

REPORT TO
ELEKTRİK İŞLERİ ETÜT İDARESİ

Power Resources Survey and Development Administration
of the
Ministry of Industry
REPUBLIC OF TURKEY

for

Engineering and Economic Feasibility

of

AKSARAY DAM AND HYDROELECTRIC PLANT

of the

GRAND RIVER DEVELOPMENT

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Electric Power Resources Survey and Development Administration
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Engineering and Economic Feasibility

of

KEBAN DAM AND HYDROELECTRIC PROJECT
of the
FIRAT RIVER DEVELOPMENT

EBASCO SERVICES

INCORPORATED

ENGINEERS - CONSTRUCTORS - MANAGEMENT CONSULTANTS

TWO RECTOR STREET

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Elektrik Isleri Etut Idaresi
Ankara, Turkey

Gentlemen:

This report was prepared in accordance with the terms of a contract for engineering services dated December 18, 1962 between Elektrik Isleri Etut Idaresi and Ebasco Services Incorporated. It sets forth the feasibility of the Keban Dam and Hydroelectric Project and related transmission system and recommends its construction. It shows the need for additional generating capacity in the interconnected electric system of Turkey and demonstrates the economic feasibility of the Keban Project in serving the estimated system loads. Major features of the Project, its estimated cost and its place in the Electric Utility Expansion Program of the Government of Turkey are set forth herein.

Very truly yours,

Ebasco Services Incorporated

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EBASCO SERVICES INCORPORATED
NEW YORK, N. Y.

KEBAN DAM AND HYDRO-ELECTRIC POWER PLANT
ON THE FIRAT RIVER, TURKEY
1,085,000 KW



MAP OF TURKEY

SHOWING LOAD AREAS

AND

MAJOR ELECTRIFIED CITIES AND TOWNS

M E D I T E R R A N E A N S E A

I - SUMMARY

KEBAN DAM AND HYDROELECTRIC PROJECT

I - SUMMARY

A - INTRODUCTION

Prior to the establishment of the Republic of Turkey in 1923, the use of electric service in Turkey was minimal. The first electric generating plant was constructed in Tarsus in 1902, but the first service to a large city was in Istanbul in 1913. In 1923, the total installed generating capacity in Turkey was only 33 000 kilowatts.

The new republican government introduced social and industrial reforms, and franchises were granted to foreign financial organizations to build and operate electric systems. This was not an entirely successful method of power development and the installations were purchased by the government and turned over to municipalities for operation. Expansion of generating capacity of these plants did not keep pace with the rising demand for power by new industries, with the result that many of these industries installed generating facilities for their own needs.

By 1945, following World War II, the total installed capacity was 246 000 kilowatts, much of it in isolated small units. Between 1945 and 1962 the generating capacity of all plants had increased to 1 332 000 kilowatts, of which 95 percent is owned and operated by agencies of the National government or by municipalities.

The forecast rate of load growth for the years immediately ahead indicates the need for 1450 mw of additional generating capacity in the areas studied for this report during the period 1963 to 1973. To meet this growth the Turkish Government has developed the following expansion program. This program follows, in a general way, the recommendations given in the "Northwest Anatolia Power Supply Priority Study" completed by Ebasco Services Incorporated for EIE in March 1961.

B - EXPANSION PROGRAM OF GENERATING FACILITIES

The Turkish Government's first five-year development plan for expansion of generating facilities includes, for the Northwest, West and East Anatolia interconnected systems which serve most of the study area, the following projects:

<u>Hydro</u>	<u>Nameplate Capacity, Mw</u>	<u>Completion Date</u>	<u>Status</u>
Kesikkopru	76	1965	Under Construction
Ciceroz	300	1968-69	Feasibility Study
Keban	620	1970-71	Feasibility Study
Sariyar III and IV	