of the fiscal year. This makes it difficult for the head office to control the accounting functions and to ensure the completeness and consistency of the consolidated accounts. Decree No. 21 issued March 19, 1974 by the Ministry of Finance provides for a new uniform accounting system for all public establishments and national companies. EPE was granted a postponement of adopting the new system until 1978. Consultants were appointed under the first Mehardeh loan to study the accounting problems and recommend a suitable utility type accounting system. A system expected to satisfy the requirements of the Ministry of Finance, has been proposed by AYC by making certain adjustments to the utility uniform systems of accounts reports. The management of EPE and the Bank have agreed on the proposed accounting system. Consultants would be appointed by EPE to implement the recommended utility accounting system, including revaluation of assets, along with the related organizational changes (see para. 4.02). Government and EPE agreed to appoint the consultants and to begin the implementation of the new accounting system by June 30, 1978, in view of the importance of their action to improvement of EPE's organization, the appointment of consultants would be a condition of loan effectiveness.

Balance Sheet

5.02 EPE's 1972-1976 balance sheets are shown in Annex 18. Gross fixed assets are stated at their 1968 values, the year when the accounts were consolidated for the 5 main cities. Smaller systems were brought in at the value at which they were appraised on acquisition. New assets are included at cost plus interest charged to construction. Asset values, including interest during construction, should be restated in 1979 according to procedures to be agreed for revaluing of assets as stated in para. 5.01.

5.03 Little construction was completed in 1972-1973. Substantial work was undertaken in 1974 on EPE's general distribution and combustion turbine installations, resulting in a 373% increase in gross assets by the end of 1976 over 1972 on the basis of the revalued asset figures developed by the mission.

5.04 Consumers' outstanding electricity accounts reflect an overall average of 153 days at the end of 1976; the amounts unpaid are mostly accounts due from Government-owned organizations, and from the public sector. Pre-1973 municipal accounts amounting to LS 4.4 million are debts due from municipalities of various small towns and villages, and are still outstanding. In 1975, during negotiation of the second loan (1144-SYR), the Government stated that arrangements had been made for settling past debts of municipalities and Government agencies for electricity supplied to them by EPE and for encouraging prompt payment of electricity bills by them in the future. On August 1, 1977, Presidential Resolution No. 110 established a Plenipotentiary Committee for the settlement of inter-agency arrears. On August 17, 1977, the Prime Minister issued instructions on the procedures to be adopted by the Committee and directed that its work should be completed by January 31, 1978; this date was subsequently extended to July 31, 1978. In connection with the proposed loan, Government agreed that receivables should be reduced to no more than 90 days billings by December 31, 1978, and that after that date receivables would not be permitted to exceed 90 days billings.

5.05 The debt equity ratio for 1976 is shown as 12:88, reflecting the treatment of interest-free funds advanced by the Government as equity (para. 5.18). Long-term debts increased from LS 46 million in 1972 to LS 194 million in 1976 reflecting the Bank loans for Mehardeh, the Abu Dhabi Fund Credit, the Kuwait Fund Loan and the promissory notes signed for financing the combustion turbines.

Income Statements

5.06 EPE's income statements (Annex 19) show that net operating revenues decreased from LS 20.4 million in 1972 to LS 9.5 million in 1976, with losses of LS 28.3 million in 1974 and LS 18.1 million in 1975. The decreases resulted from restricted sales and the increased costs of generation from diesel and combustion turbines installed to replace the steam capacity lost during the war. EPE's average sales prices for electricity increased from LS 0.121/kWh in 1972 to LS 0.127/kWh (US¢3.2/kWh) in 1976.

5.07 Under Loans 986-SYR and 1144-SYR, EPE agreed to maintain its overall average electricity rates at a level not less than the rates existing as of May 31, 1973 until December 31, 1977, and from that date EPE should earn a return of not less than 9% on revalued average net fixed assets in operation including the Thawra Hydroelectric assets (but see paragraph 5.11). The impact of additional costs and lost revenues resulted in the rate of return dropping from 12.5% in 1973 to the losses in 1974 and 1975 and a return of only 1.6% in 1976.

B. Future Performance

Construction Program

5.08 The cost of EPE's construction program (para. 2.11) is estimated at LS 4.3 billion for 1978-1982. Gross fixed assets (revalued) will amount to an estimated LS 7 billion by 1982 (US$1.8 billion). The program as approved by the Government represents a strong commitment on the Government's part to the expansion of EPE. In addition to the standard covenant to guarantee funds to complete the Project, the Government agreed to supply or cause to be supplied to EPE, under arrangements acceptable to the Bank, all necessary funds to carry out the expansion program as presently planned.

Future Operating Results

5.09 EPE's lack of action of gradually increasing tariffs to offset restricted sales and increased costs of generation (para. 5.06 and 5.07) resulted in net operating losses in 1974 and 1975. Electricity generated by the Thawra Hydroelectric facilities eased substantially the operating costs for 1976 and resulted in a small net operating profit. On the basis of present forecasts of sales and available generation, and estimates of operating costs, the overall average sales price of electricity must be increased from the present estimated average of LS 0.134/kWh to approximately LS 0.233/kWh by January 1, 1981, to earn a 9% rate of return on average net fixed assets in service, including the Thawra Hydroelectric assets (see para. 5.11). Under Loan 1144-SYR EPE is required to revalue its assets on revaluation principles to be agreed between EPE and the Bank. Since actual revaluation can be implemented only in conjunction with the installation of the new accounting system (para. 5.01), which will require time, revalued assets would be used for rate of return calculations starting in 1979 (para. 5.11).

5.10 Operating expenses are primarily depreciation and labor; labor costs are increasing substantially due to the expansion program of EPE requiring trained operators and additional employees. Inflation is estimated to increase labor costs at an annual rate of 8%. At the present time EPE enjoys the benefits of below-world-market fuel prices resulting from the Government's national policies for pricing the indigenous oil resources. To avoid financial losses that could result from possible future changes in the Government's fuel pricing policies, the new tariffs from the tariff study (para. 2.09) should provide for automatic adjustments of rates to reflect any increases in the fuel prices, as was stated in the Terms of Reference for the Tariff Study under Loan 986-SYR.

Rate of Return Covenant

5.11 Loan 1144-SYR provided that EPE should earn a 9% rate of return on its net fixed assets starting in 1978. However, during loan negotiations for the proposed loan, the Government informed the Bank that, while it was not averse to the principle of increasing tariffs in due course, it was not ready at this time to commit itself to any specific increase in 1978. Following an analysis of the financial implications of the Government's position both at the level of the sector and at the level of the Government's budget, it was agreed that EPE's attainment of a 9% rate of return calculated on the basis of its revenues from electricity tariffs would be deferred until 1981. Until then, the shortfall in EPE's revenues would be made up by a Government subsidy. During 1978, the Government will make a cash contribution to EPE equal to the full difference of EPE's revenues from the 1977 tariffs and the amount that EPE would have obtained had it raised its tariffs to a level necessary to obtain a 9% return on its net fixed assets in operation. In 1979 the cash contribution should not exceed 70% of the difference between revenues that would have been generated if the 1977 tariffs still applied, and revenues that would have been obtained had EPE applied tariffs sufficient to generate a 9% return on properly revalued net fixed assets in operation. In 1980 the cash contribution would not exceed 40% and in 1981 EPE would be required to set tariffs at a level sufficient to generate a 9% return without recourse to any subsidy. Moreover, it was agreed that EPE will prepare a satisfactory progressive rate structure for household electricity consumption by defining the first block of consumption that should benefit from the lowest rates. EPE's proposal will be completed by September 30, 1978, and implemented no later than January 1, 1979. EPE has also agreed to prepare, before September 30 each year, a review, satisfactory to the Government, made on the basis of realistic forecasts which shall demonstrate the adequacy of its electricity tariffs to enable it to meet its rate of return covenant in the succeeding year. A copy of this review will be sent to the Bank upon its completion. The covenant as now modified will permit EPE to finance approximately 13% of its construction costs from net internal cash generation in 1978, when the subsidy will be 100% of the rate deficiency, and 45% in 1981, the first year when there will be no subsidy.

Financing Plan and Funds Statement

5.12 EPE's sources and applications of funds statements for 1978-1982 are shown in Annex 21. They assume a Bank loan of US$40 million at 8% over 17 years with a 4 year grace period for the Project. Also assumed is USAID financing of US$34.2 million at 2% over 40 years with a 10 year grace period. Existing foreign currency promissory notes and Bank loans for Mehardeh amount to US$133.2 million. Government grants equivalent to US$392 million are required for the financing of the 1978-1982 construction program. EPE is in the course of negotiating loans to cover 97% of the foreign exchange costs of the Banias generation project. These loans, totalling LS 689.1 million, would be from Kreditanstalt fur Wiederaufbau, the Arab Fund for Development, the Abu Dhabi Fund, the Saudi Fund and the Islamic Bank. The financing plan is summarized as follows:

	1978-82 PROGRAM		
	LS Millions	US$ Millions	%
Internal Cash Generation	2,124.6	537.8	48
Less Debt Service	(554.7)	(140.4)	(13)
Change in Working Capital	(343.7)	(87.0)	(8)
Net Internal Cash Generation	1,226.2	310.4	27
Government Tariff Subsidy	341.6	86.5	8
Consumers' Contributions and Deposits	56.5	14.3	1
Government Capital Contributions	1,550.0	392.4	35
Long-Term Borrowing			
Existing Loans	299.9	75.9	7
Proposed Loan IBRD	158.0	40.0	4
USAID Loan	135.1	34.2	3
Other Proposed Loans	689.1	174.5	15
Total Long-term Borrowing	1,282.1	324.6	29
TOTAL SOURCES	4,456.4	1,128.2	100
Construction Program			
The Project	620.5	157.1	14
Other Construction	3,724.6	942.9	84
Total Construction	4,345.1	1,100.0	98
Change in Cash Balances	111.3	28.2	2
	4,456.4	1,128.2	100

5.13 The plan shows that EPE would be able to finance through internally generated funds 27% of its construction program for 1978 through 1982. The financing plan, which assumes tariff increases effective January 1, 1979, 1980, 1981 and 1982 is estimated to provide net cash from internal resources amounting to US$310.4 million. The rate increases, although large, reflect the fact that electricity tariffs have not changed substantially since 1973 and inflation in these years has been high. At the present rate of exchange the average retail electricity tariffs would amount to 3.6 US¢/kWh in 1978 and 4.0 US¢/kWh in 1979, which would not be considered excessively high for these years, compared to approximately 7 US¢ in Jordan and Turkey in 1978. Allowing for an estimated 8% annual inflation rate from 1980-1982 the real price trend of electricity prices would be only about 6%/a increase reflecting the cost of debt service on the construction program.

5.14 The 1978-1982 construction program is much greater than ever before undertaken in the electricity sector. Syria has given priority to the development of the electricity sector to restore the facilities lost in the war and to develop the economy by providing this essential source of energy. The financing plan assumes that 35% of the construction program would be financed by Government grants (US$392.4 million).

5.15 Government capital contributions to EPE are interest-free but are termed "development loans" under Syrian Law. Since the bulk of the contributions are unlikely ever to be repaid in view of EPE's continuing need for expansion, the Government's capital contributions are treated as increases in equity in the balance sheet and for the purposes of the debt service covenant.

Forecast Balance Sheets

5.16 The most significant change in the forecast balance sheets during the 1978-1982 period is the rate of growth of fixed assets in operation from LS 1.4 billion in 1977 to LS 5.2 billion by 1982 (7.1 billion, as revalued by the mission). There is also a substantial increase in the long-term debt of EPE which increases from LS 399.6 million in 1977 to LS 1,471.8 million by 1982. This reflects the financing of EPE's expansion program from sources other than the Government. The debt equity ratio remains about constant at 20:80 for 1978-1982 and indicates low borrowings, but the classification of government contributions as equity distorts the ratio. The estimated debt service coverage for the period 1978-1982 is approximately 3.8.

5.17 The total accounts receivable from consumers as of 1976 is rather large. Pending Government action (para. 5.04), however, it is assumed that the overall level of electricity accounts owed by consumers will fall from the present 153 days to no more than 90 days by the end of 1982. Inventory levels reflect the normal expansion of materials required to sustain the enlarged operations of EPE.

C. Accounts and Audits

Accounts

5.18 Foreign exchange funds for EPE's projects included in the official development plan are provided through CDP (see para. 2.10). Foreign long-term debts are shown in EPE's balance sheet separately only if a promissory note has been issued to the lender. All other long-term debt is included under the heading of "Government Construction Grants". This is the Government current or CDP account; no interest is paid on these amounts.

Audit

5.19 EPE's financial statements for 1974 and 1975 have been audited by the firm of Talal Abu-Ghazeleh (Kuwait) who are acceptable to the Bank. This firm has been appointed auditors for the 1976 and 1977 accounts.

D. Insurance

5.20 Insurance of EPE's major assets against the usual hazards of fire, explosion, third party, etc. is effected through the Syrian Insurance Company, the sole Government insurance agency. Although the present insurance is considered to be adequate, EPE has agreed to review its general insurance practices with the assistance of qualified consultants (probably insurance underwriters) to determine any changes to existing coverages and related inspection and safety aspects necessary to comply with sound public utility practice, and to submit the results of such a review by June 30, 1979, to the Bank to enable it to comment on any recommended changes.

VI. PROJECT JUSTIFICATION

A. Load Forecast

6.01 The load forecast for the Project facilities and the ten-year rural electrification plan are the same, since the Project constitutes the first phase of the plan. The forecast comprises the demand for electricity for rural domestic use, public lighting, small commercial enterprises and street lighting (Annex 22, Attachments 2, 3 and 4). The potential power demand for agro-industries is not addressed because of the absence of a development plan for the sector from which future loads can be extracted. Meanwhile, private irrigation pumping in Syria depends primarily on diesel fuel as a source of energy. This dependency stems from the prevailing pricing policy which undervalues energy resources relative to their respective opportunity costs to the economy. If the price of diesel fuel is not increased to reflect its scarcity relative to the residual oil used by EPE generating plants, there would be no financial incentive for private irrigation pumping to switch to electricity. Since there are no indications that an increase in diesel prices will be forthcoming, at least until the power development study (para. 2.03) is completed, the load forecast does not include private irrigation pumping as a component (public irrigation pumping is included in the forecast of demand faced by EPE's system). In view of the impact of irrigation pumping on the Project, the Government was asked during negotiations to discuss the power study and the changes required for the implementation of a comprehensive fuel pricing policy. However, since data on which to base pricing policy for the entire energy sector is still insufficient to enable the Government to form any decisions on pricing policy, after reviewing the consultant's report on the energy sector and after collecting the data required for policy formulation, the Government is expected to initiate action to gradually achieve a more efficient allocation of energy resources through pricing over the next five years.

6.02 The forecast of demand for the Project is based on three parameters or averages that are determined from samples because of the absence of comprehensive village statistics (Annex 22, Attachment 1). These parameters are:

(a) initial rate of connections;

(b) initial consumption level, and

(c) the rate of growth of demand.

6.03 The initial rate of connection refers to the number of subscribers that are provided service in the first year of electrification, once the village is electrified. The initial connection rate for the Project is set at 50%, except for the villages in the Mohafazat of Aleppo and Idlib with a rate of 48% and the Mohafazat of Deraa and Soueda with a rate of 38% (Annex 22, paras. 3 and 4).

6.04 The initial consumption level refers to the average consumption per subscriber in the first year of electrification. There are differences between the consumption level of the publicly supplied villages and the villages supplied by isolated systems. However, the consumption data of the forecast is that of the publicly supplied villages because they are more indicative of the consumption patterns of the consumers supplied from the centralized grid. The average consumption level assumed is 300 kWh/year/connection or 50 kWh/year/capita (Annex 22, paras. 5, 6, 7).

6.05 The following varying pattern of growth over the 30 years was assumed in deriving the load forecast for the Project:

Years	1	2	3	4	5	6	7	8	9	10-30
Rate of Growth in %	55	35	27.5	22.5	20.0	19.0	18.0	17.0	16.0	14.0

To facilitate the analysis an equivalent constant rate of growth of 18.2%/a was used. The constant annual growth rate was selected such that it would yield a present value of the benefit stream equal to the present value of the benefit stream for varying rates of growth. The scenario for load growth is supported by the experience of other developing nations where the growth rate in countries with less than 10 years of electricity services is 31.3%, while it is 17.0% in countries with more than 10 years of service (Annex 22, paras. 8, 9, 10).

B. Least Cost Alternative

6.06 Since the Project will extend electricity to 1,200 villages, the comparison of alternatives for each village included in the Project is virtually impossible. Instead, the comparison will be formulated in terms of a break-even relationship between the two alternatives (isolated system versus connection to the central grid). The relationship will be a function of the distance of a village with 500 inhabitants from the nearest source of centrally supplied power such as a substation or another electrified village (Annex 24, para. 1.02).

6.07 The distance at which the cost associated with the two alternatives break even for a village of 500 inhabitants is 18.2 km. This implies that, if the distance between a village of 500 inhabitants and the nearest source of centrally supplied electricty is more than 18.2 km, the least-cost alternative for its electrification would be through local generation. The break-even distance would increase as the population of the village increases.

6.08 Since, (a) the distance between any of the villages in the Project and the nearest source of centrally supplied electricty is about 11.2 kilometers, and (b) 90% of the villages in the Project have a population greater than 500 inhabitants, it is possible to conclude that the Project is the least-cost alternative to electrifying 1,200 villages.

C. Return on Investment

6.09 The return on investment is calculated for both the Project and the ten-year Rural Electrification Plan. These are presented in turn below.

I. Return on the Project

6.10 The return on investment in the Project is 8.5%. It is based on a proxy for the consumers' willingness to pay 0.24 LS/kWh (US$0.06/kWh) which is currently being paid by the rural customers supplied by the isolated systems. A cost of 0.14 LS/kWh (US$0.035/kWh) is charged to the Project for each kWh delivered to the end users. This represents the cost incurred by EPE in generating and transmitting the power consumed by the rural customer (Annex 23 and Annex 25, para. 3). The return on the investment is more sensitive to changes in the tariff level than to changes in the cost of producing the power. A decrease of 13% in the tariff level (a reduction of the tariff from 0.24 LS/kWh to 0.21 LS/kWh) reduces the rate of return on the Project to 6.1%, while an increase of 13% in the cost of the power delivered to the rural customer lowers the rate of return to 7.1% (Annex 24, para. 11).

6.11 The rate of 8.5% constitutes the minimum return on investment because electricity tariffs in Syria are heavily subsidized. The rate of return would also increase if private irrigation pumping would be connected to the public grid. At the moment, Syria's private irrigation pumping uses diesel as its principal energy source because its price is heavily subsidized. The subsidy is of such a magnitude that, relative to the prevailing undervalued electricity tariff, it would be financially unattractive to switch to electricity. If energy resources are priced to reflect their respective opportunity cost to the economy and since irrigation pumping can be accommodated in off-peak periods, the benefits associated with the Project will be substantially increased because of the increased use of electricity for private irrigation pumping. Electrically driven irrigation pumping need only be charged energy cost and no capacity cost because there is excess available capacity during off-peak periods and marginal cost pricing dictates that such consumers should

not pay capacity cost. The consultants (SOFRELEC) for the power development study are presently assessing the impact of increased fuel prices on the development of the subsector, including irrigation pumping. It is expected that after review of the study and the collection of additional necessary data on the energy sector, the Government will initiate steps to achieve over the next five years a more efficient allocation of energy resources among the energy subsectors.

II. Return on the Rural Electrification Plan

6.12 The return on investment in the ten-year rural electrification plan is 4.5%. This is based on an average revenue of 0.24 LS/kWh and a cost of 0.14 LS/kWh for each kWh produced by EPE and delivered to the rural customer. Since the villages with relatively large benefits were included in the first phase, the rate of return on the Project is higher than that on the plan. The rate of return on the plan is low because the prevailing tariffs do not cover the economic cost of the resources used in producing electricity.

VII. AGREEMENTS REACHED AND RECOMMENDATIONS

7.01 During negotiations, agreement was reached on the following principal issues:

(a) EPE agreed to complete and place in operation all 66-kV lines and 66/20-kV substations needed to supply the Project, not later than December 31, 1980 (para. 3.07);

(b) EPE agreed to monitor performance of the National Rural Electrification Plan along guidelines suggested by the Bank (para. 3.08);

(c) EPE agreed to review critical path schedules periodically in connection with project reporting arrangements, and inform the Bank of action taken or to be taken to ensure the schedules are observed (para. 3.09);

(d) EPE agreed to require all contractors to submit to supervision by the project consultants on behalf of EPE; and all bidders to show the cost of bid and performance bonds separately in their bids (para. 3.11);

(e) EPE agreed to revise its organization structure not later than December 31, 1978 (para. 4.02);

(f) EPE agreed to reduce accounts receivable from the sale of electricity to no more than 90 days by December 31, 1978 (para. 5.04);

(g) the Government agreed to supply or cause to be supplied to EPE, under arrangements acceptable to the Bank, all necessary funds to carry out the expansion program as presently planned (para. 5.08);

(h) EPE agreed to maintain the 9% rate of return covenant previously agreed in Loan 1144-SYR including cash subsidies from the Government in 1978, 1979 and 1980 (para. 5.11); and

(i) EPE agreed to review its present insurance practices and submit the results to the Bank by June 30, 1979 (para. 5.20).

7.02 The Project is suitable for a Bank Loan of US$40 million to the Etablissement Public d'Electricite with the Guarantee of the Government of Syria. The standard terms for Bank loans to Syria of 17 years including four years of grace are appropriate. The loan could become effective within six months of loan signing; engagement of project consultants (para. 3.03) and adequate initial staff of the Project Unit (para. 3.07); the engagement of accounting consultants and the beginning of the new accounting system (para. 5.01) would be conditions of effectiveness.

ANNEX 1

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Key Power Sector Statistics, 1966-1976

Etablissement Public d'Electricite	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Growth Rate (%) 1966-1976
1. Interconnected System												
a. Sales (GWh)												
Domestic & Commercial	141.4	146.3	157.6	179.4	192.9	207.2	218.8	238.3	298.0	379.0	500.0	13.5%
Private (Light) Industry	70.2	70.6	65.3	87.8	94.6	108.8	135.1	141.6	253.0	319.0	350.0	17.5%
Government (Heavy) Industry	55.7	53.2	57.7	69.4	84.5	88.5	139.9	124.3	192.0	152.0	230.0	15.2%
Government Services	18.4	21.5	24.9	30.0	32.5	36.2	39.0	34.5	54.0	74.0	90.0	17.2%
Railways	0.9	0.8	0.8	0.8	0.6	0.5	0.5	0.5	-	-	-	-
Streetlighting	10.0	9.5	10.3	11.5	13.1	15.0	16.0	15.6	-	-	-	-
National Oil Company	-	-	-	14.2	50.3	56.8	64.4	51.4	39.0	65.0	74.0	-
Thawra Construction 2/	-	-	-	13.6	81.3	132.7	144.8	132.1	-	-	-	-
Irrigation	-	-	-	-	-	-	-	-	7.0	8.0	15.0	-
Other	2.3	2.3	2.5	0.4	0.4	0.4	0.3	-	-	-	-	-
Total	298.9	304.2	319.1	407.1	550.2	646.1	758.8	738.3	843.0	997.0	1,259.0	15.4%
b. Net Generation & Purchases (GWh)	377.0	387.0	429.0	516.0	692.0	813.0	959.0	926.9	972.0	1,171.0	1,459.0	16.6%
c. Maximum Demand (MW)	88.0	92.0	105.0	124.0	143.0	165.0	170.0	163.0	250.0	240.0	327.0	13.5%
d. Installed Capacity (MW) 4/	135.0	135.0	135.0	219.0	219.0	227.0	227.0	227.0	435.0	550.0	832.0	
e. Load Factor (%)	49%	48%	47%	48%	55%	56%	64%	-	44%	56%	51%	
f. Losses and Unrecorded Energy (%)	20.7%	21.3%	25.6%	21.1%	20.5%	20.5%	20.9%	20.3%	13.3%	14.8%	13.7%	
2. Isolated Systems												
a. Sales (GWh)												
Domestic, Commercial & Government	34.8	39.4	42.2	48.2	51.7	55.5	58.9	59.5	74.6	86.8	49.0	
Industry	8.8	10.9	11.4	12.4	13.8	16.0	19.6	18.1	17.4	17.2	12.0	
Total	43.6	50.3	53.6	60.6	65.5	71.5	78.5	77.6	92.0	104.0	61.0	
b. Net Generation & Purchases (GWh)	67.0	68.0	68.0	77.0	85.0	93.0	103.0	101.2	118.0	138.0	78.0	
c. Maximum Demand (MW) 5/	21.0	22.0	22.0	25.0	28.0	32.0	34.0	34.0	38.5	45.0	25.4	
d. Installed Capacity (MW) 6/	41.0	43.0	42.0	45.0	57.0	59.0	61.0	61.0	60.0	60.0	117.0	
e. Approximate Load Factor (%)	36%	35%	35%	35%	35%	33%	35%	35%	35%	35%	35%	
f. Losses and Unrecorded Energy (%)	35%	26%	21%	21%	23%	23%	24%	23%	22%	25%	22%	

1/ Apparently consolidated into "Government Services" after 1973.
2/ Includes irrigation until end of 1973. Irrigation shown separately afterwards.
3/ Dropped out in 1974 when Thawra hydro began operating.
4/ Effective capacity.
5/ Estimated coincident peak demand. Drops off after 1975 because of transfer of load to the Interconnected System.
6/ Estimated figures, no detailed breakdown available.

SOURCE: Etablissement Public d'Electricite

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ANNEX 2

SYRIA

REGIONAL ELECTRIFICATION PROJECT

EPE Interconnected System

Installed Capacity
(MW)[1]

Hydro Stations	Nameplate Ratings			Effective Ratings		
Thawra	8 x 100	=	800	8 x 90	=	720 [2]
Souk Wadi Barada	2 x 3.5		7	2 x 3.5	=	7
Rastan	2 x 4		8	2 x 4	=	8
Total Hydro			815			735
Steam Turbines						
Hameh	2 x 15	=	30	2 x 14	=	28
Hameh	1 x 5.7	=	5.7	1 x 5	=	5
Ain Tell	1 x 13.75	=	13.75	1 x 13	=	13
Ain Tell	2 x 6.25	=	12.5	2 x 5.5	=	11
Kattineh	2 x 15	=	30	2 x 13	=	26
Kattineh	3 x 30	=	90	3 x 27	=	81
Kattineh	1 x 64	=	64	1 x 60	=	60 [3]
Mehardeh	2 x 150	=	300	2 x 142	=	284 [4]
Total Steam			546			508
Combustion Turbines						
Souedie	2 x 18.75	=	37.5	2 x 14.5	=	29)*
Souedie	1 x 20	=	20	1 x 18	=	18)*
Hassakeh	1 x 10.5	=	10.5	1 x 10	=	10)*
Aleppo	3 x 20	=	60	3 x 18	=	54
Latakia	2 x 20	=	40	2 x 18	=	36
Hama	3 x 20	=	60	3 x 18	=	54
Hama	1 x 10.5	=	10.5	1 x 10	=	10
Homs	4 x 20	=	80	4 x 18	=	72
Damascus	5 x 20	=	100	5 x 18	=	90
Total Combustion			418.5			373
Industrial Installations						
Banias Refinery	4 x 12.5	=	50	Global Estimate		
Sugar Factories	8 x 3	=	24			
Deir-Ez-Zor Paper Mill	1 x 10.5	=	10.5			50
Total			84.5			50 [5]
TOTAL SYSTEM			1,864			1,666 [6]

1/ Includes only units rated 5 MW or higher, existing unless otherwise noted.
2/ Value corresponds to average reservoir level.
3/ Start-up, 1978.
4/ Start-up, 1978-1979.
5/ Start-up, 1978-1980.
6/ For 1977, effective ratings add up to 1,275 MW, including 60 MW in small diesels not listed.
* Interconnection scheduled for 1979.

SOURCE: Preliminary Report, Power Development Study, SOFRELEC, June 1977.

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

EPE Interconnected System

Generation Capability (1977-1982)
(GWh) 1/

			Average Generation 2/ Capability (GWh)	
Thawra			2,360	
			up to 1980. Decreasing by 40 GWh per year each following year.	
Souk Wadi Barada + Rastan			50	
Ain Tell		(13.75 MW)	84	
		(6.25 MW)	31	
		(6.25 MW)	31	
Hameh		(15 MW)	85	
		(15 MW)	85	
		(5 MW)	31	
Kattineh	1	(15 MW)	54	
	2	(15 MW)	54	
	3	(30 MW)	130	
	4	(30 MW)	130	
	5	(30 MW)	130	
	6	(64 MW)	330	- Start-up, 1978
Mehardeh	1	(150 MW)	781	- Start-up, 1978
	2	(150 MW)	781	- Start-up, 1978
Banias Refinery				
Sugar Factories			232	- Start-up, 1977-1980
Deir-Ez-Zor Paper Mill				
Combustion Turbines			1,870	
Total (for 1977)			3,802 3/	

1/ Includes only units rated 5 MW or higher, existing unless otherwise noted.
2/ After units have achieved full commercial operation.
3/ For 1977, average capability is 3,802 GWh based on 60% probability of water availability at Thawra Hydro (Annex 6, page 2) and expected availability of thermal units.

SOURCE: Preliminary Report, Power Development Study, SOFRELEC, June 1977.

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

Intermediate Institute at Adraa

1. In December 1975, by Presidential decree, an Intermediate Institute of Electro-mechanical Engineering was established at Adraa on the northern outskirts of Damascus. The need for such a specialized Institute arose from the shortage of suitably qualified technicians and skilled workers entering the labor market from the technical education system administered by the Ministry of Education. In addition, much of the job-related training required to enable staff to perform effectively in thermal generating plants, substations, dispatch centers, etc., cannot be obtained in the school system.

2. When fully operational during 1978, the Intermediate Institute will have a capacity of 390 trainees and will produce an annual output of 580 skilled workers, technicians and supervisors. Of these, approximately half will be newly-recruited staff, while the remainder will be existing staff benefiting from re-training as part of a comprehensive career development program.

3. The Institute will form the focal point of all future staff development in EPE, and will offer training programs in:

(a) thermal power station operation;

(b) system control, measurement, instrumentation, protection, dispatching;

(c) high and low tension distribution;

(d) administration and management; and

(e) accountancy and financial administration.

4. Courses for new staff joining EPE with a Diploma of Industrial Studies (Baccalaureat Technique) will be of two years duration. There will be three intakes of 75 per year. Following a 20-week common syllabus in which the theory of three-phase systems, electrical machines, thermodynamics and mathematics are thoroughly covered, the trainees will be separated into the following specializations, based on preference and aptitude:

(i) thermal power plant;

(ii) system control and protection;

(iii) transmission and distribution.

The exact numbers entering each category being finally determined by the manpower planners in EPE. Each specialized course will consist of three stages of study in the Institute (50% of which time will be devoted to practical work) interspersed with periods of attachment to power stations, substations, dispatch centers or distribution teams as appropriate.

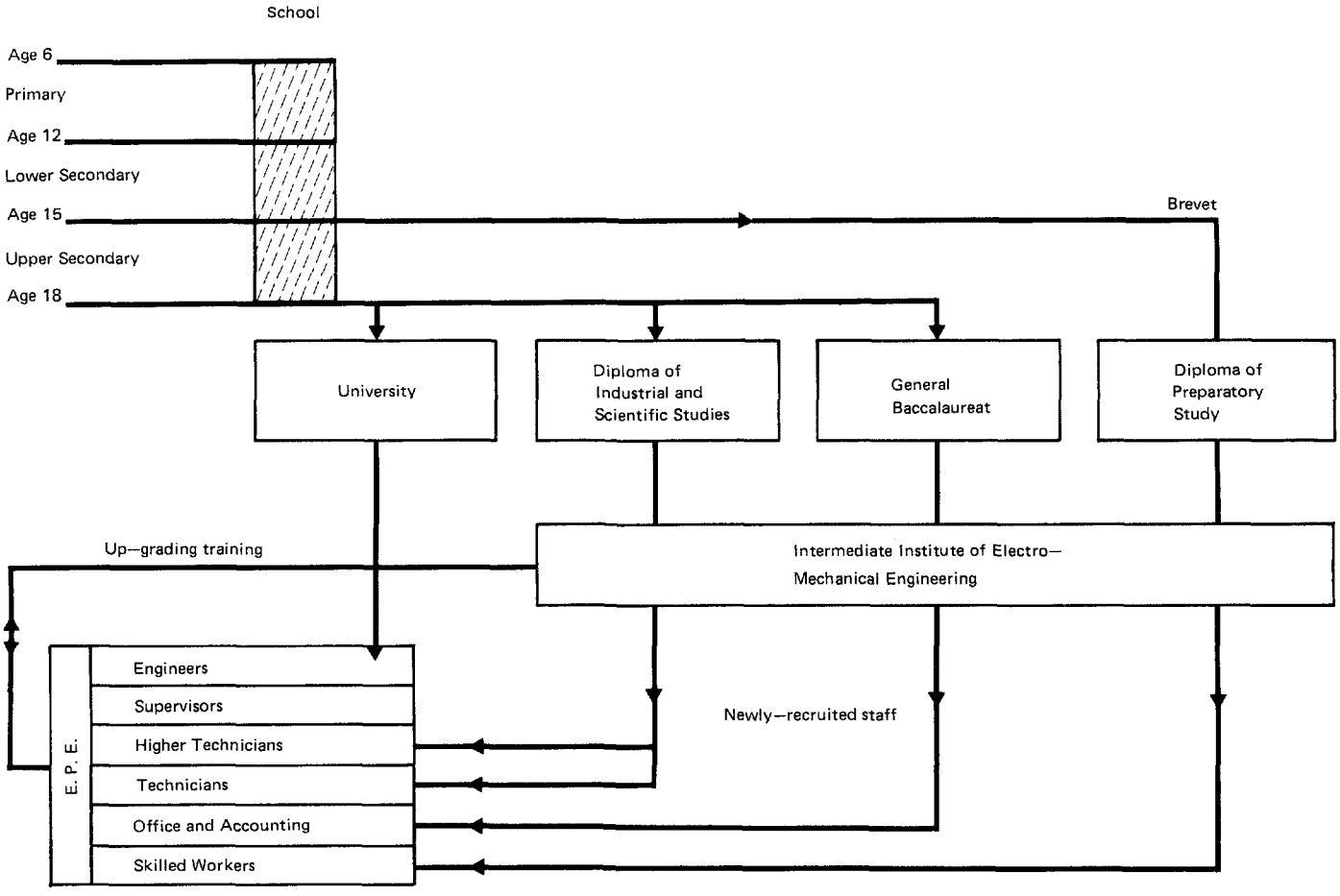
5. New staff entering EPE with a general secondary education (Baccalaureat) will follow a program consisting of four stages of study at the Institute totalling 80 weeks, interspersed with periods of up to 8 weeks attached to the financial/accounting sections in EPE. The syllabus, aimed at producing competent staff in these areas, will concentrate on economics, financial analysis, commercial principles, management, office machinery, data processing and accounting procedures. There will be three entries per year, each of 25 trainees.

6. New staff holding a school certificate of preparatory studies (Brevet) will all be trained for technical positions as skilled workers. Consequently, their program will be shorter (one year) and contain more practical than theoretical content. Preventive maintenance skills, fault-location and correction, house wiring installation, cable-joining as well as basic metal-working skills will be taught. Three entries are planned each year, each of 30 trainees.

7. Up-grading courses, aimed at improving the performance of existing staff (who have mostly received no specialized training) will represent an important part of the Institute's work. EPE's present work force suffers from low morale resulting from poor personnel policies and the almost complete absence of a career-development policy through which able workers can have access to training leading to promotion. It is planned to conduct seven-week courses in all the specializations described above, catering for an annual through-put of 100 trainees.

8. The creation of the Institute has been a joint effort between the Government, which has financed the construction costs, the Bank, which has included US$1.0 million for training equipment including a thermal power plant simulator in previous loans, and French technical assistance, which has provided expatriate instructors to establish the courses, as well as training in France for Syrian instructors.

9. The relationship between the Institute and the country's education system is shown on page 3 of this Annex.



World Bank — 18085

SYRIA

REGIONAL ELECTRIFICATION PROJECT

EPE TARIFFS

DOMESTIC, GENERAL LIGHTING, SMALL COMMERCIAL

Group "A", applicable outside Aleppo, Homs, Hama and Damascus	LS/kWh
- Latakia, Tartous, ElBab, Massiaf, Deir-ez-Zor	0.22
- Banias	0.20
- All others	0.24
- Government, Municipalities, Army, discount 10%	

Group "B"	LS/kWh			
	General	Municipality	Government	Army
- Damascus	0.19	0.135	0.17	0.16
- Aleppo	0.19	Changes yearly w/ actual costs	0.19	0.19
- Homs	0.19	0.16	0.16	0.16
- Hama	0.19	0.16	0.16	0.16

STREET LIGHTING	LS/kWh
Group "A"	
-All	0.18
Group "B"	
- Damascus - 300,000 kWh yearly	no charge
- 350,000 kWh monthly	0.135
- all excess kWh monthly	0.12
- Aleppo: Changes yearly with actual costs	-
- Homs	0.07
- Hama	0.07

SMALL INDUSTRIES

kWh Group "A"	LS/kWh		
	LT		HT
	Less than 10 kW	More than 10 kW	ALL
1-250 LT; 1-500 HT	0.19	0.16	0.14
251-500 LT; 501-1000 HT	0.16	0.13	0.11
over 500 LT; over 1000 HT	0.14	0.11	0.08
If meters provided:			
- peak time		0.24	0.15
- day time		0.16	0.11
- night time		0.10	0.07
Government and Army discount 10%			
Group "B"			
1 - 1,000		0.17	0.16
1,001 - 4,000		0.15	0.14
4,001 - 10,000		0.13	0.12
10,001 - 100,000		0.11	0.10
100,00 - 500,000		0.10	0.09
500,001 and above		0.09	0.08

LARGE INDUSTRIES (5.5 kV; 20 kV)

Group "A" see Small Industries

Group "B"

The variations between the various contracts is so great that a tabulation would indicate little, except the extreme diversity; kWh charges range as follows:

	LS/kWh	
	Minimum	Maximum
Damascus	0.055	0.220
Aleppo	0.066	0.156
Homs and Hama	0.030	0.500

HEAVY INDUSTRIES (66 kV; 230 kV)

	LS/kWh					
Supply from:	Gen. Busbars		20 kV		66 kV	
Type of Operation	Normal	Continuous	Normal	Continuous	Normal	Continuous
- peak time	0.10	0.05	0.11	0.055	0.13	0.066
- day time	0.05	0.05	0.055	0.055	0.066	0.066
- night time	0.035	0.05	0.028	0.055	0.033	0.066

ARMY AND GOVERNMENT, POWER	LS/kWh
Damascus	
Army and Government	0.13
Aleppo	
Government	0.15
Army	0.13

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

Government Industrial Projects of More than 5 MW Connected Load
Planned or Under Construction (1977-1983)

No.	Name	Location	Mohafazat	Peak Load MW	Coincident Load MW	Start-up Year	Remarks
1	Cement Plant	Moussel Mie	Aleppo	9	5	1979	Second Stage
2	Cement Plant)	Sheik Said	Aleppo	(24	7	1979	First Stage
	)	Sheik Said	Aleppo	(	6	1980	Second Stage
3	Wire & Cable Factory	Aleppo	Aleppo	(13	2	1978	First Stage
				(	6	1983	Second Stage
4	Sugar Factory	Meskane	Aleppo	5	4.5	1977	
5	National Defense)		Hama	5.5	5.5	(1977	Scattered loads
	)		Homes	6	6	(/	
	)		Aleppo	10	10	(1978	
	)		Latakia	.5	.5	(	
	)		Damascus	2.6	2.6	(	
6	Cement Plant)	Adraa	Damascus	22	10	1977	First Stage
	)	Adraa	Damascus	18	9	1981	Second Stage
7	Synthetic Fiber Plant	Deir ez Zor	Deir ez Zor	5	3.6	1979	Chinese supply (Second stage of plant)
8	Paper Mill	Deir ez Zor	Deir ez Zor	12	11	1980	
9	Phosphate Fertilizer Plant	Deir ez Zor	Deir ez Zor	12	8	1980	
10	Cement Plant	Hama	Hama	12	5	1977	Second Stage
11	Scrap Metal Foundry	Hama	Hama	30	7.5	1977	Electric arc furnace
12	Tire & Tubes Factory	Jafie	Hama	7.5	5.4	1979	
13	Pipeline Pipe Factory	Hama	Hama	5	3	1977	
14	Sugar Mill	Ga'b	Hama	5	4.5	1977	
15	Textile Mill (Cotton)	Hassakeh	Hassakeh	6.6	4.7	1978	
16	Ministry of Petroleum	Souedie	Hassakeh	15	10	1977/ 1980	300 motors 80 kW each
17	National Oil Company	Taladass					
18	Phosphate Fertilizer Plant	Kattineh	Homs	25	14	1978	
19	Ammonia & Urea Plant	Kattineh	Homs	13	9	1979	
20	Synthetic Fiber Plant	Idlib	Idlib	5	3.6	1980	Czech supply (first stage)
21	Synthetic Fiber Plant	Idlib	Idlib	7.8	5.6	1979	Chinese supply (second stage)
22	Synthetic Fiber Plant	Jableh	Latakia	5	3.5	1978	English & W. German supply
23	Sugar Mill	Raqqa	Raqqa	5	4.5	1977	
24	Cement Plant	Tartous	Tartous	(54	8	1979	First Stage
				(	7	1980	Second Stage
				(	7	1981	Third Stage
				(	7	1982	Fourth Stage
25	Ministry of Petroleum, Banias Refinery	Banias	Tartous/ Banias	24	22	1978	
	Total			364.5	228	1977-1983	

SOURCE: Preliminary Report, Power Development Study, SOFRELEC, June 1977

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Large Irrigation Loads, Planned or Under Construction (1977-1980) 1/

1. Major Contracts in Progress

Zone	Project Area (km^2)	Contractor Nationality	Estimated Construction Time
Meskenne West	210	USSR	2 years
Meskenne East	330	Japan	4 years
Raqqa (Middle Euphrates)	270	Romania	2 years
Balikh (Part A)	100	Syria	2 years

2. Schedule of Loads (Total Fourth Five-Year Plan, 1976-1980)

Year	Energy Consumption (GWh)	Connected Load (MW)
1976	-	-
1977	28	14
1978	78	39
1979	150	75
1980	196	95
1981	306	153
1982	600	300

1/ Includes only large scale Government programs. Does not include small scale irrigation in the Project areas using subsidized fuel (see Annex 23).

SOURCE: Preliminary Report, Power Development Study, SOFRELEC, February 1977

September 1977

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Balance of Energy and Power, 1976-1982

	Historic 1976	Estim. 1977	Forecast 1978	1979	1980	1981	1982
Interconnected System							
Sales, GWh							
Domestic & Commercial	500	550	600	675	764	848	940
Private (Light) Industry	350	400	428	473	523	579	640
Government (Heavy) Industry)	( )						
Government Services)	( )						
Railways & Streetlighting)	(394)	900	1,015	1,522	1,838	2,108	2,479
National Oil Companies)	( )						
Irrigation	15	28	78	150	196	306	600
Rural Electrification	-	-	10	20	40	70	100
	1,259	1,578	1,831	2,384	2,856	3,284	3,778
Losses, GWh	200	261	451	582	664	745	873
Required Net Generation, GWh	1,459	1,834	2,104	2,740	3,283	3,775	4,342
of which:							
Hydro	1,229	1,620	1,900	2,290	2,290	2,290	2,290 1/
Steam	140	214	204	450	626	1,187	1,772
Diesel 1/	9	-	-	-	-	-	-
Combustion Turbine	81	-	-	-	307	298	280
Purchases	-	-	-	-	-	-	-
Peak Demand, MW	327	409	437	521	625	709	826
Load Factor, %	51%	51%	55%	60%	60%	60%	60%
Effective Capacity							
Hydro	465	735	735	735	735	735	735
Steam	24	164	366	508	508	508	650
Diesel	27	60	60	50	50	50	50
Combustion Turbine	316	316	373	373	373	373	373
Total Effective Capacity MW	832	1,275	1,534	1,666	1,666	1,666	1,808
Reserve, MW							
2 largest hydro units 2x90	180	180	180	180	180	180	180
plus largest steam unit	30	30	142	142	142	142	142
Firm Capacity, MW	622	1,062	1,212	1,344	1,344	1,344	1,486
Capacity Margin, MW	265	653	775	823	719	635	660
Isolated Systems							
Sales, GWh							
Domestic & Commercial	49	40	44	40	32	29	27
Industrial	12	20	28	25	22	20	18
	61	60	72	65	54	49	45
Required Net Generation, GWh	78	80	90	81	68	61	56
of which:							
Diesel	78	50	90	81	68	61	56
Combustion Turbine	-	30	-	-	-	-	-
Purchased Power	-	-	-	-	-	-	-
Installed Capacity, MW							
Diesel	60	60	60	60	60	60	60
Gas Turbine	57	57	-	-	-	-	-
	117	117	60	60	60	60	60
Summary							
Total Sales, GWh	1,320	1,638	1,903	2,449	2,910	3,333	3,823
Total Generation, GWh	1,537	1,914	2,194	2,821	3,351	3,836	4,398
Total Effective Capacity, MW	949	1,389	1,594	1,726	1,726	1,726	1,868

1/ Replaced from 1979 on by industrial steam capacity (see Annex 2).

SOURCE: Etablissement Public d'Electricite.

February 1978

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Potential Power Production of the Euphrates (Thawra) Power Plant

Order	Probability of Water Availability %	Water Flow into Reservoir billion m³ p.a. [1/]	Water Requirements for Irrigation Areas Above the Dam 1980 billion m³ [2/]	Water Requirements for Irrigation Areas Above the Dam 1985 billion m³ [2/]	Available Water for Power Production 1980 billion m³	Available Water for Power Production 1985 billion m³	Potential Power Production 1980 billion kWh [3/]	Potential Power Production 1985 billion kWh [3/]
1		46.0						
2		40.8						
3	10	38.1	1.2	3.1	36.9	35.0	3.50	3.31
4		37.0						
5		35.5						
6	20	33.7	-	-	32.5	30.6	3.08	2.90
7		33.0						
8		32.6						
9	30	32.5	-	-	31.3	29.4	2.96	2.78
10		31.5						
11		30.2						
12	40	29.8	-	-	28.6	26.7	2.71	2.53
13		29.7						
14		28.4						
15	50	27.6	-	-	26.4	24.5	2.50	2.32
16		27.4						
17		26.5						
18	60 [4/]	26.0	-	-	24.8	22.9	2.35	2.17
19		26.0						
20		25.8						
21	70	25.1	-	-	23.9	22.0	2.26	2.08
22		22.8						
23		22.8						
24	80	22.8	-	-	21.6	19.7	2.05	1.86
25		22.2						
26		21.7						
27	90	21.3	-	-	20.1	18.2	1.90	1.72
28		20.8						
29		19.2						
30	97	19.1	-	-	17.9	16.0	1.70	1.51
31	100	14.7	-	-	13.5	11.6	1.27	1.10

1/ Water flow at Thawra, annual figures 1937/38-1967/68, classified (from: World Bank, Preliminary Study of Reservoir Filling and Operation for Projects on the Euphrates River, Draft, 24/1/1975, Annex 2, Table 6).
2/ Basis: Water demand of 20,000 m^3/hectare/year; irrigation areas 1980: 62,000 hectares, 1985: 153,000 hectares.
3/ Basis: Water requirements per 100 MW-unit: 292 m^3/sec.
4/ Basis for firm energy estimates, with Keban Dam (Turkey) regulation.

SOURCE: Etablissement Public d'Electricite

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

EPE Interconnected System

Firm Thermal (Steam) Generation (1980-1985), Proposed Generation Expansion Program
(GWh)

Station	Effective Ratings (MW)	1980	1981	1982	1983	1984	1985
Hameh	2 x 14 = 28	112	112	112	112	112	112
	1 x 5 = 5	20	20	-	-	-	-
Kattineh	2 x 13 = 26	104	104	104	104	104	104
	3 x 27 = 81	324	324	324	324	324	324
	1 x 60 = 60	196	240	240	240	240	240
Ain Tell (Aleppo)	1 x 13 = 13	52	52	52	52	52	52
	2 x 5.5 = 11	44	-	-	-	-	-
Mehardeh	1 x 142 = 142	639	781	781	781	781	781
	1 x 142 = 142	497	639	781	781	781	781
Banias	1 x 142 = 142	-	-	142	497	639	781
	1 x 142 = 142				355	497	639
Banias Refinery		150	150	150	150	150	150
Sugar Factories		32	32	32	32	32	32
Deir Ez Zor (Paper Mill)		25	25	25	25	25	25
Total Firm Thermal (Steam) Energy		2,195	2,479	2,743	3,453	3,737	4,021

SOURCE: Preliminary Report, Power Development Study, SOFRELEC, June 1977

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

EPE Interconnected System

Energy Balance (1980-1985)

TYPE	1980	1981	1982	1983	1984	1985
Hydro						
Thawra 1/	2,360	2,320	2,280	2,240	2,200	2,160
Other Hydro	40	40	40	40	40	40
Steam Turbine 2/	2,195	2,479	2,743	3,453	3,737	4,021
Combustion Turbine 3/	746	746	746	746	746	746
Total Firm Energy	5,341	5,585	5,809	6,479	7,220	6,967
Required Generation	3,283	3,775	4,342	4,860	5,350	5,880
Available Energy	adequate	adequate	adequate	adequate	adequate	adequate

1/ With 25 billion m^3 flow regulated through Keban Dam (Turkey), see Annex 6, page 2.
2/ Estimated 4,000 hours/a operation for all pre-Mehardeh units. 5,500 hours/a for Mehardeh and Banias.
3/ Estimated 2,000 hours/a operation average for all combustion turbine units.

SOURCE: Preliminary Report, Power Development Study, SOFRELEC, June 1977, and IBRD mission estimates.

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

Development Program Costs, 1/ - 1976-1982
(LS Million)

Local Currency (LC) Cost

Base Prices, 1976	Work in Progress as of Dec. 31, 1976	1977	1978	1979	1980	1981	1982	1976-82	1977-82
I. Generation									
a) Not Subject to Escalation									
Kattineh Reconstruction	6.9	1.0	-	-	-	-	-	7.9	1.0
Hameh Reconstruction	3.0	0.9	0.1	-	-	-	-	4.0	1.0
Combustion Turbine fuel conversion	10.3	0.3	-	-	-	-	-	10.6	0.3
Diesels	2.5	1.5	-	-	-	-	-	4.0	1.5
Bank Projects:									
Mehardeh I & II (986/1144-SYR)	33.5	80.7	71.0	35.1	5.0	-	-	225.3	191.8
Subtotal	56.2	84.4	71.1	35.1	5.0	-	-	251.8	195.6
b) Subject to Escalation									
Kattineh Unit #6	1.5	12.5	25.3	3.0	-	-	-	42.3	40.8
Banias	-	-	15.0	40.0	95.0	42.0	8.0	200.0	200.0
Various minor plants	5.3	3.0	6.0	6.0	2.4	6.0	6.0	34.7	29.4
Subtotal	6.8	15.5	46.3	49.0	97.4	48.0	14.0	277.0	270.2
(Escalation Factor)	-	(0.04)	(0.14)	(0.24)	(0.35)	(0.45)	(0.57)	-	-
Price Contingency	-	0.6	6.5	11.8	34.0	21.6	8.0	82.5	82.5
Total Gen. LC Cost	63.0	100.5	123.9	95.9	136.4	69.6	22.0	611.3	548.3
II. Transmission									
a) Not Subject to Escalation									
66-kV lines, ongoing	22.0	6.4	-	-	-	-	-	28.4	6.4
Bank Projects:									
Loans 986/1144-SYR	13.3	21.6	13.6	1.4	-	-	-	49.9	36.6
Subtotal	35.3	28.0	13.6	1.4				78.3	43.0
b) Subject to Escalation									
230-kV line ongoing	8.5	12.0	4.4	4.0	1.5			30.4	21.9
230-kV lines, new	-	-	-	-	7.5	8.6	10.0	26.1	26.1
230-kV substations, new	-	-	-	-	-	34.0	15.0	49.0	49.0
Dispatching facilities, ongoing	1.9	1.4	12.3	1.3				16.9	15.0
Dispatching facilities, new	-	-	0.5	1.0	1.0	0.5	-	3.0	3.0
66-kV lines, new	-	-	-	-	13.0	5.7	21.0	49.7	49.7
66-kV substations, ongoing	45.0	14.0	2.5	-	-	-	-	61.5	16.5
66-kV substations, new					12.0	23.0	26.0	61.0	61.0
Subtotal	55.4	27.4	19.7	6.3	35.0	81.8	72.0	297.6	242.2
(Escalation Factor)	-	(0.04)	(0.14)	(0.24)	(0.35)	(0.45)	(0.57)	-	-
Price Contingency	-	1.1	2.8	1.5	12.3	36.8	41.0	95.5	95.5
Total Transmission Cost	90.7	56.5	36.1	9.2	47.3	118.6	113.0	471.4	380.7
III. Distribution									
Urban distribution, ongoing	64.0	97.0	110.0	114.0	126.0	135.0	137.0	783.0	719.0
Rural distribution, ongoing	33.0	53.0	15.0	15.0	15.0	-	-	131.0	98.0
Regional Electrification									
Stage I (the Project)	-	-	1.9	72.2	72.2	95.5	-	241.8	241.8
Stage II	-	-	-	-	-	-	80.0	80.0	80.0
Subtotal	97.0	150.0	126.9	201.2	213.2	230.5	217.0	1,235.8	1,138.8
(Escalation Factor)	-	(0.04)	(0.14)	(0.24)	(0.35)	(0.45)	(0.57)	-	-
Price Contingency	-	6.0	17.8	48.3	74.6	103.7	123.7	374.1	374.1
Total Dist. LC Cost	97.0	156.0	144.7	249.5	287.8	334.2	340.7	1,609.9	1,512.9
IV. General Plant									
Total General Plant LC Cost		0.5	0.5	0.5	0.5	0.5	0.5	3.0	3.0
V. Other Investments									
Total Program LC Cost	250.7	313.5	305.2	355.1	472.0	522.9	476.2	2,695.6	2,444.9

1/ Including escalation.

SOURCE: EPE and Mission's estimate.

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REGIONAL ELECTRIFICATION PROJECT

Development Program Costs, 1/ 1976-1982
(LS Million)

Foreign Currency (FC) Costs

Base Prices, 1976	Work in Progress as of Dec. 31, 1976	1977	1978	1979	1980	1981	1982	1976-1982	1977-1982
I. Generation									
a) Not Subject to Escalation									
Kattineh Reconstruction	27.4	4.0	-	-	-	-	-	31.4	4.0
Hameh Reconstruction	22.0	8.1	0.9	-	-	-	-	31.0	9.0
Combustion Turbine Fuel Conversion	17.3	0.5	-	-	-	-	-	17.8	0.5
Diesels	8.2	5.0	-	-	-	-	-	13.2	5.0
Bank Projects:									
Mehardeh I & II (986/1144-SYR)	135.0	141.3	117.9	49.3	9.0	-	-	452.5	317.5
Subtotal	209.9	158.9	118.8	49.3	9.0	-	-	545.9	336.0
b) Subject to Escalation									
Kattineh Unit #6	6.0	33.5	23.5	2.5	-	-	-	65.5	59.5
Banias	-	-	50.0	90.0	215.0	153.0	42.0	550.0	550.0
Various minor plants	3.5	2.0	4.0	4.0	4.0	4.0	4.0	25.5	22.0
Subtotal	9.5	35.5	77.5	96.5	219.0	157.0	46.0	641.0	631.5
(Escalation Factor)	-	(0.04)	(0.12)	(0.20)	(0.29)	(0.38)	(0.47)	-	-
Price Contingency		1.4	9.3	19.3	63.5	59.7	21.6	174.8	174.8
Total Gen. FC Cost	219.4	195.8	205.6	165.1	291.5	216.7	67.6	1,361.7	1,142.3
II. Transmission									
a) Not Subject to Escalation									
230-kV lines, ongoing	24.1	34.8	28.4	-	-	-	-	87.3	63.2
230-kV lines, new	-	-	14.7	26.0	15.7	20.0	20.0	96.4	96.4
60-kV lines, ongoing	20.0	5.6	-	-	-	-	-	25.6	5.6
Bank: Loans 986/1144-SYR	54.8	37.6	22.7	1.8	-	-	-	116.9	62.1
Subtotal	98.9	78.0	65.8	27.8	15.7	20.0	20.0	326.2	227.3
b) Subject to Escalation									
230-kV substation, new	-	-	-	-	-	36.0	15.0	51.0	51.0
Dispatching facilities, ongoing	30.0	13.6	13.3	1.7	-	-	-	58.6	28.6
Dispatching facilities, new	-	-	4.5	9.0	11.0	2.5	-	27.0	27.0
66-kV lines, new	-	-	-	12.0	12.0	17.0	19.0	60.0	60.0
66-kV substations, ongoing	55.0	17.0	11.0	-	-	-	-	83.0	28.0
66-kV substations, new	-	-	-	4.3	13.0	27.0	34.0	78.3	78.3
Subtotal	85.0	30.6	28.8	27.0	36.0	82.5	68.0	357.9	272.9
(Escalation Factor)	-	(0.04)	(0.12)	(0.20)	(0.29)	(0.38)	(0.47)	-	-
Price Contingency	-	1.2	3.5	5.4	10.4	31.4	32.0	83.9	83.9
Total Trans. FC Cost	183.9	109.8	98.1	60.2	62.1	133.9	120.0	768.0	584.1
III. Distribution									
Urban Distribution, ongoing	16.0	23.0	18.0	20.0	22.0	34.0	35.0	168.0	152.0
Rural Distribution, ongoing	10.0	17.0	52.0	52.0	52.0	-	-	183.0	173.0
Regional Electrification									
Stage I (the Project)	-	-	4.7	66.7	66.7	87.9	-	226.0	226.0
Stage II	-	-	-	-	-	-	70.0	70.0	70.0
Subtotal	26.0	40.0	74.7	138.7	140.7	121.9	105.0	647.0	621.0
(Escalation Factor)		(0.04)	(0.12)	(0.20)	(0.29)	(0.38)	(0.47)	-	-
Price Contingency		1.6	9.0	27.7	40.8	46.3	49.4	174.8	174.8
Total Dist. FC Cost	26.0	41.6	83.7	166.4	181.5	168.2	154.4	821.8	795.8
IV. General Plant									
Total General Plant FC Cost		6.0	6.5	7.0	7.5	8.0	8.5	43.5	43.5
V. Other Investments									
Total Other Investments FC Cost			0.2		0.2	0.3	0.5	1.2	1.2
Total Program FC Cost	429.3	353.2	394.1	398.7	542.8	527.1	351.0	2,996.2	2,566.9

1/ Including escalation.

SOURCE: EPE and Mission's estimates.

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REGIONAL ELECTRIFICATION PROJECT

Development Program Costs, 1977-1982
(LS Million)

1976 Base Prices		Work in Progress as of Dec. 31, 1976	1977	1978	1979	1980	1981	1982	Beyond 1982	Total	Total 1977-82
I. Generation (Startup Date)											
1. Steam -											
a) Kattineh reconstruction (120 MW) (end 1977)	LC	6.9	1.0							7.9	1.0
	FC	27.4	4.0							31.4	4.0
	T	34.3	5.0							39.3	5.0
b) Hameh reconstruction (35 MW) (end 1977)	LC	3.0	0.9	0.1						4.0	1.0
	FC	22.0	8.1	0.9						31.0	9.0
	T	25.0	9.0	1.0						35.0	10.0
c) Kattineh #6 (60 MW) (end 1978)	LC	1.5	12.5	25.3	3.0					42.3	40.8
	FC	6.0	33.5	23.5	2.5					65.5	59.5
	T	7.5	46.0	48.8	5.5					107.8	100.3
d) Banias 1 & 2 (300 MW) (1982)	LC			15.0	40.0	95.0	42.0	8.0		200.0	200.0
	FC			50.0	90.0	215.0	153.0	42.0		550.0	550.0
	T			65.0	130.0	310.0	195.0	50.0		750.0	750.0
2. Combustion Turbines (4x80 MW) Conversion to Heavy Fuel (end 1977)	LC	10.3	0.3							10.6	0.3
	FC	17.3	0.5							17.8	0.5
	T	27.6	0.8							28.4	0.8
3. Diesels	LC	2.5	1.5							4.0	1.5
	FC	8.2	5.0							13.2	5.0
	T	10.7	6.5							17.2	6.5
4. Various	LC	5.3	3.0	6.0	6.0	2.4	6.0	6.0		34.7	29.4
	FC	3.5	2.0	4.0	4.0	4.0	4.0	4.0		25.5	22.0
	T	8.8	5.0	10.0	10.0	6.4	10.0	10.0		60.2	51.4
5. Bank Loans 986/1144-SYR Mehardeh I & II	LC	33.5	80.7	71.0	35.1	5.0				225.3	191.8
	FC	135.0	141.3	117.9	49.3	9.0				452.5	317.5
	T	168.5	222.0	188.9	84.4	14.0				677.8	509.3
Total Generation (Unescalated)	LC	63.0	99.9	117.4	84.1	102.4	48.0	14.0		528.8	465.8
	FC	219.4	194.4	196.3	145.8	228.0	157.0	46.0		1,186.9	967.5
	T	282.4	294.3	313.7	229.9	330.4	205.0	60.0		1,715.7	1,433.3

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REGIONAL ELECTRIFICATION PROJECT

Development Program Costs, 1977-1982
(LS Million)

		Work in Progress as of Dec. 31, 1976	1977	1978	1979	1980	1981	1982	Beyond 1982	Total	Total 1977-82
II. Transmission											
1. 230-kV lines, ongoing	LC	8.5	12.0	4.4	4.0	1.5				30.4	21.9
	FC	24.1	34.8	28.4	-	-				87.3	63.2
	T	32.6	46.8	32.8	4.0	1.5				117.7	85.1
2. 230-kV lines, new	LC					7.5	8.6	10.0	10.0	36.1	26.1
	FC			14.7	26.0	15.7	20.0	20.0	20.0	116.4	96.4
	T			14.7	26.0	23.2	28.6	30.0	30.0	152.5	122.5
3. 230-kV substations, new	LC						34.0	15.0	10.0	59.0	49.0
	FC						36.0	15.0	10.0	61.0	51.0
	T						70.0	30.0	20.0	120.0	100.0
4. Dispatching facilities, ongoing (Abu Dhabi financing)	LC	1.9	1.4	12.3	1.3					16.9	15.0
	FC	30.0	13.6	13.3	1.7					58.6	28.6
	T	31.9	15.0	25.6	3.0					75.5	43.6
5. Dispatching facilities, new	LC			0.5	1.0	1.0	0.5			3.0	3.0
	FC			4.5	9.0	11.0	2.5			27.0	27.0
	T			5.0	10.0	12.0	3.0			30.0	30.0
6. 66-kV lines, ongoing	LC	22.0	6.4							28.4	6.4
	FC	20.0	5.6							25.6	5.6
	T	42.0	12.0							54.0	12.0
7. 66-kV lines, new	LC					13.0	15.7	21.0	16.0	65.7	49.7
	FC				12.0	12.0	17.0	19.0	14.0	74.0	60.0
	T				12.0	25.0	32.7	40.0	30.0	139.7	109.7
8. 66-kV substations, ongoing	LC	45.0	14.0	2.5						61.5	16.5
	FC	55.0	17.0	11.0						83.0	28.0
	T	100.0	31.0	13.5						144.5	44.5
9. 66-kV substations, new	LC					12.0	23.0	26.0	23.0	84.0	61.0
	FC				4.3	13.0	27.0	34.0	27.0	105.3	78.3
	T				4.3	25.0	50.0	60.0	50.0	189.3	139.3
10. Bank Loans 986/1144-SYR 230-kV substations	LC	13.3	21.6	13.6	1.4					49.9	36.6
	FC	54.8	37.6	22.7	1.8					116.9	62.1
	T	68.1	59.2	36.3	3.2					166.8	98.7
Total Transmission (Unescalated)	LC	90.7	55.4	33.3	7.7	35.0	81.8	72.0	59.0	434.9	285.2
	FC	183.9	108.6	94.6	54.8	51.7	102.5	88.0	71.0	755.1	500.2
	T	274.6	164.0	127.9	62.5	86.7	184.3	160.0	130.0	1,190.0	785.4

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REGIONAL ELECTRIFICATION PROJECT

Development Program Costs, 1977-1982
(LS Million)

			Work in Progress as of Dec. 31, 1976	1977	1978	1979	1980	1981	1982	Beyond 1982	Total	Total 1977-82
III.	Distribution											
	1. Urban, ongoing program	LC	64.0	97.0	110.0	114.0	126.0	135.0	137.0		783.0	719.0
		FC	16.0	23.0	18.0	20.0	22.0	34.0	35.0		168.0	152.0
		T	80.0	120.0	128.0	134.0	148.0	169.0	172.0		951.0	871.0
	2. Rural, ongoing program	LC	33.0	53.0	15.0	15.0	15.0				131.0	98.0
		FC	10.0	17.0	52.0	52.0	52.0				183.0	173.0
		T	43.0	70.0	67.0	67.0	67.0				314.0	271.0
	3. Regional Electrification Project (The Project)	LC			-	73.0	73.0	97.0			243.0	243.0
		FC			4.7	66.7	66.7	87.9			226.0	226.0
		T			4.7	139.7	139.7	184.9			469.0	469.0
	4. Regional Electrification (Start of second stage)	LC							80.0		80.0	80.0
		FC							70.0		70.0	70.0
		T							150.0		150.0	150.0
	Total Distribution (Unescalated)	LC	97.0	150.0	125.0	202.0	214.0	232.0	217.0		1,237.0	1,140.0
		FC	26.0	40.0	74.7	138.7	140.7	121.9	105.0		647.0	621.0
		T	123.0	190.0	199.7	340.7	354.7	353.9	322.0		1,884.0	1,761.0
IV.	General Plant 1/											
	(Escalated)	LC	-	0.5	0.5	0.5	0.5	0.5	0.5		3.0	3.0
		FC	-	6.0	6.5	7.0	7.5	8.0	8.5		43.5	43.5
		T 2/	-	6.5	7.0	7.5	8.0	8.5	9.0		46.5	46.5
V.	Other Investments											
	(Escalated)	LC										
		FC			0.2		0.2	0.3	0.5		1.2	1.2
		T										

1/ Automotive Equipment, Tools and Work Equipment, Office Furniture and Fixtures, Computer, Laboratory Equipment Uniforms, etc.

2/ Pole Plant and Equipment, various small investments.

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REGIONAL ELECTRIFICATION PROJECT

Summary of Development Program Costs,[1] 1976-1982
(LS Million)

			% [2]	Work in Progress as of Dec. 31, 1976	1977	1978	1979	1980	1981	1982	Total 1976-82	Total 1977-82
I.	Generation	LC	32	63.0	100.5	123.9	95.9	136.4	69.6	22.0	611.3	548.3
		FC	68	219.4	195.8	205.6	165.1	291.5	216.7	67.6	1,361.7	1,142.3
		T	100	282.4	296.3	329.5	261.0	427.9	286.3	89.6	1,973.0	1,690.6
II.	Transmission	LC	43	90.7	56.5	36.1	9.2	47.3	118.6	113.0	471.4	380.7
		FC	57	183.9	109.8	98.1	60.2	62.1	133.9	120.0	768.0	584.1
		T	100	274.6	166.3	134.2	69.4	109.4	252.5	233.0	1,239.4	964.8
III.	Distribution	LC	66	97.0	156.0	144.7	249.5	287.8	334.2	340.7	1,609.9	1,512.9
		FC	34	26.0	41.6	83.7	166.4	181.5	168.2	154.4	821.8	795.8
		T	100	123.0	197.6	228.4	415.9	469.3	502.4	495.1	2,431.7	2,308.7
IV.	General Plant	LC	7		0.5	0.5	0.5	0.5	0.5	0.5	3.0	3.0
		FC	93		6.0	6.5	7.0	7.5	8.0	8.5	43.5	43.5
		T	100		6.5	7.0	7.5	8.0	8.5	9.0	46.5	46.5
V.	Other Investments	LC	-									
		FC	100			0.2	-	0.2	0.3	0.5	1.2	1.2
		T	100			0.2	-	0.2	0.3	0.5	1.2	1.2
	Total Program	LC	47	250.7	313.5	305.2	355.1	472.0	522.9	476.2	2,695.6	2,444.9
		FC	53	429.3	353.2	394.1	398.7	542.8	527.1	351.0	2,996.2	2,566.9
		T	100	680.0	666.7	699.3	753.8	1,014.8	1,050.0	827.2	5,691.8	5,011.8

1/ Including escalation.
2/ Percentage of total 1977-1982 cost.

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REGIONAL ELECTRIFICATION PROJECT

Draft Terms of Reference for

Consulting Services for
Engineering Design and Project Management

I. INTRODUCTION

1.01 Etablissement Public d'Electricite (EPE) is responsible for the supply of public service electricity throughout Syria.

1.02 These terms of reference outline the purpose and scope of consulting services required by EPE for a Regional Electrification Project. The Project is part of a ten-year National Rural Electrification Plan recently approved to provide central station electricity by 1987 to all villages with 100 or more population.

II. GENERAL

2.01 The National Rural Electrification Plan covers about 5,000 villages all over the country. Total poulation to be covered by the Plan is about 3,800,000 taking into account a 3%/a rate of population growth.

2.02 The Plan was formulated following a feasibility report by Consultants (SOFRELEC, France) with World Bank financing. The Plan is programmed to be carried out in three stages: 1978-1981, 1982-1984, and 1985-1987, at a total estimated cost of $522 million (in constant 1977 US dollars).

2.03 The Project is the first stage (1978-1981) of the Plan. It will extend central station service to approximately 1,200 villages, at an estimated cost of US$157 million (including price escalation).

III. OBJECTIVE

3.01 The Consultant would assist EPE in preparing bid documents and specifications and completing engineering designs based on material quantities and cost estimates developed during project appraisal. The Consultants would encourage maximum participation of EPE's personnel in all aspects of the

consultants' work, through a Project unit to be established within EPE's Rural Electrification Department specifically for this purpose.

3.02 In addition to the engineering, supervision, and management services, the Consultant would also assist EPE in developing adequate service extension policies for new customer services within the National Rural Electrification Plan.

3.03 Close work with the Consultant on the Project is expected to strengthen EPE's Rural Electrification Department and develop the skills of local personnel to contribute increasingly to the planning and execution of subsequent stages in the Plan.

IV. SCOPE OF WORK

4.01 USAID will finance the US dollar cost of the engineering consulting service contract for the Phase I Program (1978-1981). During joint discussions in Damascus attended by EPE, IBRD, and USAID, it was agreed that a single consultant would be used for services covering the total Phase I Program, including the medium tension and low-extension distribution systems. This not only will reduce the complexity of contract management by EPE, but will ensure appropriate coordination design and construction functions, smooth the construction consumable procurement process for both IBRD and USAID.

4.02 The contract will be a host-country contract, and include the following:

A. Design Review and Bid Preparation

1. Review the low-tension distribution design, and recommend cost-effective alternatives, if any. Of particular importance during the design review stage is the study of SOFRELEC's low-tension distribution design recommendations. It is possible that some significant reduction in per-village costs can be realized if a single-phase system based on appropriate international standards is utilized in some villages rather than the three-phase system recommended by SOFRELEC. If another alternative is defined by the USAID financed consultant and is acceptable to EPE and IBRD, it is possible that more than the projected 1,200 villages could be electrified by the Project.

2. Recommend a final list of villages to be electrified during the Phase I Program.

3. Based on 1 and 2 above, prepare final system design and complete equipment and materials take-off and cost estimates.

4. Prepare detailed implementation schedule for overall Phase I Program.

5. Review completed and planned high tension distribution system (230-kV lines, 230/66-kV substations, 66-kV transmission and 66/20-kV substations) to verify technical adequacy and availability for providing power to the Project.

6. Prepare equipment and materiel IFB's for Phase I of the Program (IBRD and AID-financed), assist EPE in the bid evaluation of supplier bids, and recommend award to EPE. Documents for IBRD financed procurement will be in accordance with the latest World Bank Group "Guidelines for Procurement".

7. Advise EPE on preparation of construction contract IFB's for the Phase I Program, assist EPE in the analysis and verification of bids, and recommend awards.

B. Construction Management and Supervision

1. Assist EPE in identification of suitable storage space for imported construction consumables.

2. Establish and implement an inventory control system for equipment and materiel receipt, storage, and issuance to construction contractors.

3. Establish a Phase I Program accounting system compatible with EPE's overall accounting system being installed following recommendations by the Management Consultant financed by the IBRD.

4. Supervise construction of Phase I Program works.

5. Assist EPE in preparation of Project Completion Report to fulfill IBRD requirements.

C. Strengthening EPE's Rural Electrification Department

1. Assist EPE in developing effective policies for extension of services to new customers in the National Rural Electrification Plan, compatible with acceptable technical, financial, and socioeconomic criteria.

2. Make optimum use of human and material resources allocated by EPE for the Project through the Project Unit in EPE's Rural Electrification Department. The Consultant shall encourage maximum possible participation by EPE personnel in all Project activities under the Consultant.

3. Assist EPE in developing and establishing a monitoring system to measure and analyze the performance of the National Rural Electrification Plan along the lines suggested in Attachment 1.

V. CONTRACT PERFORMANCE

5.01 The Consultant shall work under the general direction of EPE through a counterpart Project unit specifically established for this Project. EPE shall also assist the Consultant to obtain copies of all studies and reports required for the performance of the Consultants' services.

5.02 The Consultant shall submit a quarterly report to the EPE not later than the 15th of the following month. The quarterly reports shall contain information on the Consultants' activities, listing all personnel employed on the Project during the quarter and the functions they performed. The report shall indicate progress during the quarter toward achieving contract objectives, point out any difficulties or impediments, and recommend suitable remedies.

5.03 As part of Project management and supervision services, the Consultant shall develop detailed construction schedules and suitable monitoring devices including specifically critical path schedules. The Consultant shall review these schedules periodically in connection wtih quarterly reports and recommend steps to ensure keeping the Project on schedule.

5.04 Within a year after start of construction the consultant shall submit to EPE recommendations for the establishment of an information system to gather and process data to evaluate the performance of the National Rural Electrification Plan.

5.05 Within three months of completion of construction the Consultant shall submit to EPE a report summarizing the Project's history, construction costs, results achieved, problems encountered, and lessons learned which may be useful to EPE.

VI. TIMING

6.01 These services are expected to be required over a period of approximately four years, starting in early 1978 with revision of the preliminary design and ending in late 1981, after testing and placing in commercial operation of major facilities being provided and installed under the Project.

VII. PAYMENTS

7.01 Payments for the foreign currency portion of the costs of these services are expected to be made from proceeds of an USAID loan for which the Syrian Government is applying. Local currency costs would be paid in Syrian pounds by EPE.

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

Guidelines for Monitoring the National Rural Electrification Program

General

1. EPE's National Rural Electrification Program is the first major step in rural electrification in Syria. It is essential that a monitoring system be developed to gather extensive data during the execution of the first stage (1979-81) in order that the experience gained can be used in EPE's continuing program.

2. These guidelines have been prepared to serve as the basis for discussions in the development by EPE and its consultants of an appropriate monitoring system.

3. It would seem desirable that the data system be designed to collect the information on a geographical basis using the power system configuration, i.e., data would be gathered for each village, then village data would be totalled by distribution substations, and finally substation data would be totalled by bulk supply point or possibly districts. The loads connected directly to 20-kV feeders would be grouped with the feeder village loads. This would readily permit comparing system area inputs with sales, developing average supply costs, etc. However, the finally selected system would depend on EPE's particular requirements. Similarly, it is obvious that the monitoring system should be designed for computer use in view of the volume of detailed data and the desirability of processing it for various purposes.

Load Data

4. To provide data on rate of load development for different regions under varying economic conditions, as the villages are electrified the following data should be collected by village (data should also be collected for the villages already electrified, to the extent possible);

(i) The growth in number of consumers, demand (kWh and kW) and revenue per consumer (including, if possible, statistical analysis of individual consumer growth) since each village was electrified. Consumers would be classified as follows:

Residential
Commercial
Government and Municipal
Public Lighting
Industrial
Irrigation
Other

(ii) The growth of total village demand (kWh and kW) and revenues.

(iii) The uses to which electricity is put by each category of consumer, indicating information on the types and numbers of appliances installed.

(iv) Information on taxes paid by consumers as part of the electricity bills.

(v) How revenues change over time (for instance does the system load factor and load factor per consumer category improve)?

(vi) Types and number of dwellings and the numbers connected to "networks".

(vii) Trends in socio-economic factors such as:

Population growth
Migratory flow
Household incomes (giving the range as well as the average)
Average number of people per dwelling.

(viii) Details of village infrastructure (e.g. roads, water supply, schools, health centers).

(ix) Details of any new economic activities (commercial, industrial or agricultural) which have developed since the electrification of the village.

(x) The projected demand (kWh and kW), revenue and costs over the next 15-20 years, and justification of the projections.

Cost Data

5. A costing system should be developed so that the following data can be compiled:

(i) Statistical information on transformers, feeder lengths, capacities, etc.

(ii) 66- and 20-kV facility costs by substation, area, line feeder, etc. giving the investment costs for specific load areas.

(iii) Individual village distribution costs and average connection costs for the various consumer categories.

(iv) Purchased power costs for the various areas.

(v) Operating and maintenance costs prorated by village and by other block load.

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REGIONAL ELECTRIFICATION PROJECT

Development of Project Cost Estimates

13.1 Base Cost

	Base Prices Early 1977 LS	Estimated Project Quantities	-----Appraisal Base Cost----- LS '000 Local	Foreign	Total
Materials and Labor					
1. Overhead, three-phase 20-kV primary, per km					
- 50/10 Sq. mm ACSR	25,000	1,455	13,095	23,280	36,375
- 120/20 Sq. mm ACSR	32,000	630	6,800	13,360	20,160
2. Distribution Transformers, 20,000-380/220 V 1/ 3-Phase, per unit rated:					
- 25 kVA	13,300	267	570	2,980	3,550
- 50 kVA	15,700	359	770	4,870	5,640
- 100 kVA	19,700	407	1,280	6,740	8,020
- 200 kVA	47,700	2	40	55	95
- 400 kVA	52,800	14	280	460	740
3. Overhead, 4-wire, 3-Phase, 380/220 V Secondary, 25 & 50 Sq. mm AA, (including streetlighting), per km	88,000 2/	2,910	115,240	140,840	256,080
4. Engineering and Administration			4,820	12,245	17,065
5. Technical Assistance			395	790	1,185
Total Base Cost			143,290	205,620	348,910

1/ Includes high and low voltage switching and protective equipment and LV distribution panels with metering.
2/ Includes service drops, watthour meters, and service entrance equipment for 26 connections/km and streetlights including control and supply circuits.

SOURCE: Preliminary Reports Rural Electrification Study, SOFRELEC, May 1977; and EPE and IBRD Mission estimates.

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REGIONAL ELECTRIFICATION PROJECT

Development of Project Costs '000 LS

13.2 Local Currency Costs

Base Prices, Early 1977	1978	1979	1980	1981	1978-1981
1. Overhead 20-kV Distribution		5,965	5,965	7,965	19,895
2. Distribution Transformers		880	880	1,180	2,940
3. Overhead 380/220 V Distribution and Streetlighting		34,570	34,570	46,100	115,240
4. Engineering and Administration	1,590	955	1,110	1,165	4,820
5. Technical Assistance	150	200	45	-	395
Total Base Cost	1,740	42,570	42,570	56,410	143,290
Physical Contingency	170	4,260	4,260	5,640	14,330
Import Duties		25,360	25,360	33,420	84,140
Subtotal	1,910	72,190	72,190	95,470	241,760
(Escalation Factor)	(0.14)	(0.24)	(0.35)	(0.45)	
Price Contingency	270	17,325	25,265	42,960	85,820
Total Escalated LC Cost	2,180	89,515	97,455	138,430	327,580

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REGIONAL ELECTRIFICATION PROJECT

Development of Project Costs, '000 LS

13.3 Foreign Currency Costs

Base Prices, Early 1977	1978	1979	1980	1981	1978-1981
1. Overhead 20-kV Distribution		11,000	11,000	14,640	36,640
2. Distribution Transformers		4,540	4,540	6,025	15,105
3. Overhead 380/220 V Distribution and Streetlighting		42,250	42,250	56,340	140,840
4. Engineering and Administration	4,045	2,500	2,800	2,900	12,245
5. Technical Assistance	300	395	95	-	790
Total Base Cost	4,345	60,685	60,070	79,905	205,620
Physical Contingency	435	6,070	6,070	7,990	20,565
Subtotal	4,780	66,755	66,755	87,895	226,185
(Escalation Factor)	(0.12)	(0.20)	(0.29)	(0.38)	
Price Contingency	575	13,350	19,360	33,400	66,685
Total Escalation FC Cost	5,355	80,105	86,115	121,295	292,870

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REGIONAL ELECTRIFICATION PROJECT

Development of Project Costs, '000 LS

13.4

Base Prices, early 1977		%	1978	1979	1980	1981	1978-1981
Materials and Labor							
1. Overhead 20-kV Distribution	LC	35		5,965	5,965	7,965	19,895
	FC	65		11,000	11,000	14,640	36,640
	T	100		16,965	16,965	22,605	56,535
2. Distribution Transformers	LC	16		880	880	1,180	2,940
	FC	84		4,540	4,540	6,025	15,105
	T	100		5,420	5,420	7,205	18,045
3. Overhead 380/220 V Distribution and Streetlighting	LC	45		34,570	34,570	46,100	115,240
	FC	55		42,250	42,250	56,340	140,840
	T	100		76,820	76,820	102,440	256,080
4. Engineering and Administration	LC	28	1,590	955	1,110	1,165	4,820
	FC	72	4,045	2,500	2,800	2,900	12,245
	T	100	5,635	3,455	3,910	4,065	17,065
5. Technical Assistance	LC	33	150	200	45	-	395
	FC	67	300	395	95	-	790
	T	100	450	595	140	-	1,185
Import Duties	LC	100	-	25,360	25,360	33,420	84,140
	FC	-	-	-	-	-	-
	T	100	-	25,360	25,360	33,420	84,140
Contingencies:							
Physical	LC	41	170	4,260	4,260	5,640	14,330
	FC	59	435	6,070	6,070	7,990	20,565
	T	100	605	10,330	10,330	13,630	34,895
Price	LC	56	270	4,260	17,325	25,265	85,820
	FC	44	575	6,070	13,350	19,360	66,685
	T	100	845	10,330	30,675	44,625	152,505
Total Escalated Project Cost	LC	53	2,180	89,515	97,455	138,430	327,580
	FC	47	5,355	80,105	86,115	121,295	292,870
	T	100	7,535	169,620	183,570	259,725	620,450

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REGIONAL ELECTRIFICATION PROJECT

Summarized Project Cost Estimate, LS3.95 = US$1.00

13.5

	LS THOUSANDS			US THOUSANDS		
	Local	Foreign	Total	Local	Foreign	Total
1. Overhead 20-kV Distribution	19,895	36,640	56,535	5,040	9,280	14,320
2. Distribution Transformers	2,940	15,105	18,045	740	3,820	4,560
3. Overhead 380/220 V Distribution and Streetlighting	115,240	140,840	256,080	29,175	35,660	64,835
4. Engineering and Administration	4,820	12,245	17,065	1,220	3,100	4,320
5. Technical Assistance	395	790	1,185	100	200	300
Subtotal	143,290	205,620	348,910	36,275	52,060	88,335
Import Duties	84,140	-	84,140	21,300	-	21,300
Physical	14,330	20,565	34,895	3,630	5,210	8,840
Price	85,820	66,685	152,505	21,730	16,880	38,610
Total Project Cost	327,580	292,870	620,450	82,935	74,150	157,085

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REGIONAL ELECTRIFICATION PROJECT

Basic Assumptions used in Development of Project Costs

1. Installation and erection of the project facilities would be by local contractors (80%) and EPE's own service crews (20%).

2. Wood pole construction would be used in areas of difficult access (about 50% of the total) where use of concrete poles would be less practical. Concrete poles for the rest of the project would be pre-stressed concrete (in some cases also spun).

3. A single distribution transformer would serve one village. The transformer would incorporate HV and LV protection and a LV distribution board.

4. About half of the 380/220 V conductors would be weatherproof (service drops and conductor protection).

5. Account was taken of the probability that procurement through tied financing (USAID) would make costs for some items higher by 20-30% over similar procurement under international competitive bidding (ICB).

6. Overall project costs are not unreasonable given the widely dispersed project areas and terrain difficulties.

7. Breakdown of costs and origin of foreign currency follows:

	US$ Million			
	LC	FC		Total
		IBRD	USAID	
A. Materials & Equipment				
Imported Materials (20-kV*	-	11.4	-	11.4
and Equipment (380/220 V	-	6.8	21.0	27.8
Local Supply (20-kV	1.0	0.3	-	1.3
Materials and Equipment (380/220 V	7.0	2.0	-	9.0
Total Materials and Equipment	8.0	20.5	21.0	49.5
B. Installation & Erection				
Contracts (20-kV **	4.8	1.4	-	6.2
(380/220 V	16.8	4.4	-	21.2
Force Account (380/220 V)	5.4	1.5	-	6.9
Total Installation & Erection	27.0	7.3	-	34.3
C. Engineering Consultants	1.2	-	3.1	4.3
D. Technical Assistance	0.1	0.2	-	0.3
Total Project Base Cost	36.3	28.0	24.1	88.4

* Includes 20/0.4-kV distribution transformers.
** See page 5 of this Annex for applicable contingencies.

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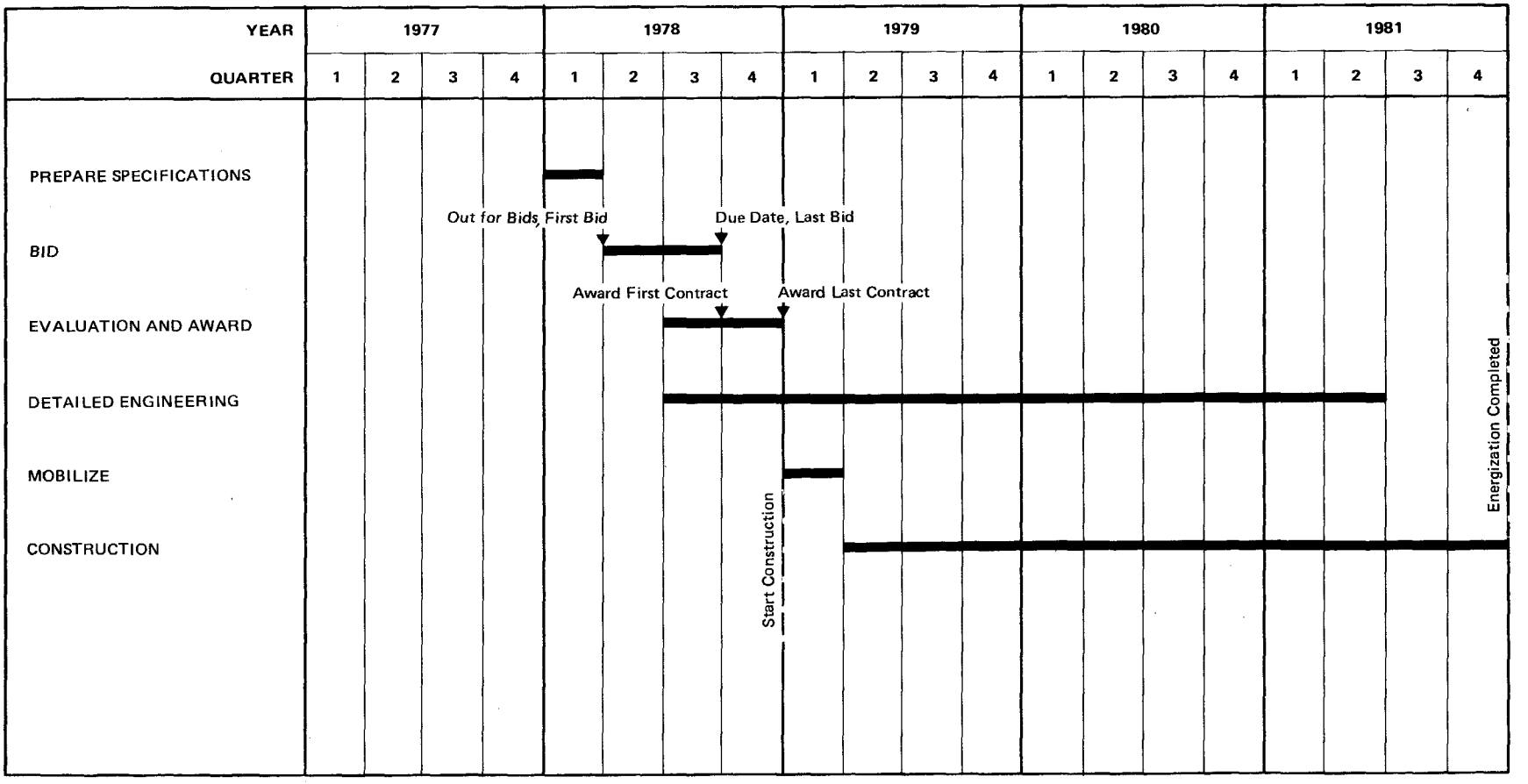
REGIONAL ELECTRIFICATION PROJECT
ESTIMATED PROJECT IMPLEMENTATION SCHEDULE



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ANNEX 15

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REGIONAL ELECTRIFICATION PROJECT

Estimated Disbursement Schedule

(Assumed Loan Effective July 1, 1978)

Bank Fiscal Year and Quarter	-------US$ Million-------- Cumulative Disbursement At the end of the Quarter
1978/1979	
September 30, 1978	-
December 31, 1978	-
March 31, 1979	11
June 30, 1979	15
1979/1980	
September 30, 1979	19
December 31, 1979	23
March 31, 1980	27
June 31, 1980	31
1980/1981	
September 30, 1980	35
December 31, 1980	38
March 31, 1981	40

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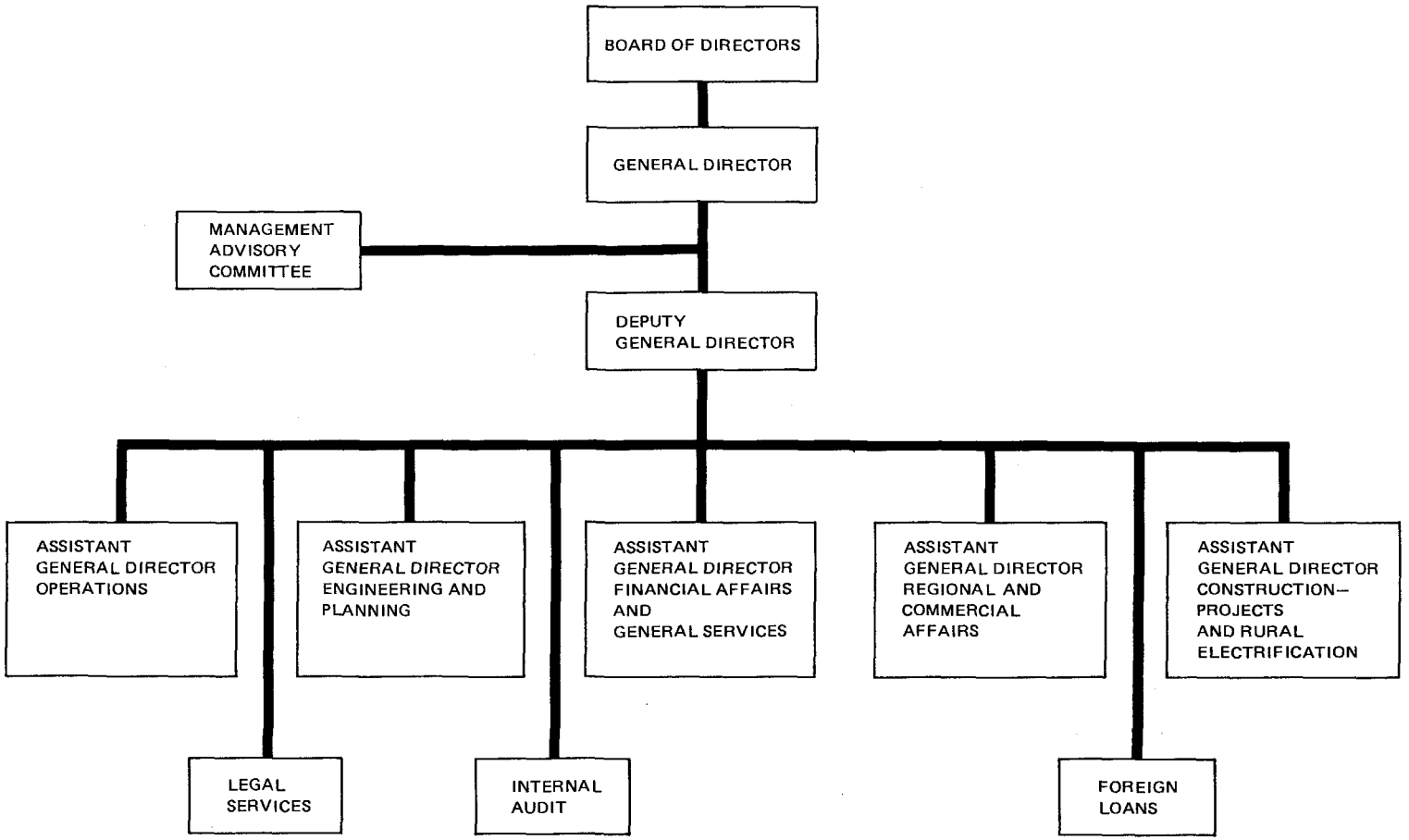
REGIONAL ELECTRIFICATION PROJECT
EPE ORGANIZATION CHART



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REGIONAL ELECTRIFICATION PROJECT

EPE Manpower Development
Forecast Needs up to 1981
(not annual recruitment figures)

Categories of staff and their educational standard	YEAR 1975 *	YEAR 1976	YEAR 1977	YEAR 1978	YEAR 1979	YEAR 1980
Management and engineering university graduates	503	713	823	911	992	1058
Higher technicians from post-secondary institutes (diplomates)	348	764	1075	1211	1345	1452
Technicians from general and technical secondary schools (baccalaureat)	1250	2057	2757	3013	3273	3578
Skilled workers from lower-secondary schools (brevet)	934	1591	1884	2200	2446	2808
Unskilled and laborers from primary schools	6644	8014	9234	10184	11237	12140
TOTALS	9679	13139	15773	17519	19293	21036

Note 1: The ratio of engineers to higher technicians was excessively high in 1975, but the planned increase in technician level staff will redress this imbalance gradually.

Note 2: Most of these additional diploma level staff will be trained in the Institut Moyen

* 1975 figures are actual.

SOURCE: Etablissement Public d'Electricite

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REGIONAL ELECTRIFICATION PROJECT

Balance Sheets for the Years Ended December 31, 1972-1982

LS Millions LS 3.95 = US$1

	ACTUAL					ESTIMATED	FORECAST				
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
ASSETS											
FIXED ASSETS											
Gross Fixed Assets in Service	344.6	351.9	482.7	727.9/8	965.9	1,437.9	2,328.2	4,063.8	4,881.8	5,868.2	7,101.3
Less: Accumulated Depreciation	103.6	116.6	140.9	160.8	206.6	276.3	378.7	630.6	857.4	1,137.3	1,483.2
Net Fixed Assets in Service /1	241.0	235.3	341.8	567.1	759.3	1,161.6	1,949.5	3,433.2	4,024.4	4,730.9	5,618.1
Work in Progress	31.8	113.0	166.6	172.6	625.2	828.6	1,061.1	806.6	1,345.6	1,830.4	1,932.2
Total Net Electric Assets	272.8	348.3	508.4	739.7	1,384.5	1,990.2	3,010.6	4,239.8	5,370.0	6,561.3	7,550.3
Other Investments	.3	.7	.3	.3	.3	.3	.5	.5	.7	1.0	1.5
Total Fixed Assets	273.1	349.0	508.7	740.0	1,384.8	1,990.5	3,011.1	4,240.3	5,370.7	6,562.3	7,551.8
CURRENT ASSETS											
Cash	9.3	32.8	21.1	67.1	63.7	63.7	103.6	93.6	127.2	141.3	175.0
Accounts Receivable - Electric	40.6	44.8	53.3	65.7	70.4	103.7	70.0	99.4	140.4	197.7	231.2
Pre-1973 Municipal Accounts /2	4.4	4.4	4.4	4.4	4.4	4.4	-	-	-	-	-
Inventories	51.2	71.9	69.2	93.8	96.9	100.0	125.0	137.0	300.0	287.0	258.1
Sundry Debit Accounts /3	87.5	88.1	87.3	192.3	194.0	195.0	233.2	238.5	248.9	250.9	250.5
Total Current Assets	193.0	242.0	235.3	423.3	429.4	466.8	531.8	568.5	816.5	876.9	914.8
TOTAL ASSETS	466.1	591.0	744.0	1,163.3	1,814.2	2,457.3	3,542.9	4,808.8	6,187.2	7,439.2	8,466.6
EQUITY AND LONG TERM DEBT											
EQUITY											
Government Formation /4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
Government Transfer of Thawra Assets /5	-	-	-	-	-	-	400.0	400.0	400.0	400.0	400.0
Government Construction Grants /6	56.4	96.0	244.5	628.5	1,183.0	1,594.7	1,944.7	2,144.7	2,594.7	2,944.7	3,144.7
Customer Contributions	57.5	60.1	65.6	74.7	86.7	93.7	101.3	109.7	118.5	127.5	136.7
Reserve for Revaluation	-	-	-	-	-	-	-	577.4	852.1	1,174.0	1,552.4
Replacement and Termination Reserve	18.9	21.0	39.5	48.8	30.4	37.3	46.6	61.7	80.4	106.0	139.9
Accumulated Surplus	152.0	171.4	155.7	131.1	112.0	111.4	122.7	241.9	455.9	716.8	1,028.2
Surplus for Year	19.4	(15.7)	(24.6)	(19.1)	(0.6)	11.3	119.2	214.0	260.9	311.4	377.1
Total Equity	329.6	358.2	506.1	889.4	1,436.9	1,873.8	2,759.9	3,774.8	4,787.9	5,805.8	6,804.4
LONG TERM DEBTS											
IBRD - Loan No. 986-SYR	-	-	-	5.6	52.1	86.9	111.4	118.9	111.0	101.8	91.3
- Loan No. 1144-SYR	-	-	-	-	25.3	166.0	237.7	260.1	266.1	259.8	253.0
- Proposed Loan	-	-	-	-	-	-	-	90.9	150.1	151.9	139.7
Kuwait Fund	-	-	-	6.5	7.0	25.5	78.7	90.1	90.4	76.8	63.2
Foreign Promissory Notes	45.7	89.1	93.6	98.3	99.5	96.3	58.5	43.0	29.5	19.4	12.4
Future Foreign Loans /7	-	-	-	-	-	-	54.0	158.2	425.9	629.5	689.1
Abu Dhabi Credit	-	-	-	-	9.9	24.9	41.5	44.7	41.3	37.9	34.5
ATD	-	-	-	-	-	-	5.5	46.6	86.1	135.1	135.1
Total Long Term Debt	45.7	89.1	93.6	110.4	193.8	399.6	587.3	852.5	1,200.4	1,412.2	1,418.3
CURRENT LIABILITIES											
Accounts Payable - Supplies	7.4	9.5	18.9	28.6	39.0	42.0	20.0	15.0	20.0	25.0	30.0
- Other	94.3	63.3	147.1	147.0	150.0	150.0	100.0	90.0	100.0	110.0	120.0
Customer Security Deposits	10.8	11.6	14.4	21.4	24.5	26.9	29.4	32.0	34.7	37.5	40.4
Other Current Liabilities /9	(21.7)	59.3	(36.1)	(33.5)	(30.0)	(35.0)	46.3	44.5	44.2	48.7	53.5
Total Current Liabilities	90.8	143.7	144.3	163.5	183.5	183.9	195.7	181.5	198.9	221.2	243.9
TOTAL EQUITY AND LONG TERM DEBT	466.1	591.0	744.0	1,163.3	1,814.2	2,457.3	3,542.9	4,808.8	6,187.2	7,439.2	8,466.6
DEBT EQUITY RATIO	12:88	20:80	16:84	11:89	12:88	18:82	19:81	19:81	19:81	20:80	18:82

/1 Assets shown at "Book Cost" 1972-1978, assets revalued 1979-1982 and offset by reserve for revaluation under "Equity".
/2 Assumes Government action to clear the receivables from municipalities.
/3 Sales of generators to military, hospitals, etc. and miscellaneous debits to pole plant for manufacturing poles.
/4 Theoretically repayable (with interest) if surplus funds are available.
/5 Assumes transfer of Thawra Hydroelectric assets to EPE as Government equity contributions.
/6 Same as /4 but without interest.
/7 Includes notes EPE has submitted to Government for approval.
/8 Completed work transferred from work in progress (LS238.0)
/9 Includes Net Regional Balances, and, from 1978, Long Term Debt payable within one year.

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REGIONAL ELECTRIFICATION PROJECT

Income Statements for the Years Ended December 31, 1972-1978

LS Millions LS3.95 = US$1

	ACTUAL					ESTIMATED	FORECAST				
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Purchased Power - GWh	11	119	408	729	1,200	1,620	- /8	-	-	-	-
Generated: Thermal - GWh	989	892	651	552	308	262	294	531	1,061	1,546	2,108
Hydroelectric - GWh	62	17	31	28	29	32	1,900	2,290	2,290	2,290	2,290
Total Purchased and Generated GWh	1,062	1,028	1,090	1,309	1,537	1,914	2,194	2,821	3,351	3,836	4,398
Sales GWh	837	816	934	1,102	1,320	1,638	1,903	2,449	2,910	3,333	3,823
Average Sales Price P(S) kWh	12.1	12.9	12.9	12.7	12.7	13.4	14.1	15.7	18.8	23.3	23.8
Revenues: Sales of Electricity /1	100.9	104.9	121.2	139.9	167.6	219.5	267.5	384.9	548.5	777.6	911.1
Other Electrical Income /2	9.3	9.9	2.8	14.5	12.0	12.0	12.5	12.5	13.0	13.0	13.5
Total Operating Revenues	110.2	114.8	124.0	154.4	179.6	231.5	280.0	397.4	561.5	790.6	924.6
Expenses:											
Personnel /3	33.1	37.0	52.8	66.5	76.0	87.0	100.0	120.0	130.0	140.0	150.0
Fuel	23.4	14.9	33.3	38.9	11.4	5.7	6.4	11.0	15.3	23.1	30.5
Purchased Power	.9	10.3	23.9	11.5	18.4	24.3	-	-	-	-	-
Materials	5.8	8.6	8.6	11.3	12.1	12.0	12.0	12.0	12.5	13.5	14.4
Water, Electricity /4	3.9	4.0	2.8	2.7	-	-	-	-	-	-	-
Administrative & Transport	2.5	2.2	2.6	4.1	4.2	4.4	4.7	5.0	5.3	5.5	5.8
Taxes /5	7.6	1.3	.8	1.6	1.3	1.5	1.5	1.7	1.7	1.9	2.0
Mosques & Churches - Free Supply /6	.9	.9	.9	.9	.9	1.0	1.2	1.2	1.2	1.3	1.3
Depreciation	11.7	13.2	26.6	35.0 /9	45.8	69.7	102.4	141.3	176.3	211.3	254.9
Total Expenses	89.8	92.4	152.3	172.5	170.1	205.6	228.2	292.2	342.3	396.6	458.9
Net Operating Revenue	20.4	22.4	(28.3)	(18.1)	9.5	25.9	51.8	105.2	219.2	394.0	465.7
Other Income and Expenses											
Interest Expense	(.1)	-	(2.5)	(1.2)	(13.2)	(16.9)	(35.7)	(52.9)	(73.7)	(88.5)	(94.0)
Less Interest Charged to Capital	-	-	-	-	6.6	8.7	23.7	39.3	17.2	31.0	38.8
Net Interest	(.1)	-	(2.5)	(1.2)	(6.6)	(8.2)	(12.0)	(13.6)	(56.5)	(57.5)	(55.2)
Interest Income	.5	.5	10.1	3.8	.5	.5	.5	.5	.5	.5	.5
Government Subsidy /7	-	-	-	-	-	-	88.2	137.0	116.4	-	-
Extraordinary Income/(Loss)	.3	(36.5)	(1.3)	(1.3)	.5	-	-	-	-	-	-
Income from Operations	21.1	(13.6)	(22.0)	(16.8)	3.9	18.2	128.5	229.1	279.6	337.0	411.0
Less Reserves: Termination	(.5)	(.9)	(1.4)	(1.1)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Replacement	(1.2)	(1.2)	(1.2)	(1.2)	(3.5)	(5.9)	(8.3)	(14.1)	(17.7)	(24.6)	(32.9)
Total Reserves	(1.7)	(2.1)	(2.6)	(2.3)	(4.5)	(6.9)	(9.3)	(15.1)	(18.7)	(25.6)	(33.9)
Retained Surplus for Year	19.4	(15.7)	(24.6)	(19.1)	(.6)	11.3	119.2	214.0	260.9	311.4	377.1
Average Net Fixed Assets in Service	183.6	179.4	225.7	384.3	582.5	870.3	1,556.6	2,691.4 /10	3,728.8	4,377.7	5,174.5
Rate of Return	11.1	12.5	-	-	1.6	3.0	3.3	3.9	5.9	9.0	9.0

/1 Assumes tariff increases in 1979, 1980, 1981, 1982.
/2 Meter rents, income from works for consumers, manufacture of concrete poles, etc.
/3 Includes training school staff from 1976.
/4 Electricity used by EPE from 1976 deducted from sales.
/5 Assumes that EPE will continue to be exempt from income taxes.
/6 Equivalent amounts included in revenues.
/7 Assumed at 100% (1978), 70% (1979) and 40% (1980) of the difference between a 9% rate of return and the net operating income based on 1977 tariffs.
/8 Assumes transfer of Thawra assets to EPE.
/9 Adjusted for additions to plant transferred from work-in-progress.
/10 Revalued assets.

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Main Assumptions for the Financial Forecasts 1977-1982

The independent auditors (Talal Abu-Ghazaleh & Co.) have not completed the 1976 audit as of this date. The final audit report could change the financial data shown as actual. EPE has not closed its books for 1977; the accounts are subject to final closing and to adjustments.

Balance Sheet

1. Gross Fixed Assets: Carried at "Book Value" through 1978 and revalued from 1979-1982. Consultants recommended revaluation based on "replacement" costs. For proforma purposes the electric assets in service as of 1978 were revalued on indexes of cost based on original installation dates. Assets installed after 1978 are revalued annually by 8% estimated to be the annual inflation rate for costing replacement. Actual revaluing procedures will be implemented by the consultants in establishing the recommended utility accounting system for EPE.

2. Depreciation: The applied depreciation is for rate making purposes as opposed to the rates fixed by law, which are on the high side. The applied annual rates are:

    Building 3%
    Hydro generating facilities 3.5%
    Thermal plants 4%
    Combustion turbines 6.6%
    Diesel generating units 4.5%
    Transmission and distribution 3.5%
    General Plant 3.2%

3. Accounts Receivable: As of the end of 1976 the receivables averaged 160 days, this is reduced to about 90 days as of the end of 1982 assuming that the Government will pay promptly their accounts.

4.	Inventories:	Annual increases from 1972-1977 reflect the frequent maintenance requirements of the diesel and combustion turbines. The increase in 1980 is attributed to the required spare parts and inventories necessary to the operation of the Mehardeh power plant going into operations.
5.	Accounts Payable:	Assumed at 2 months fuel costs and approximately 1 month's local construction costs.
6.	Equity from Government:	Assuming that the Thawra hydro assets will be transferred as Government's equity contributions.
7.	Construction Grants:	From the budgets approved by the Government of Syria, includes "grants in kind" and cash grants which are reported net of EPE repayments.
8.	Long-Term Debt:	Includes outstanding loans signed, loans to be signed, and loans being negotiated for the Banias Power Station.

Income Statements

9.	Electricity Sales:	See Annex 8.
10.	Electricity Revenues:	Assumes tariffs increase effective January 1, 1979, 1980, 1981 and 1982 in accordance with the agreement reached during negotiations (para. 5.11). Assets are revalued in 1979 and require annual revaluation 1980-1982 due to inflation.
11.	Personnel Costs:	Staffing is estimated to increase from the present 13,000 employees to approximately 22,000 employees in 1982; revenues from sales per employee is expected to increase from the present 16,000 LS to 43,200 LS in 1982. Average salary increases are estimated at 8% annually from 1978-1982.
12.	Fuel Costs:	Calculated on the expected requirements for each station (Annex 10) at the existing fuel prices established by the Government of Syria. A "ratchet" clause for fuel adjustments will be incorporated in the tariff proposals of OCS for automatic fuel cost adjustments to reflect the Government's policies of fuel pricing
13.	Income Tax:	No corporate income tax is payable by EPE as from 1973, only minor taxes are applied.

ANNEX 21

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REGIONAL ELECTRIFICATION PROJECT

Sources and Applications of Funds

LS Millions LS3.95 = US$1

	FORECAST					TOTAL
	1978	1979	1980	1981	1982	1978-1982
SOURCES						
Internal Cash Generation						
Net Operating Revenues	51.8	105.2	219.2	394.0	465.7	1,235.9
Other Income	.5	.5	.5	.5	.5	2.5
Depreciation	102.4	141.3	176.3	211.3	254.9	886.2
Internal Cash Generation	154.7	247.0	396.0	605.8	721.1	2,124.6
Government Subsidy	88.2	137.0	116.4	-	-	341.6
CAPITAL						
Decrease (Increase) in Working Capital (Excluding Cash)	(62.1)	(61.7)	(199.4)	(31.3)	10.8	(343.7)
Consumer's Contributions & Deposits	10.1	11.0	11.5	11.8	12.1	56.5
Government Capital Contributions	350.0	200.0	450.0	350.0	200.0	1,550.0
Subtotal Capital	298.0	149.3	262.1	330.5	222.9	1,262.8
LONG TERM BORROWING						
IBRD Loan 986-SYR	31.6	14.2	-	-	-	45.8
1144-SYR	78.9	27.7	11.8	-	-	118.4
Proposed Loan	-	90.9	59.2	7.9	-	158.0
Kuwait Fund	70.2	25.0	13.9	-	-	109.1
Abu Dhabi Credit	20.0	6.6	-	-	-	26.6
Future EPE Borrowing for Banias	54.0	104.2	267.7	203.6	59.6	689.1
AID Loan	5.5	41.1	39.5	49.0	-	135.1
Subtotal Long Term Borrowing	260.2	309.7	392.1	260.5	59.6	1,282.1
TOTAL SOURCES	801.1	843.0	1,166.6	1,196.8	1,003.6	5,011.1
APPLICATIONS						
Construction Costs						
The Project	7.6	169.6	183.6	259.7	-	620.5
Other	691.7	584.2	831.2	790.3	827.2	3,724.6
Subtotal Construction Costs	699.3	753.8	1,014.8	1,050.0	827.2	4,345.1
DEBT SERVICE						
Interest						
IBRD Loan 986-SYR	7.4	9.1	9.1	8.6	7.9	42.1
1144-SYR	13.4	18.5	23.0	22.7	22.2	99.8
Proposed Loan	3.7	7.5	12.1	13.4	13.2	49.9
Kuwait Fund	3.1	4.0	4.2	3.8	3.2	18.3
Abu Dhabi Credit	1.8	2.1	2.0	1.9	1.7	9.5
Existing Foreign Promissory Notes	4.6	4.5	4.4	4.3	4.2	22.0
Future EPE Borrowing for Banias	1.6	6.3	17.2	31.0	38.8	94.9
AID Loan	.1	.9	1.7	2.8	2.8	8.3
Subtotal Interest	35.7	52.9	73.7	88.5	94.0	344.8
AMORTIZATION						
IBRD Loan 986-SYR	1.2	5.9	6.7	7.9	9.2	30.9
1144-SYR	2.3	4.9	5.3	5.8	6.3	24.6
Proposed Loan	-	-	-	-	6.1	6.1
Kuwait Fund	3.4	13.6	13.6	13.6	13.6	57.8
Abu Dhabi Credit	-	3.4	3.4	3.4	3.4	13.6
Existing Foreign Promissory Notes	19.3	18.5	15.5	13.5	10.1	76.9
Subtotal Amortization	26.2	46.3	44.5	44.2	48.7	209.9
TOTAL DEBT SERVICE	61.9	99.2	118.2	132.7	142.7	554.7
SUBTOTAL	761.2	853.0	1,133.0	1,182.7	969.9	4,899.8
CHANGE IN CASH	39.9	(10.0)	33.6	14.1	33.7	111.3
TOTAL APPLICATIONS	801.1	843.0	1,166.6	1,196.8	1,003.6	5,011.1
Cash at Start of Period	63.7	103.6	93.6	127.2	141.3	63.7
Cash at End of Period	103.6	93.6	127.2	141.3	175.0	175.0
Times Debt Service Covered by Internal Cash Generation	2.5	2.5	3.4	4.6	5.1	-

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Load Forecast for Project and Program

1. The load forecast for the ten year rural electrification plan and the Project are identical for the first three years, since the latter is the first phase of the former. After the first three years, the load forecast of the plan includes the load of the villages electrified in the second phase. Finally the expected load of the villages to be electrified in the third phase are added to form the load forecast for the plan. The forecast comprises the demand for electricity for rural domestic use, public lighting, small commercial enterprises and street lighting. The agro-industries demand is not addressed because of the lack of a development plan for the sector from which future loads can be determined. Private irrigation pumping in Syria depends primarily on diesel as a source of energy. This dependency is caused by the present pricing policy which undervalues energy sources relative to their respective opportunity costs to the economy. If the price of diesel fuel is not increased to reflect the fuel's economic value relative to the value of the residual oil used by EPE generating plant, there would be no financial incentive for private irrigation pumping to switch to electricity. Since there are no indications that revaluation of diesel prices will be forthcoming, at least until the power development study is completed, the load forecast does not include private irrigation pumping as a component. However, the load forecast for EPE's system includes the load expected for the public irrigation pumping projects.

2. The load forecast is based on three parameters (averages). These were determined from samples because of the lack of adequate and comprehensive village statistics. The parameters are:

(a) initial rate of connection;

(b) initial consumption level;

(c) the rate of growth of demand.

Two samples of unequal numbers of villages were used. The first sample consisted of 94 villages individually supplied by local diesel generators. The second sample consisted of 73 centrally supplied villages. All villages selected had access to electricity for more than five years (Attachment 1).

Initial Rate of Connection

3. The initial rate of connection refers to the number of subscribers that are provided service during the first year of electrification. It was 57% for the centrally supplied villages and 52% for the villages supplied by

isolated systems. The difference is largely attributed to the villages of the Mohafazah of Damascus with a high connection rate of 90%. The high rate is due to two factors that are unique to the Mohafazah. These are:

(a) the accessibility of the villages to EPE's service connection teams because of their proximity to the capital area; and

(b) the per capita income of the inhabitants of the Mohafazah is higher relative to the other Mohafazat because of the composition of its labor force of which 30% are employed in sectors other than the agriculture sector (public sector, small industries, etc.).

4. In determining the initial connection rate for the Project, the villages in the Mohafazah of Damascus were ignored because of the pronounced difference between the economic conditions of villages in the Mohafazah relative to the rest of rural Syria. However, the same villages were included in determining the initial consumption level used in the forecast (para. 6). The initial connection rate for all of Syria excluding the Mohafazah of Damascus ranged from 30% to 50%. To compensate for possible sampling errors, a 50% average initial rate of connection was used for all the Mohafazat with the exception of Aleppo and Adlib with a rate of 48% and Deraa and Soueda with a rate of 38%.

Average Initial Level of Consumption

5. The initial consumption level refers to the average consumption per subscriber in the first year of electrification. The consumption for the villages supplied from the public grid was higher than that of the villages supplied by the isolated systems. The former had an average consumption level of 611 kWh/year, while the latter had an average consumption of 415 kWh/year (Attachment 1). The difference is primarily attributed to the inability of the isolated systems to expand their respective capacities to meet the growth in their respective demands.

6. The average consumption data used in the forecast is that of the publicly supplied villages because they are more indicative of the consumption patterns of consumers supplied from the centralized grid. However, the average of these villages was high (611 kWh/year) because the sample included the Mohafazah of Damascus. Consequently, two averages were used in the forecast, one for the villages of the Mohafazah of Damascus to be electrified by the Project and the other for the rest of the Mohafazat. Furthermore, the average initial consumption, with the exception of the Mohafazah of Damascus, was reduced by about 30% from 413 kWh to 300 kWh per year. This, it was felt, would cushion against any cross regional differences that might not have been detected in the statistical analysis.

The Average Rate of Growth of Demand

7. The rate of growth of demand denotes the average yearly rate at which demand for electricity increases over a 30 year period. The data collected supports the following growth scenario:

Table I

Year	1	2	3	4	5	6	7	8	9	10-30
Rate of Growth in %	55	35	27.5	22.5	20.0	19.0	18.0	17.0	16.0	14.0

8. The yearly rate of growth for each of the first seven years is based on the experience of the Syrian villages electrified since 1968. The forecast of the growth rate of 14% per year for the rest of the period is based on the growth experiences of the rural areas in industrialized nations. The higher rate assumed for Syria is justified because, although the rural population in industrialized countries and in Syria are growing at an annual rate of 1%, the development of the rural areas in Syria is at the take off stage while that of the industrialized countries has already reached a relatively steady state of economic growth.

9. An 18.2% rate of exponential rate of growth of rural demand for electricity yields the same forecast as that of the varying growth rates. The use of a single rate of growth facilitates load forecasting. The uniform rate (18.2%) is not inconsistent with the average rates of growth experienced in other countries. Table II below presents some of the rates that were observed in other developing countries.

Table II

Average Rate of Growth of Demand for Electricity by Rural Population in other Developing Nations

Rate Based on Less than 10 Years		Rate Based on More than 10 Years	
Country	% Growth	Country	% Growth
Iran	22.3	Thailand	12-20
Kuwait	24.3	Costa Rica	20.0
Bahrain	26.0	El Salvador	20.0
Abu Dhabi	43.7	India	15.0
Ethiopia	40.0		

Summary of Assumptions Relating to the Forecast

10. The assumptions used in developing the forecast of the load associated with the Project and the ten-years rural electrification plan are:

(a) An average initial subscription rate in the first year of electrification of 50% for all the regions with the exception of Deraa and Soueda with a rate of 38% and Aleppo and Idlib with a rate of 48%.

(b) An initial consumption per capita of approximately 50 kWh/capita/year for all the regions except Damascus where the level was set at 100 kWh/capita/year.

(c) A rate of growth over the life of the Project or plan of 18.2% per year.

(d) An average number of 6 persons per connection.

The load forecast associated with the low voltage customers in Syria is presented in Attachment 2. Attachments 3 and 4 summarize the forecast of demand for the Project and the plan respectively.

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Summary of Data Collected from Electrified Villages in 1976-1977

Regions	Type of Supply	Rate of Initial Connection in the first year	Average level of Consumption per Connection in kWh	Initial level of Consumption per Connection in kWh	Average rate of growth of Consumption in % (average of 5 years)	Declared Average Income per Family in S.L.(1977)	Expenditure on electricity as % of Income (1977)
Aleppo	Grid	48	400	422	-	10,000	0.8
Damascus	Grid	90	1,176	1,047	47.0	15,000	1.5
Hama	Grid	52	759	601	47.9	7,960	1.8
Homs	Grid	44	401	352	42.0	9,000	1.1
Idlib	Grid	48	320	280	-	9,000	0.4
Weighted average for Grid		57	611.0	540*	46.7	-	-
Aleppo	Diesel	49	283	260	18.0	10,000	0.7
Daraa	Diesel	27	310	196	32.0	3,200	2.3
Deir ez Zor	Diesel	30	482	236	22.8	7,125	1.6
Hama	Diesel	-	414	227	29.3	7,960	1.3
Hassakeh	Diesel	62	678	451	22.0	12,000	1.4
Homs	Diesel	-	304	-	23.8	9,000	0.8
Idlib	Diesel	37	152	135	15.7	9,000	0.4
Latakia	Diesel	60	480	-	9.4	3,625	3.2
Raqqa	Diesel	81	-	-	6.4	12,750	-
Soueida	Diesel	49	123	160	16.4	5,500	.5
Tartous	Diesel	82	729	191	24.4	11,250	1.6
Weighted average for diesel		52.5	415.0	240.0	20.2		

* Average including Damascus region. If the region is removed the average is equal to 415 kWh.

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Forecast of Low Voltage Demand By End Use 1977-1985

L.V. Consumer	1977	1978	1979	1980	1981	1982	1983	1984	1985
Existing Rural:	GWh	GWh	GHh	GWh	GWh	GWh	GWh	GWh	GWh
a. Agro-Industry	13	15	17	19	21	23	26	29	32
b. Lighting	10	13	16	24	33	40	43	45	46
c. Commercial	9	10	12	16	20	23	25	27	29
d. Government & Street Lighting	11	12	15	20	25	28	31	33	36
Total Existing	43	50	60	79	99	114	125	134	143
Ongoing Rural: (Government)									
a. Lighting	1.5	2.0	2.6	3.2	4.6	4.9	5.7	6.1	6.2
b. Commercial	0.6	0.8	1.0	1.3	1.7	1.8	2.1	2.2	2.3
c. Government & Street Lighting	0.9	1.2	1.6	1.9	2.4	2.5	2.7	2.8	2.8
Total	3.0	4.0	5.2	6.4	8.7	9.2	10.5	11.1	11.3
New Rural: (Project)									
a. Lighting	-	-	8.9	18.5	31.8	48.3	67.2	88.7	112.9
b. Commercial	-	-	2.2	4.6	8.0	12.1	16.8	22.2	28.2
c. Government & Street Lighting	-	-	4.7	9.5	15.5	22.4	29.5	37.0	44.6
Total	-	-	15.8	32.6	55.3	82.8	13.5	147.9	185.7
Urban:									
a. Lighting	164.0	179.0	198.0	220	237	261	292	326	364
b. Commercial	245.0	268.0	295.0	330	356	391	437	489	547
c. Government	64.0	74.0	84.0	97	111	125	136	149	162
d. Street Lighting	31.0	34.0	37.0	45	51	57	62	68	74
Total	504.0	555.0	614.0	692	755	836	927	1,032	1,147
L.V. Energy Demand	276	330	370	414	464	520	583	653	732

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Load Forecast for Project in (GWh) 1979-2008

No.	Year	Load Forecast for Villages electrified in the first year of Project	Load Forecast for Villages electrified in the second year of Project	Load Forecast for Villages electrified in the third year of Project	Total Yearly Forecast for Project	Total Population of Villages included in the Project	kWh Consumed per Capita
1	1979	15.8			15.8	308,076	51.3
2	1980	22.1	10.5		32.6	564,137	57.6
3	1981	28.7	14.6	12.0	53.3	927,562	59.4
4	1982	35.3	19.0	16.8	71.1	955,389	74.4
5	1983	41.3	23.4	21.3	86.6	984,057	88.0
6	1984	47.5	27.4	26.9	101.8	1,013,572	100.4
7	1985	54.7	31.5	31.5	117.7	1,043,979	112.7
8	1986	62.9	36.2	36.2	135.3	1,075,299	125.8
9	1987	72.3	41.6	41.6	155.3	1,107,558	140.4
10	1988	83.1	47.9	47.8	178.8	1,140,784	156.7
11	1989	95.6	55.1	55.0	205.7	1,175,008	175.1
12	1990	109.9	63.3	63.3	236.5	1,210,258	195.4
13	1991	126.9	72.8	72.8	272.0	1,246,566	218.2
14	1992	145.3	83.8	83.7	312.8	1,283,963	243.6
15	1993	167.1	96.3	96.2	359.6	1,322,482	271.9
16	1994	192.2	110.9	110.7	413.7	1,362,156	303.7
17	1995	221.0	127.4	127.3	475.7	1,403,021	339.1
18	1996	254.2	146.5	146.3	547.0	1,445,111	378.5
19	1997	292.3	168.5	168.3	629.1	1,488,465	422.7
20	1998	336.2	193.7	193.5	723.4	1,533,119	471.8
21	1999	386.6	222.8	222.6	832.0	1,579,112	526.9
22	2000	444.6	256.2	256.0	956.8	1,626,486	588.3
23	2001	511.3	294.7	294.3	1,100.3	1,676,280	656.8
24	2002	588.0	338.9	338.3	1,265.4	1,725,539	733.3
25	2003	676.2	389.7	389.3	1,455.2	1,777,305	818.8
26	2004	777.6	448.1	447.7	1,673.4	1,830,624	914.1
27	2005	894.3	515.4	514.8	1,929.5	1,885,543	1,020.7
28	2006	1,028.4	592.7	592.0	2,213.1	1,942,109	1,139.5
29	2007	1,182.7	681.6	680.8	2,545.1	2,000,372	1,272.3
30	2008	1,360.1	783.8	783.0	2,926.9	2,060,383	1,420.6

September 1977

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Load Forecast for the Program in GWh

1979 - 2008

Number	Year	Load Forecast for Villages electrified in the first year of program	Load Forecast for Villages electrified in the second year of program	Load Forecast for Villages electrified in the third year of program	Load Forecast for Villages electrified in the fourth year of program	Load Forecast for Villages electrified in the fifth year of program	Load Forecast for Villages electrified in the sixth year of program	Load Forecast for Villages electrified in the seventh year of program	Load Forecast for Villages electrified in the eight year of program	Load Forecast for Villages electrified in the ninth year of program	Load Forecast for Villages electrified in the tenth year of program	Rural System Forecast of Total Energy Demand	kWh Consumed per Capita
1	1979	15.8										15.8	51.3
2	1980	22.1	10.5									32.6	57.8
3	1981	28.7	14.6	12.0								55.3	59.6
4	1982	35.3	19.0	16.8	11.7							82.8	62.7
5	1983	41.3	23.4	21.9	16.4	10.5						113.5	65.8
6	1984	47.5	27.4	26.9	21.3	14.8	10.0					147.9	69.0
7	1985	54.7	31.5	31.5	26.2	19.2	14.0	8.6				185.7	73.6
8	1986	62.9	36.2	36.2	30.6	23.6	18.2	12.0	7.4			227.1	78.6
9	1987	72.3	41.6	35.2	27.6	22.4	15.6	10.3	6.4			273.0	84.4
10	1988	83.1	47.9	47.8	40.5	31.7	26.2	19.2	13.4	9.0	4.1	322.9	91.2
11	1989	95.6	55.1	55.0	46.6	36.5	30.1	22.5	16.5	11.6	5.7	375.2	102.9
12	1990	109.9	63.3	63.3	53.6	41.9	34.6	25.8	19.3	14.3	7.5	433.5	115.4
13	1991	126.4	72.8	72.8	61.6	48.2	39.8	29.7	22.1	16.8	9.2	499.4	129.1
14	1992	145.3	83.8	83.7	70.8	55.4	45.8	34.2	25.5	19.3	10.7	574.5	144.2
15	1993	167.1	86.3	96.2	81.5	63.8	52.7	39.3	29.3	22.2	12.3	660.7	161.0
16	1994	192.2	110.8	110.7	93.7	73.3	60.6	45.2	33.7	25.5	14.2	759.9	179.7
17	1995	221.0	127.4	127.3	107.7	84.3	69.7	52.0	38.7	29.3	16.3	873.7	200.7
18	1996	254.2	146.5	146.3	123.9	97.0	80.1	59.8	44.5	33.7	18.8	1,004.8	224.0
19	1997	292.3	168.5	168.3	142.5	111.5	92.2	68.7	51.2	38.8	21.6	1,155.6	250.1
20	1998	336.2	193.7	193.5	163.8	128.2	106.0	79.0	58.9	44.6	24.8	1,328.7	279.3
21	1999	386.6	222.8	222.6	189.4	147.5	121.9	90.9	67.7	51.3	28.6	1,528.3	311.8
22	2000	444.6	256.2	256.0	216.7	169.6	140.2	104.5	77.9	59.0	32.8	1,757.5	348.2
23	2001	511.3	294.7	294.3	249.2	195.0	161.2	120.2	89.6	67.8	37.8	2,021.1	388.7
24	2002	588.0	338.9	338.5	286.6	224.3	185.4	138.2	103.0	78.0	43.4	2,324.3	434.0
25	2003	676.2	389.7	389.3	329.6	257.9	213.2	158.9	118.4	89.7	50.0	2,672.9	484.6
26	2004	777.6	448.1	447.7	379.0	296.6	245.2	182.8	136.2	103.1	57.5	3,073.8	541.0
27	2005	894.3	515.4	514.8	435.8	341.1	281.9	210.2	156.6	118.6	66.1	3,534.8	604.0
28	2006	1,028.4	592.7	592.0	501.2	392.3	324.2	241.7	180.1	136.4	76.0	4,065.0	674.4
29	2007	1,182.7	681.6	680.8	576.4	451.1	372.9	278.0	207.2	156.9	87.4	4,675.0	753.0
30	2008	1,360.1	783.8	783.0	662.8	518.8	428.8	319.7	238.2	180.4	100.5	5,376.1	830.7

September 1977

SYRIA

REGIONAL ELECTRIFICATION PROJECT

The Incremental Cost of Power Delivered to the Rural Distribution System

1. The Project is the first phase of Syria's ten-year rural electrification plan. It will supply 1,200 villages with electricity by expanding the rural distribution network. Henceforth, this network will be referred to as the rural system. In order to calculate the return on the investment, the rural system is assumed to be independent from the rest of Syria's power production system. Furthermore, the rural system is assumed to purchase power from EPE at the 66/20-kV substation level at a marginal cost based tariff (Annex 26), that is, a tariff which reflects the opportunity cost to the economy of the incremental resources allocated to the production of the power demanded by the rural customer. This annex is devoted to the determination of that tariff.

2. The incremental cost per kWh delivered to the rural system consists of three components:

(a) a capacity cost for generation;

(b) a capacity cost for transmission; and

(c) an energy cost of generation.

The incremental cost derived is not intended as a tariff to be paid by the beneficiaries but instead it is an approximation of the economic value of each kWh demanded at the 66/20-kV substation.

Incremental Capacity Cost for Generation

3. The incremental capacity cost for generation is based on EPE's generation development program between 1977 and 1982 (Attachment 1). The program consists of six projects, two of which involve the construction of steam plants at Mehardeh (2 x 150 MW) and Banias (2 x 150 MW). The other four are conversions, after rehabilitation, of the plants at Kattineh (2 x 15 MW and 3 x 30 MW), Lameh (2 x 15 MW), Damascus (1 x 15 MW) and Aleppo (1 x 5 MW) to residual oil instead of diesel fuel.

4. The conversion of the plants is an economic decision that has an impact on both the size of future plants and the cost of operating the system. This will in turn alter incremental cost associated with the development plan. Since the converted plants will run on cheaper fuel, making possible their use for meeting base loads, the conversion cost is included in the estimation of the capacity cost.

5. Fuel savings will accrue between 1977-1985 from the economic dispatching of plant. Savings are estimated from the expected contribution of each plant to the total yearly generation (Attachment 3). The magnitude of these savings is equal to the difference between the economic costs of fuel used in operating the system with the existing plants unconverted and without the two new steam plants and the fuel cost of operating the system with the proposed expansion program. Savings in fuel are principally attributed to the substitution of the steam plants for the diesel fueled combustion turbines currently in operation. The turbines were installed after the last Middle East war because the time required for their installation is shorter than that for steam plants. The yearly fuel saving constitutes a benefit whose present value is deducted from the cost of the development program (Attachment 4).

6. The generation development program cost of 1,589.3 LS millions (US$409.82 M) is spread between 1977 and 1982. Only the undisbursed outlays (1977-1981) for Mehardeh are included in that cost. Since marginal cost pricing is a forward-looking approach that addresses future rather than past costs, the disbursed segment of Mehardeh's capital cost prior to 1977 is created as historical costs and not considered in estimating the capacity cost. The capital cost of Banias is included to compensate for the exclusion of Mehardeh's disbursed costs from the cost of the program. This is despite the fact that Banias will only contribute to the total generation of 1982 and that the same contribution could otherwise be met by operating some of the existing smaller plants for longer periods of time.

7. The incremental cost for generation is 160.3 LS per kW/year. It is equal to the annuitized ratio of the present values of the net cost of the program (net of the discounted stream of fuel saving) and the sum of the incremental demand for each year. It includes a yearly maintenance cost for generation of 1% of the capital cost of the program (Attachment 5).

Incremental Capacity Cost for Transmission

8. The capital expenditure program for transmission consists of the cost of the 230-kV and the 66-kV network and the dispatch center (Attachment 2). These are discounted to their 1977 equivalent value and the sum is allocated according to the peak responsibility imposed on the system by each of EPE's customer classes. Customer classes are classified according to the voltage level of their demand (230-kV, 66-kV, 20-kV, 20-kV/LV and LV). Peak responsibility is determined from the load factor for each voltage level and the forecast of incremental energy demanded (Attachment 6).

9. Assigning cost responsibilities are more difficult in the case of transmission than in generation because of the lumpiness of transmission investments. Lumpiness in generation is less severe because matching generation and demand can be accomplished to the nearest increment of capacity available for the plant selected. On the other hand, transmission is characterized by lumpy initial investments (poles, substations, and minimum capacity of wires) which are required at the initial stage of operation and remain in service for

several years (at least 10 years) before the network's capacity is fully taxed. Thus, the following were determined before allocating the cost responsibilities among customer classes:

(a) length of time in which the network will be used before its capacity is fully absorbed; and

(b) the maximum capacity that will be imposed on the network by the end of the time horizon considered in the determination of the tariff.

10. Of Syria's transmission investment program between 1977 and 1985, more than 50% of the investment (62% for 230-kV and 57% for 66-kV) will be undertaken after 1980 (Attachment 2). Meanwhile, the capacity cost is being determined for the years between 1977 and 1980. Assuming that the network will be fully utilized in 12 years, the proportion charged to the period under consideration must recover 25% of the capital cost (3 years/12 years). However, since certain minimum facilities must be erected in order to transmit power, 40% instead of 25% of the capital cost will be used in determining the capacity cost.

11. Only 20% of the development cost of the 230/66-kV substation are allocated to the higher voltage consumers because of their minimal use of the facility. That is, the 230-kV customers are allocated 20% of the cost of the 230/66-kV substations and 80% are assigned to the 66-kV customers. Meanwhile, both the 230/66-kV and 66/20-kV substations are used by the 66-kV customers, consequently 20% of their cost are assigned to that customer class.

12. Forty percent of the cost of the dispatch center is considered relevant to the tariff period considered. The sum is allocated equally between the 230-kV and 66-kV customers. For the calculation of the transmission charge including maintenance cost see Attachment 7.

13. The incremental cost of transmission at each level is allocated according to the peak responsibility of each customer class (Attachment 6). The results are summarized in Table I below:

Table I

Customer Voltage Level	Peak Responsibility Factor %	Cost Per kW per Year 230-kV LS	66-kV LS	60/20 S.S. LS
230-kV	1.01	17.2		
66-kV	1.01	17.4	22.7	
20-kV	1.035	18.0	23.5	40.1

14. The incremental capacity cost for generation and transmission for power delivered to the 66/20-kV substation is equal to the sum of the incremental capacity cost of generation (160 LS/kW/year), the incremental capacity cost of transmission at the 230-kV level (18.0 LS/kW/year), the incremental capacity cost at the 66-kV level (23.5 LS/kW/year) and the incremental capacity cost at the 66/200-kV substation (40.1 LS/kW/year). The sum is equal to 241.60 LS/kW/year (Attachment 8). The sum of 9,422,400 LS/year is the required contribution of the rural system to the capital costs of the period considered (Attachment 6). This sum is equal to the product of the incremental capacity cost for generation and transmission (241.60 LS/kW/year) and the peak responsibility of the rural system (39 MW). The incremental capacity cost per kWh delivered to the rural system is 0.10 LS/kWh (9,422,400 LS/95 GWh).

Average Energy Cost of Generation

15. The incremental generation cost is estimated from the schedule of the yearly economic dispatching of plant (Attachment 3). The schedule gives a hypothetical contribution of each plant to the total generation required including systems losses. The yearly fuel cost is valued at 1977 border prices. The hydro energy is assigned a value per kWh equal to the next higher fuel cost in the mix which is flare gas (79.0 LS/1000 kg).

16. The average energy cost per kWh produced between 1978 and 1982 is 0.04 LS. It is equal to the ratio of the present value of the yearly fuel outlays and the sum of the present value of the total yearly kWh produced (Attachment 9).

17. Therefore, the cost per kWh delivered to the 66/20-kV system is equal to 0.14 LS kWh which is the sum of the capacity cost of 0.10 LS/kWh and the average cost of energy of 0.04 LS/kWh.

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Generation Development Program for the Interconnected Grid in LS Millions
1977-1982

Generation Plant(s)	1977 F/C	1977 L/C	1977 Total	1978 F/C	1978 L/C	1978 Total	1979 F/C	1979 L/C	1979 Total	1980 F/C	1980 L/C	1980 Total	1981 F/C	1981 L/C	1981 Total	1982 F/C	1982 L/C	1982 Total	Total Outlays per Plant F/C	Total Outlays per Plant L/C	Total Outlays per Plant Total
Kattineh:																					
Reconstruction			34.3																		34.3
6th Unit (60 MW)	39.5	14.0	53.5	23.5	25.3	48.4	2.5	3.0	5.5										65.5	42.3	107.8
Banias																					
(2x150 MW) end 1981	-	-	-	50.0	15.0	65.0	90.0	40.0	130.0	215.0	95.0	310.0	153.0	42.0	195.0	42.0	8.0	50.0	550.0	200.0	750.0
Gas Turbines																					
Conversion to Operate on Crude Oil (2 in Hameh, 1 Aleppo, and 1 Damascus)	-	-	28.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28.4
Meharden																					
Meharden I & II	276.3	114.2	390.5	117.9	71.0	188.9	49.3	35.1	84.4	9.0	5.0	14.0	-	-	-	-	-	-	452.5	225.3	677.8
Total Outlays for Generation Expansion and Rehabilitation	-	-	506.7	-	-	302.0	-	-	219.9	-	-	324.0	-	-	195.0			50.0			1,598.3

September 1977

SYRIA

APPRAISAL OF A REGIONAL ELECTRIFICATION PROJECT

THIRD POWER PROJECT

Transmission Development Program for Syria
1977-1982
(In '000 LS)

Type of Network	1977			1978			1979			1980			1981			1982			Beyond 1982		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
230 kV System																					
Ongoing Work	58.9	20.5	79.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New 230-kV Lines	-	-	-	15.9	5.5	21.4	22.2	7.8	30.0	26.0	9.0	35.0	24.4	8.6	33.0	20.0	10.0	30.0	20.0	10.0	30.0
New 230-kV Substations	-	-	-	2.0	-	2.0	32.4	22.0	54.4	66.0	54.0	120.0	36.0	34.0	70.0	15.0	15.0	30.0	10.0	10.0	20.0
Total Outlays for 230-kV System	58.9	20.5	79.4	17.9	5.5	23.4	54.6	29.8	84.4	92.0	63.0	155.0	60.4	42.6	103.0	35.0	25.0	60.0	30.0	20.0	50.0
Dispatching Centre																					
Ongoing Work	43.6	3.3	46.9	13.3	12.3	25.6	1.7	1.3	3.0	-	-	-	-	-	-	-	-	-			
New Work	-	-	-	0.5	4.5	5.0	9.0	1.0	10.0	11.0	1.0	12.0	2.5	0.5	3.0	-	-	-			
Total Outlays for Dispatching System	43.6	3.3	46.9	13.8	16.8	30.6	10.7	2.3	13.0	11.0	1.0	12.0	2.5	0.5	3.0	-	-	-			
66-kV System																					
Ongoing Work Network Lines	25.6	28.4	54.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Ongoing Work in Substations	72.0	59.0	131.0	11.0	9.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-			
New Work Lines	-	-	-	12.0	13.0	25.0	12.0	13.0	25.0	17.0	18.0	35.0	19.0	21.0	40.0	14.0	16.0	30.0	14.0	16.0	30.0
New Work in Substations	-	-	-	4.3	-	4.3	13.0	12.0	25.0	27.0	52.0	79.0	34.0	26.0	60.0	27.0	23.0	50.0	27.0	23.0	50.0
Total Outlays for 66-kV Network	97.6	87.4	185.0	27.3	22.0	49.3	25.0	25.0	50.0	44.0	70.0	114.0	53.0	47.0	100.0	41.0	39.0	80.0	41.0	39.0	80.0
Total Outlays for the Transmission	200.10	111.20	311.3	59.0	44.30	103.3	90.3	27.10	147.40	147.0	134.0	281.0	115.9	90.10	206.0	76.0	64.0	140.0			

September 1977

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Forecast of Sales and Generation

	1978	1979	1980	1981	1982
Interconnected System					
Sales (GWh)					
Domestic & Commercial	600	726	799	878	966
Government	150	177	213	250	308
Light Industry	428	473	523	579	640
Heavy Industry	533	792	932	1,104	1,284
	50	116	239	273	330
Irrigation	70	100	150	200	250
Total	1,831	2,384	2,856	3,284	3,778
Losses 1/	375	488.3	584.9	672.6	773.8
Required Generation	2,206	2,872.3	3,440.9	3,956.6	4,551.8
of which:					
Hydro	2,206	2,400	2,400	2,360	2,280
Steam	-	472.3	1,040.9	1,596.6	2,271.8
Diesel	-	-	-	-	-
Combustion Turbine	-	-	-	-	-
Isolated System					
Sales (GWh)					
Domestic & Commercial	44	40	32	29	27
Others	28	25	22	20	18
Total	72	65	54	49	45
Losses 2/	24	21.7	18.0	16.3	15.0
Required Generation	96	86.7	72	65.3	60
of which:					
Diesel	96	86.7	72	65.3	60
Total Sales (GWh) Interconnected and Isolated Systems	1,903	2,449	2,910	3,333	3,823

1/ Assumed at 17%
2/ Assumed at 25%

January 1978

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Calculation of Fuel Savings Because of Mehardeh and Banias

I. Table of Alternatives to Producing Yearly Requirements in GWh

Alternatives for Producing the Required GWh	1978	1979	1980	1981	1982	1983	1984	1985
1. Gas Turbines								
a. GT Fueled by Residual Oil	259	260	260	260	260	260	260	-
b. GT Fueled by Diesel		300	571	740	740	740	615	573
2. Steam								
Mehardeh and Banias	259	560	831	1,000	1,000	1,000	875	573

II. Table of Yearly Cost of Fuel of the Two Alternatives and the Net Saving Due to the Steam Plants in Millions of S.L.

Alternatives for Producing the Required GWh	1978	1979	1980	1981	1982	1983	1984	1985
1. Gas Turbines								
Fuel Cost of GT (Residual Oil)	25.9	26.0	26.0	26.0	26.0	26.0	26.0	
Fuel Cost of GT (Diesel)	-	47.0	89.5	116.0	116.0	116.0	96.4	89.8
Total Fuel Cost of Operating GT	25.9	74.0	115.5	142.0	142.0	142.0	122.4	89.9
2. Steam								
Mehardeh and Banias	18.1	39.2	58.2	70.0	70.0	70.0	61.3	40.1
Fuel Savings	7.8	34.8	57.3	72.0	72.0	72.0	60.7	49.7

	1978	1979	1980	1981	1982	1983	1984	1985
Current Value of Fuel Savings	7.8	34.8	57.3	72.0	72.0	72.0	60.7	49.7
Present Value of Feul Savings	7.1	28.76	43.1	49.2	44.7	40.6	31.7	23.2

Sum of Present Value of Savings in Fuel = 268.4 LS Million

September 1977

1. Assumptions about plant efficiencies
Gas Turbine Fuel Efficiency

0.4 kg/kWh for Plants Operated on Residual Oil
0.33 kg/kWh for plants operated on Diesel

Steam Plants Fuel Efficiency

0.28 kg/kWh for Plants Operated on Residual Oil

2. Assumptions about Fuel Prices

Price of Residual Oil = 294.7 LS Ton
Price of Diesel = 560 LS/Ton

3. Cost per GWh

a. Gas Turbines (Residual Oil) = 0.4 kg.kWhx10^6x250 LS/Ton = 100,000 LS/Ton

b. Gas Turbines (Diesel) = 0.33 kg/kWhx10^6x475 LS/Ton = 156,750 LS/GWh

c. Steam Plant (Residual Oil) = 0.28 kg/kWhx10^6x250 LS/Ton = 70,000 LS/GWh

Calculation of Incremental Capacity Cost for Generation

Present Value of the Development Program:

Year	1977	1978	1979	1980	1981	1982	Total
Outlays in 1977 prices	506.7	302.0	219.9	324.0	195.0	50.0	1,598.3
Present value in 1977 prices 1/	506.7	274.6	181.7	243.0	133.0	31.1	1,370.0

Incremental Peak Capacity to be met by the Development Program:

	1977	1978	1979	1980	1981	1982	1983	1984	1985	Sum of Present Value
Incremental peak demand 2/	-	144.0	161.0	110.0	130.0	152.0	174.0	202.0	234.0	
Present value at end of 1977	-	130.9	133.1	82.6	88.8	94.4	98.2	103.7	109.2	841.0

Present value of fuel savings (Attachment 5) = 268.4 LS Million

Net present value of the development program = 1,370 - 268 = 1101.6 LS Million

Present value of cost per kW = $\frac{1,101.6 \text{ m.S.L.}}{841}$ = 1,309.9 LS

Maintenance cost per year = 1% (of capital cost of program) = 1% (1,370) = 13.7 LS Millions

Yearly cost per kW = 1,309.9(.11) = 144.0 LS

Yearly maintenance cost per kW = $\frac{13.7 \text{ LS Millions}}{841 \text{ MW}}$ = 16.3 LS

Total yearly cost per kW = 160.3 LS per kW per year

1/ At 10% rate of interest.
2/ Incremental peak capacity calculated from forecast of Balance of Capacities 1977-1985

September 1977

SYRIA

REGIONAL ELECTRIFICATION PROJECT

Peak Responsibility of EPE Customer Classes

	1977	1978	1979	1980	1981	1982	1983	1984	1985	PV 1/	Load Factor	MW	Peak Load Factor	MW
	GWh													849
230-kV	183	225	393	471	527	658	803	1,297	1,390	734	0.71	118	1.01	841
66-kV	487	532	732	879	1,021	1,224	1,433	1,865	2,050	965.6	0.85	130	1.01	716
20-kV	332	354	489	587	681	817	956	1,243	1,367	637.4	0.60	121	1.35	566
20-kV/lv	50	80	160	200	300	500	600	700	800	470.3	0.40	134	1.01	134
LV														
Industrial	276	330	370	414	464	520	583	653	732	292.5	0.40	83		
Commercial	245	268	295	330	356	391	437	489	547	188.7	0.40	54		
Public	77	89	101	121	140	159	174	192	210	86.7	0.41	24		
Free Supply	18	19	20	21	22	23	24	25	26	5.3	0.40	2		
Domestic Urban	164	179	198	220	237	261	292	326	364	125.1	0.30	48		
Domestic Rural	11.5	15.0	27.5	45.7	69.4	93.2	115.9	139.8	165.1	95.0	0.28	39		
Others Rural	34.5	39	53.5	72.3	93.6	112.8	133.1	153.2	174.9	88.6	0.35	29		

1/ PV = The sum of the present value of the yearly incremental demand for energy.

September 1977

II. Calculation of incremental Capacity Cost for Transmission:

1. Estimation of the Capital Cost to be used for mc-pricing:

TABLE I

Facility	Outlays	'77	'78	'79	'80	'81	'82	'83	'84	'85	Total PV
230/66-kV Substations	Outlays in '77 values	-	2	54.4	120	70	30	20	-	-	
	Present worth in '77	-	1.8	44.9	90.2	47.8	18.6	11.3	-	-	214.7
230-kV Network	Outlays in '77 values	79.4	21.4	30.0	35.0	33.0	30.0	30.0	-	-	
	Present worth in '77	79.4	19.4	24.8	26.3	22.5	18.6	17.0	-	-	208.0
Dispatching Centre	Outlays in '77 values	46.9	30.6	13.0	12.0	3.0	-	-	-	-	
	Present worth in '77	46.9	27.8	10.7	9.0	2.1	-	-	-	-	96.5
66-kV Network	Outlays in '77 values	54.0	25.0	25.0	35.0	40.0	30.0	30.0	-	-	-
	Present worth in '77	54.0	22.7	20.7	26.3	27.32	18.6	17.0	-	-	186.0
66/20-kV Substations	Outlays in '77 values	131.0	24.3	25.0	79.0	60.0	50.0	50.0	-	-	
	Present worth in '77	131.0	22.1	20.7	59.4	41.0	31.0	28.2	-	-	333.4

The 230-kV and 66-kV networks will continue expanding up until 1983 with substantial outlays in 1980 and 1982. All network are designed with the aim of transporting electricity for at least from 10-15 years. Consequently, both networks in Syria are considered to be of sufficient capacity in order to accommodate the load growth for at most 12 years. Meanwhile, since the initital investment is lumpy and must be undertaken irrespective of the magnitude of the system peak in the first few years relative to the peak capacity of the network, 40% of the cost of the networks (lines and substations) will be attributed to the period considered for mc-pricing which is 1978-1982.

In addition, the cost of the substation is allocated between the 230-kV. Customers and the 66-kV customers in the ratio of 20% to the former to 80% to the latter. Similarly, the recalculated cost of the 66/20-kV substations (cost of 66/20-kV substations and 0.8 of the cost of the (230/66-kV substation) will be divided between the customers of the 66-kV network and the 20-kV network. The proportion used will be 20% for the higher voltage network and 80% for the lower voltage network.

The cost of the dispatch center will be allocated between the customers of the 66-kV and the 230-kV. Yet, only 40% of the cost of the dispatch center will be attributed to the period considered for mc-pricing.

Capital cost attributable to the period under consideration:

Present value of 230/66 kV substation used for mc-pricing = .4(214.7) = 85.88 LS Million

Present value of 230 network used for mc-pricing = .4(208.0) = 83.20 LS Million

Present value of Dispatching used for mc-pricing = .4(96.0) = 38.00 LS Million

Present value of 66/20 kV substation used for mc-pricing = .4(333.4) = 133.40 LS Million

Present value of 66 network used for mc-pricing = .4(186.0) = 74.4 LS Million

Capital Cost allocation to customer class:

230-kV: .2(85.9) + 83.20 + .5(38) = 119.4 LS Million

66-kV: .2[.8(85.9)] + .2(133.4) + 74.4 + 19 =

13.7 + 26.7 + 74.7 + 19 = 134.1 LS Million

Cost for rural electrification at the substation without delivery

.8[.8(85.9) + 133.4] = 161.7 LS Million

II. Operation and Maintenance:

TABLE II

		Capital Cost in LS Millions	Assumed O&M Cost	Annual O&M LS Millions	MW Added at voltage	Annual Cost per kW
230-kV customer	S.S.	17.2	2%	0.34		
	Lines	83.2	0.5%	0.42	841	1.58
	Dispat.	19.0	3%	0.57		
66-kV customer	S.S.	40.4	3%	1.21		
	Lines	74.4	1%	.74	761	3.31
	Dispat.	19.0	3%	0.57		
66/20-kV Substation		161.7	3%	4.85	566	8.57

III. Marginal Transmission Cost

Type of Network	Capital Cost LS Millions	Incremental increase in demand MW	Marginal Cost per kW LS	Annual Cost per kW LS	O & M per kW LS	Capacity Cost LS
230-kV	119.4	841	142	15.6	1.6	17.2
66-kV	134.0	761	176	19.4	3.3	22.7
Substation at 66/20-kV	161.7	566	285.7	31.5	8.6	40.1

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Estimated Incremental Cost at Each Voltage Level for the Interconnected System
All Costs are in 1977 Values in Syrian Pounds

Consumer Voltage Level	Loss Factor	Cost per kW per year			
		Generation 1/	Main Transmission	66-kV Transmission	66/20-kV Substation
	%	L.S			
At power station		160.3	-		
	1.01				
230-kV		162.0	17.2		
	1.01				
66-kV		164.0	17.4	22.7	
	1.035				
20-kV		160.0*	18.0*	23.5*	40.1*
	1.01				
20-kV/LV		171.0	18.2	23.7	
	1.11				
LV		190.0	20.2	26.3	
Village			20.2	26.3	

1/ Cost per kW includes maintenance cost for capacity assumed to be 1% of capital cost (see Attachment 7).

* The sum is the total capacity cost (generation and transmission) per kW/year for the power delivered to the rural system.

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Yearly Outlays for Fuel

Plant	1978	1979	1980	1981	1982	Total
1. Thawra 1/ Other Hydro	50.7	50.7	50.7	50.7	50.7	not applicable
2. Gas Turbine Souedie (Flared Gas) 2/	-	-	6.8	6.6	6.2	not applicable
3. Banias (Flared Gas) 3/	-	-	4.6	5.1	5.1	not applicable
4. Kattineh (Residual Oil)	-	32.4	32.4	32.4	32.4	not applicable
5. Banias (Residual Oil)	-	-	-	-	117.9	not applicable
6. Mehardeh (Residual Oil)	21.5	61.6	69.0	117.9	84.6	not applicable
7. Kattineh (Residual Oil)	-	-	-	2.2	-	not applicable
Total Outlays in 1977 Prices	72.2	144.7	163.5	214.9	296.9	not applicable
Present Value of Fuel Cost at 10%	65.6	119.6	122.8	146.8	184.4	639.2
Total Output in kWh	2,501	3,422	4,025	4,656	5,632	
Present Value of Output	2,346	2,828	3,024	3,180	3,497.1	14,875

1/ The energy cost for Thawra was assumed equal to the fuel cost of flared gas. Thus an economic cost of 79 LS/1000 kg ($20/1000 kg) was assumed.
2/ Plant efficiency of .28 kg/kWh. Fuel valued at 79 LS/1000 kg or .022 LS/kWh.
3/ Plant efficiency of .28 kg/kWh. Fuel valued at 296.2 LS/1000 kg = 0.296 LS/kg or 0.083 LS/kWh.

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Least Cost Alternative

1. There are two basic alternatives for supplying a village with electricity:

(a) local generation; and

(b) connection to the central supply grid.

In the comparison of these alternatives, the distribution network within the village is not considered because it is identical for both alternatives.

2. Since the project will extend electricity to 1,200 villages, the comparison of alternatives for each of the villages included in the Project is not feasible. Instead, the approach adopted in this annex is to derive, using a small village of 500 inhabitants, the relationship between the two alternatives. The length of the 20-kV lines used is the principal cost determinant for the centrally supplied alternative. The analysis will determine the length of the 20-kV line (break-even distance) which equates the present values of the cost stream of each alternative. The break-even distance will be used to draw conclusions about the villages included in the Project, bearing in mind that the break-even distance increases as the village population increases.

3. The analysis extends over a period of 30 years, consequently the two alternatives involve upgrading, replacement and expansion of facilities to meet the forecast demand (Attachment 2). Other assumptions that affect the results are summarized in Attachment 1. The cost streams associated with each alternative are presented in Attachment 3.

4. The break-even distance between the two alternatives is 18.3 km. This leads to the conclusion that the Project is the least cost alternative for electrifying the 1,200 villages because:

(a) the distance between any of the villages in the Project and the nearest source of centrally supplied electricity is about 11.2 kilometers; and

(b) 90% of the villages in the Project have a population greater than 500 inhabitants.

ANNEX 24
Attachment 1

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REGIONAL ELECTRIFICATION PROJECT

Assumption for the Comparison of Least Cost Alternative

I. Beneficiaries
a. Village population: 500
b. Electricity consumption per capita: 50 kWh/year/capita
c. Average inhabitants/connection: 6 persons/connection
d. Expected rate of growth of demand:

Year	1	2	3	4	5
Rate	40%	30%	23%	17%	15%

II. Isolated System
a. Capital cost per kVA (diesel generator): 2,000 LS/kVA
b. Diesel consumption/kWh: 0.280 kg/kWh
c. Oil consumption/kWh: 0.97
d. Effiency: 0.97
e. Expected life: 10 years
f. Operating cost 1%/year of capital cost
g. Maintenance cost: 5%/year of capital cost
h. Fuel cost: 0.56 LS/kg
i. Oil Cost: 10 LS/kg

III. Interconnected Grid

Cost of Transformers:
a. 100 kVA : 19,700 LS (US$4,987.3)
b. 200 kVA : 47,700 LS (US$11,139.2)
c. 400 kVA : 52,800 LS (US$12,405.1)

Cost of 20-kV lines
a. installation cost/km : 32.000 LS (US$8,101.3)
b. upgrading cost/km : 20,000 LS (US$ 79,000)
c. maintenance cost : 2% per year of capital investment
d. losses : 5%

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Forecast of Demand and Required Capacities of the Two Alternatives Required

			--Local Generation Alternative--			--Centrally Supplied Alternative--			
Year	MW	Equiv. kVA	Diesel			Transformers			20-kV Lines
			kVA of newly installed generation	kVA of replaced generation	capital cost in '000LS	kVA of newly installed transformer	kVA replaced or changed	capital cost in '000LS	capital cost per km. '000LS
1	25	12.5	70		140	100		19.7	32.0
2	35	17.5							
3	42.5	21.3							
4	56	28.0							
5	65.5	32.7							
6	75.3	37.7							
7	86.6	43.3							
8	99.6	49.8							
9	114.5	57.3							
10	131.7	65.9	2 x 70	70	280				
11	151.5	75.8							
12	174.2	87.1				100		19.7	
13	200.3	100.2							20.0
14	230.3	115.2							
15	264.9	132.5	100		200				
16	304.6	152.3							
17	350.3	175.2				200	100	47.7	
18	402.9	201.5							
19	463.3	231.7	100		200				
20	532.8	266.4	250	2 x 70	500				
21	612.7	306.3				200	100	47.7	
22	704.6	352.3							
23	810.3	405.2				400	200	52.8	
24	931.9	465.9	250		500				
25	1,071.7	535.8		100					20.0
26	1,232.4	616.2	500		1,000		200	52.8	
27	1,417.3	708.7							
28	1,629.9	814.9						52.8	
29	1,874.3	937.2		100					
30	2,155.5	1,077.8	500		1,000				

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Cost Streams Associated with the Two Alternatives

	Alternative I – Isolated System				Alternative II – Centrally Supplied System				
Year	Capital Investment [1] '000LS	Maintenance Cost [2]	Operational Cost [3]	Fuel and Lubricant Cost [4]	Capital Cost of Transformers in '000 LS	Maintenance Cost [5]	Cost per kWh delivered by the central grid [6] in '000 LS	Capital Cost 20-kV lines per km in '000 LS	Maintenance Cost '000 LS
1	140	0.7	14.4	4.7	19.7	0.4	3.5	40.0	0.8
2		0.7	14.4	6.6		0.4	4.9		0.8
3		0.7	14.4	8.5		0.4	6.0		0.8
4		0.7	14.4	10.5		0.4	7.8		0.8
5		0.7	14.4	12.3		0.4	9.2		0.8
6		0.7	14.4	14.1		0.4	10.5		0.8
7		0.7	14.4	16.2		0.4	12.1		0.8
8		0.7	14.4	18.7		0.4	13.9		0.8
9		0.7	14.4	21.5		0.4	16.0		0.8
10	280	1.4	28.8	24.7		0.4	18.4		0.8
11		1.4	28.8	28.4		0.4	21.2		0.8
12		1.4	28.8	32.6	19.7	0.8	24.4		0.8
13		1.4	28.8	37.5		0.8	28.1	20	1.2
14		1.4	28.8	43.1		0.8	32.2		1.2
15	200	2.4	36.0	49.6		0.8	37.1		1.2
16		2.4	36.0	57.1		0.8	42.6		1.2
17		2.4	36.0	65.6	47.7	1.7	49.0		1.2
18		2.4	36.0	75.5		1.7	56.4		1.2
19	200	4.4	43.2	86.8		1.7	64.9		1.2
20	500	4.5	43.2	99.8	47.7	2.6	74.6		1.2
21		4.5	43.2	114.8		2.6	85.8		1.2
22		4.5	43.2	132.0		2.6	98.6		1.2
23		4.5	43.2	151.8	52.8	3.6	113.4		1.2
24	500	7.0	43.2	174.5		3.6	130.5		1.2
25		7.0	43.2	200.7		3.6	150.1	20	1.6
26	1,000	11.0	43.2	230.8	52.8	4.6	172.5		1.6
27		11.0	43.2	265.5		4.6	198.4		1.6
28		11.0	43.2	305.3	52.8	5.6	228.2		1.6
29		11.0	43.2	351.1		5.6	262.4		1.6
30	1,000	15.0	43.2	403.7		5.6	301.7		1.6
TOTAL PRESENT VALUES AT 10%									
	582.1	16.6	212.2	448.9	60.2	8.7	289.6	40.4	8.8

1/ Capital investments as expressed in 1977 constant prices.
2/ Yearly maintenance is assumed to be 0.5% of the capital cost.
3/ Yearly operation cost is assumed to be 1% of the capital cost.
4/ Valued at 1977 border prices.
5/ Yearly maintenance is assumed to be 2% of the capital cost.
6/ MC-based tariff of 0.14 (See Annex 24).

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Calculation of the Break-even
distance between the two alternatives

The sum of the present value associated with the isolated system are = 1,259,000 LS

The sum of the present value associated with the central grid are = 358,500 LS

The sum of the present value associated with the erection of 1 km of 20-kV line = 49,200 LS

The distance at which the cost associated with the two alternatives break-even for a village of 500 inhabitants can be determined from the following equation:

1,259,000 LS = 358,500 LS + X (49,200 LS) where X is equal to the distance between the village and the nearest source of centrally supplied electricity. Therefore, the distance at which the two alternatives will break-even is:

X = (1,259,900 - 358,500 LS/49,200 LS/km

X = 18.3 km

Based on the assumption used in the comparison of the two alternatives and the magnitude of the break-even distance derived, it is possible to conclude that the Project is the least cost alternative to electrifying 1,200 villages in Syria. This is because of the following fact:

(a) The distance between any of the villages in the Project and the nearest source of centrally supplied electricity is about 11.2 kilometers; and

(b) 90% of the villages in the Project have a population greater than 500 inhabitants.

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REGIONAL ELECTRIFICATION PROJECT

Return on Investment

The return on investment is calculated for both the Project and Syria's ten-year rural electrification plan.

I. Return on Project

1. The rate of return on an investment refers to the discount rate which equates the present values of the benefit and the cost streams defined over the expected life of the project being financed. In this appraisal, only the pecuniary segments of the benefits and costs will be considered in the rate of return analysis. There are several identifiable benefits and costs that are not quantifiable and consequently are not included in the analysis.

2. Since the Project extends electric service to rural areas, the present value of the non-quantifiable benefits of the Project such as decreased rural migration, employment creation potential and improved quality of life, should be greater than the present value of its non-measurable costs. Thus, the calculated return on investment represent the minimum expected return from implementing Syria's rural electrification program.

A. Costs

3. Costs are divided into two categories:

(a) Project costs which refer to the costs that are imposed on EPE as a result of the construction and maintenance of the project; and

(b) Power systems costs which denote the costs that are incurred by EPE in supplying the rural distribution system with power.

Both costs are expressed in 1977 constant prices.

Project Costs

4. The project costs include the initial capital outlays distributed over four years (1978-1980) and the operation and maintenance costs. Project costs are expressed net of price contingencies or import duties and taxes. The operations and maintenance cost is assumed to be 2% of the yearly capital outlay. The Project's local costs of capital and labor are not expressed in efficiency prices because conversion factors were not available for Syria at the time of the analysis.

System Costs

5. EPE's system is artificially separated from the rural distribution system for the purpose of rate of return analysis. The latter will henceforth be referred to as the rural system. The rural system is assumed to purchase power from EPE at marginal cost based tariff. The tariff includes the costs of generation and high and medium tension transmission of power to the 66/22-kV substation (Annex 24, paras 1, 2, 17).

B. Benefits

6. The measurable benefits are divided into two categories:

(a) the revenue attributable to the project from the sale of power; and

(b) the savings accrued to the economy resulting from the implementation of the project.

The Revenue Associated with the Project

7. The existing tariff of 0.21 LS/kWh (US$ 0.53) for electricity supplied to the domestic customers from the public grid consists of two parts: a flat rate for consumption of 0.19 LS/kWh (US$0.048) and a fixed system expansion tax of .02 LS/kWh (US$0.005). The analysis assumes an average revenue of 0.24 LS/kWh (US$0.06) as a proxy for the consumers willingness to pay. This is justified because of two reasons:

(a) At present, the customers of the isolated systems pay a tariff of 0.24 LS/kWh and there are strong indications that their consumption at that rate would be higher if the constraints imposed by the limited capacities of the diesel generators are removed; and

(b) The 0.24 LS/kWh represents a 14% economic increase in the 1979 rate relative to the rate charged in 1977. The increase is justified because the prevailing tariff is below the economic cost of producing electricity and the Bank will seek to have that gap closed through a tariff covenant (para. 5.10).

The impact on the rate of return of using the prevailing tariff of 0.21 LS/kWh as a proxy for benefits will be assessed in the sensitivity analysis (para. 12).

Fuel Savings

8. The fuel saved by absorbing the isolated systems into the public grid constitutes a project benefit. It is estimated by determining the proportion of the rural population which is served by the isolated systems. Then based on both an average number of inhabitants and an average consumption rate per connection, the yearly supply of electricity required by the isolated systems is approximated (see Attachment 1).

9. The net fuel saving associated with the project is equal to the difference between the economic value of the diesel used and the economic value of the alternate fuel consumed by the public system in order to deliver the same amount of power. In the analysis, the estimated fuel saving is a gross rather than a net stream, because the cost of the fuel used by the central system was not subtracted from the savings. However, this has no impact on the rate of return because the value of the alternate fuel used by the public system is included in the mc-based tariff charged to the Project for the power delivered to the rural system.

Rate of Return and Sensitivity Analysis

10. The return on the Project is equal to 8.5%. This rate is based on an average revenue of 0.24 LS/kWh and an incremental cost of 0.14/kWh for the power delivered to the rural system (Attachments 2 and 3).

11. If an average revenue of 0.21/kWh instead of 0.24/kWh is used as a proxy for the consumers' willingness to pay, which represents a decrease of 13%, the rate of return decreases to 6.1% (Attachments 3 and 4). If the cost of 0.14 LS/kWh paid by the rural system increases by 13%, the return on investment decreases to 7.3%. This demonstrates that the rate of return on the Project is more sensitive to changes in the average revenue than to changes in the cost of power delivered to the rural system. Changes in fuel savings and operations and maintenance had no significant impact on the rate of return.

12. When the existing tariff of 0.21 LS/kWh is used as a proxy for consumers' willingness to pay, the return of 6.1% indicates that electricty is priced below the value of the resources used in its production. If an average revenue of 0.24 LS/kWh is used instead, the magnitude of the distortion would be lessened but the return of 8.5% would support the same conclusion. The return on investment would be 11.3%, if a 22% increase in the average revenues is implemented to meet the financial assumptions of para. 5.12.

13. The rate of 8.5% represents the minimum return on investment because the possible use of the rural network for agro-industries and private irrigation pumping was not included in the load forecast. Syria's private irrigation pumping is dependent on diesel for its source of energy. This is because the price of diesel is subsidized to an extent that even at the prevailing electricity tariffs, it would be financially unattractive to switch to electricity.

14. Proper allocation of energy resource among competing ends in Syria would dictate an integrated energy pricing plan that reflects the opportunity cost of these resources to the economy. The new prices would induce a switch from diesel to electric power in irrigation pumping because of relatively lower electricity prices because of two reasons: (a) the border price for the residual oil used by most of EPE generating plants is lower than the border price for diesel; and (b) private irrigation pumping can be accommodated during off-peak periods and need only pay energy cost for its power consumption. In addition, an implementable agro-industries' development plan is required, before the rural distribution network is to be fully utilized. If the impact of these plans (energy pricing and agro-industries development), are integrated into the load forecast the return on investment would be substantially higher than 8.5%.

II. Return on the Ten-Year Rural Electrification Plan

15. The cost of the plan extends over eleven years; the cost of the Project constitutes the outlays for the first four years. Similar to Project analysis, the plan is charged a mc-based tariff for the electricity delivered to the rural system of 0.14 LS/kWh. The yearly operations and maintenance costs are assumed to be equal to 2% of the total capital outlays. An average revenue of 0.24 LS/kWh is used as a proxy for the consumers' willingness to pay.

Rate of Return on Program and Sensitivity Analysis

16. The rate of return on the program is equal to 4.5%. It is less than the return on the Project because of two reasons: (a) in the formulation of the electrification plan, villages were allocated to the three phases of the plan according to the magnitude of their expected benefits. Thus the villages in the first phase have the highest benefits relative to the cost whilst phase three includes the villages with the lowest benefits; (b) and neither the 0.24 LS/kWh nor the 0.21 LS/kWh cover the economic cost of the resources used in producing the electricity. For example, if the average revenue per kWh is increased by 22% required to achieve EPE's financial objectives, the rate of return increases to 7.3% (Attachment 5).

ANNEX 25
Attachment 1

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REGIONAL ELECTRIFICATION PROJECT

Estimation of Economic Value of Fuel Savings

1. The estimation of the economic value of the fuel saving associated with the Project is a gross concept in that the economic value of the alternate fuel used by EPE to deliver the same amount of electricity is not deducted from the value of the diesel saved. The number of villages that are dependent on local diesel generators for electricity, their total population and the date for their absorption in the public grid are presented in Table 1.

2. The estimation is based on the following assumptions:

(a) The average number of inhabitants per connection is about 6 persons.

(b) The average consumption of electricity per capita is 65 kWh per year.

(c) The average fuel consumption of diesel generators is 0.28 kilograms/kWh.

(d) The border price of diesel (prevailing in 1977) is 0.475 LS per kilogram.

Table 1

Year absorbed in the public grid	Number of villages	Aggregate population of villages absorbed	kWh demanded in GWh	Accumulated demand in GWh	Economic value of diesel fuel saved in millions LS	Sum of economic value of diesel fuel saved in millions LS
1	62	113,090	7.35	7.35	0.978	0.978
2	48	103,039	6.70	14.05	0.891	1.869
3	44	90,678	5.89	19.94	0.783	2.652

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Project and Program Benefits and Costs Streams

LS MILLION

PROJECT						PROGRAM					
	BENEFITS 1/		COSTS 1/				BENEFITS 1/		COSTS 1/		
Year	Revenue 2/	Fuel Savings 3/	Project Cost 4/	Cost of Power 5/	O & M Cost 6/		Revenue 2/	Fuel Savings 3/	Project Cost 7/	Cost of Power 5/	O & M Cost 6/
1978	0	0	6.7	-	-	1978	0	0	6.7	0	
1979	3.8	1.0	113.6	2.2	2.3	1979	3.8	1.0	113.6	2.2	2.3
1980	7.8	1.9	113.6	4.6	4.5	1980	7.8	1.9	113.6	4.6	4.5
1981	13.3	2.7	149.9	7.7	7.5	1981	13.3	2.7	149.9	7.7	7.5
1982	17.1	"		9.9	"	1982	19.9	"	174.2	11.6	11.2
1983	20.8	"		12.1	"	1983	27.2	"	173.0	15.9	14.8
1984	24.4	"		14.2	"	1984	35.5	"	176.9	20.7	18.4
1985	28.2	"		16.5	"	1985	44.6	"	161.6	26.0	21.6
1986	32.5	"		18.9	"	1986	54.5	"	152.9	31.8	24.7
1987	37.3	"		21.8	"	1987	65.5	"	142.9	38.2	27.5
1988	42.9	"		25.0	"	1988	77.5	"	116.5	45.2	29.9
1989	49.4	"		28.8	"	1989	90.1	"		52.5	"
1990	56.8	"		33.1	"	1990	104.0	"		60.7	"
1991	65.3	"		38.1	"	1991	119.9	"		69.9	"
1992	75.1	"		43.8	"	1992	137.9	"		80.4	"
1993	86.3	"		50.3	"	1993	158.6	"		92.5	"
1994	99.3	"		57.9	"	1994	206.4	"		106.4	"
1995	114.2	"		66.6	"	1995	209.7	"		122.3	"
1996	131.3	"		76.6	"	1996	241.2	"		140.7	"
1997	150.9	"		88.0	"	1997	277.3	"		161.8	"
1998	173.6	"		101.3	"	1998	318.9	"		186.0	"
1999	199.7	"		116.5	"	1999	366.8	"		213.9	"
2000	299.6	"		133.9	"	2000	414.6	"		246.1	"
2001	264.1	"		154.0	"	2001	485.1	"		282.9	"
2002	303.7	"		177.2	"	2002	557.8	"		325.4	"
2003	349.3	"		203.7	"	2003	641.5	"		374.2	"
2004	401.6	"		234.3	"	2004	737.7	"		430.3	"
2005	461.9	"		269.4	"	2005	848.4	"		494.9	"
2006	531.1	"		309.8	"	2006	975.6	"		569.1	"
2007	610.8	"		356.3	"	2007	1,122.0	"		654.5	"
2008	702.5	2.7		409.8	7.5	2008	1,290.3	2.7		752.7	29.9

1/ All benefits and cost streams are expressed in 1977 constant prices.
2/ Revenue from sale of electricity is equal to the product of the forecast stream and an average rate per KWh of 0.24 LS (US$ 1.00 = 3.95 LS).
3/ Fuel savings refer to the diesel saved as a result of the absorbtion of the isolated systems in the public grid. The fuel is valued at 1977 border prices.
4/ See Annex 9.
5/ Cost of power purchased from EPE. The rate per KWh is based on incremental cost associated with EPE's systems development program between 1977-1982. The rate per KWh used is equal to 0.14 LS.
6/ Operations and maintenance cost is equal to 2% of the capital investments.
7/ See Annex 9.

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SYRIA

REGIONAL ELECTRIFICATION PROJECT

Project and Program Return on Investment

	PROJECT						PROGRAM						
Interest	PV. of Revenue	PV. of Fuel Savings	PV. of Project Cost	PV. of Cost of Power	PV. of O & M Cost	PV. of Net Benefit	Interest	PV. of Revenue	PV. of Fuel Savings	PV. of Project Cost	PV. of Cost of Power	PV. of O & M Cost	PV. of Net Benefit
0	5,354.3	78.5	383.9	3,082.3	222.5	1,744.1	0	9,653.4	78.5	1,481.8	5,621.1	760.4	1,868.6
1	4,230.9	67.2	376.0	2,434.9	185.5	1,301.7	1	7,616.0	67.2	1,402.7	4,433.9	639.8	1,206.8
2	3,363.0	58.0	368.6	1,935.2	164.2	953.0	2	6,043.5	58.0	1,329.5	3,517.7	542.2	712.1
3	2,689.8	50.5	361.2	1,547.5	139.1	692.5	3	4,824.0	50.5	1,261.7	2,807.3	462.9	342.6
4	2,164.6	44.3	354.3	1,245.3	125.1	484.2	4	3,873.7	44.3	1,198.8	2,253.0	397.8	68.4
5	1,753.3	39.2	347.4	1,008.6	107.6	328.9	5	3,129.5	39.2	1,140.3	1,820.4	344.2	-136.2
6	1,429.0	34.8	340.9	822.2	98.1	202.6	6	2,543.8	34.8	1,085.8	1,479.4	299.2	-285.8
7	1,172.6	31.2	334.5	674.6	85.6	109.1	7	2,080.6	31.2	1,035.1	1,209.8	262.6	-395.7
8	968.0	28.1	328.4	557.3	79.0	31.8	8	1,712.4	28.1	987.9	995.5	231.4	-474.3
9	805.4	25.5	322.3	463.5	69.8	- 24.7	9	1,418.3	25.5	943.8	824.3	205.0	-529.3
10	674.0	23.1	316.6	388.1	65.1	- 72.6							
11	568.2	21.3	310.8	327.2	58.1	-106.6							
12	482.0	19.6	305.5	277.7	54.7	-136.3							
13		18.1	300.1	237.3	49.3								
14	354.0	16.8	295.0	204.2	46.8	-175.2							
15	306.5	15.6	289.9	176.8	42.5	-187.1							

Sensitivity	% variation required in relevant cost or benefit to make PV of net benefits equal 0						
0	-33.0	+454	+57	0	-20%	+130.0	+30%
1	-31.0	+346	+53	1	-16%	+ 86.0	+27%
2	-28.0	+259	+49	2	-12%	+ 54.0	+20%
3	-26.0	+192	+45	3	- 7%	+ 27.0	+12%
4	-22.0	+137	+39	4	- 2%	+ 6.0	+ 3%
5	-19.0	+ 95	+33	5	+ 4%	- 12.0	- 7%
6	-14.0	+ 59	+25	6	+11%	- 26.0	-19%
7	- 9.0	+ 33	+16	7	+19%	- 38.0	-33%
8	- 3.3	+ 9	+ 6	8	+28%	- 48.0	-48%
9	+ 3.0	- 8	- 5	9			
10	+10.8	- 23	-19	10			
11	+19.0	- 34	-33	11			
12	+28.3	- 45	-49	12			

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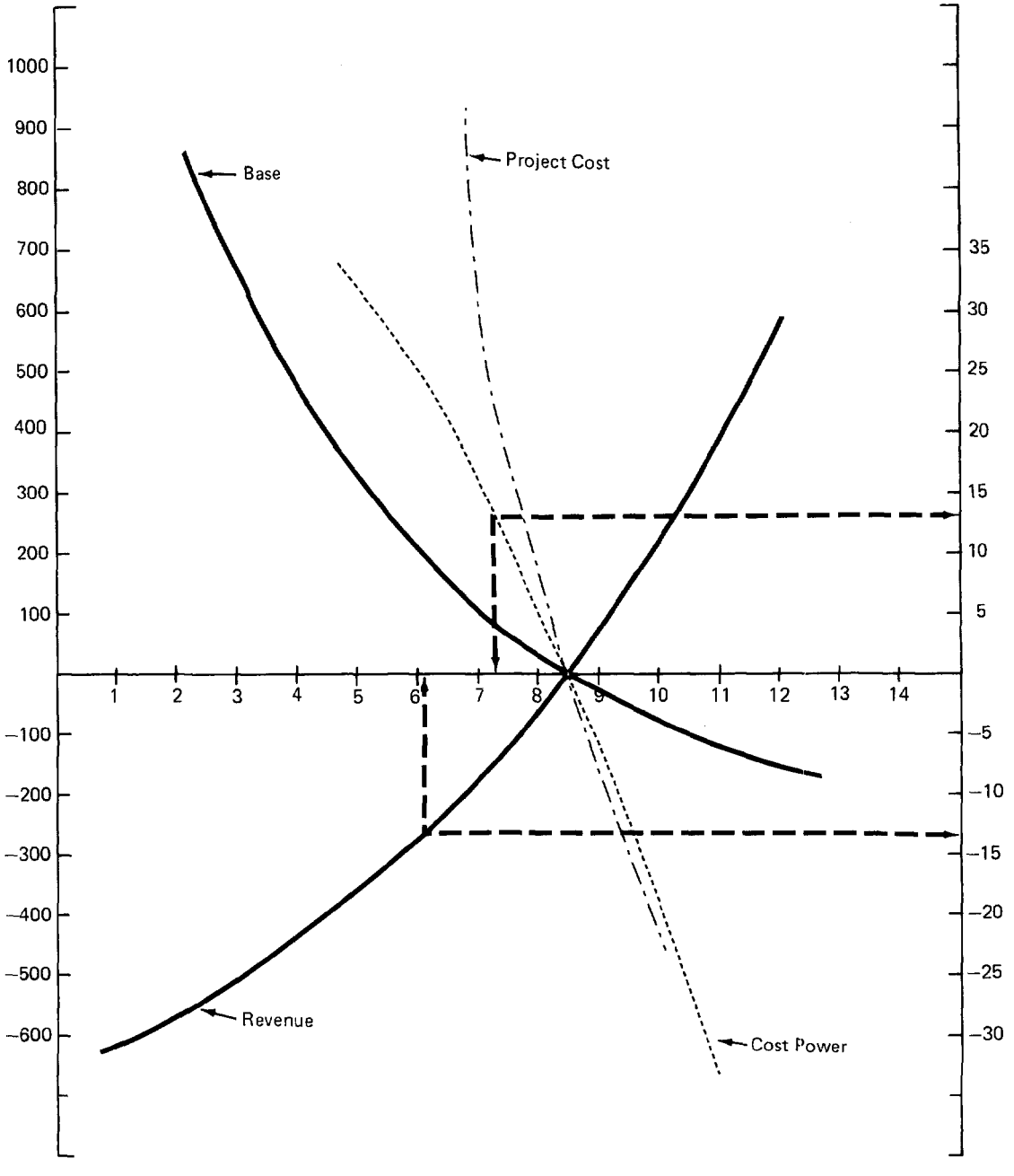
RETURN ON INVESTMENT AND
SENSITIVITY ANALYSIS FOR PROJECT



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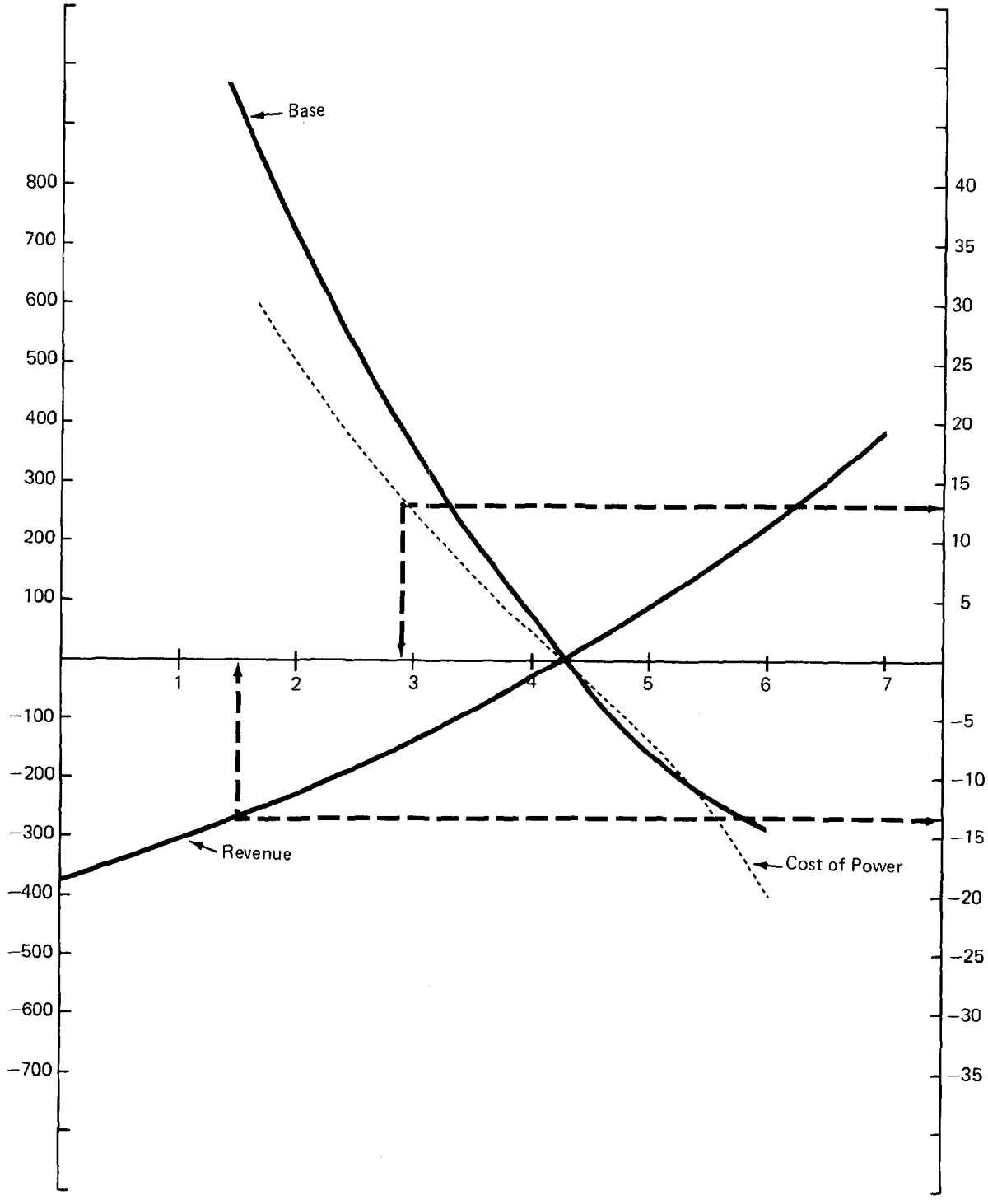
REGIONAL ELECTRIFICATION PROJECT
RETURN ON INVESTMENT AND
SENSITIVITY ANALYSIS FOR PROGRAM



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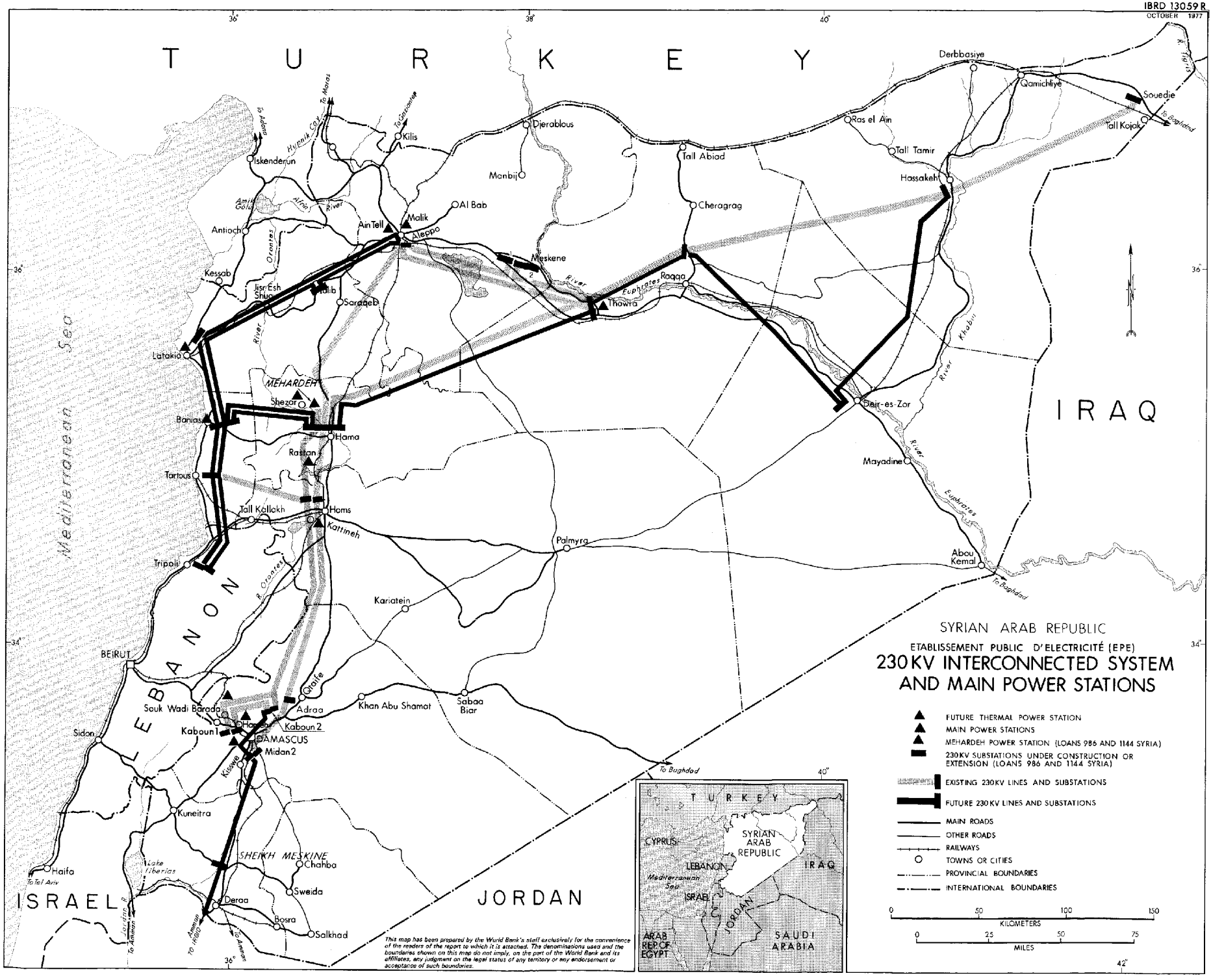

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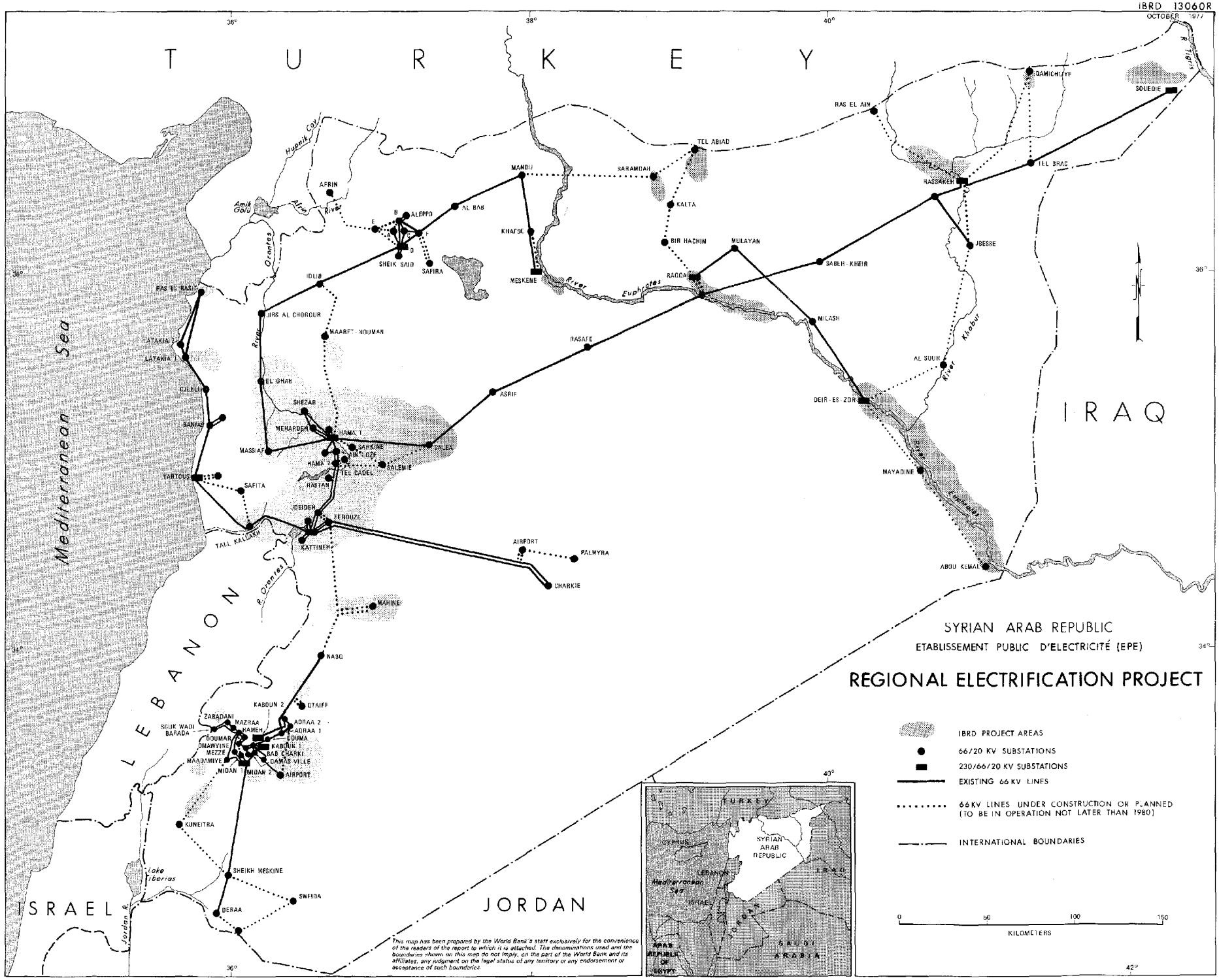

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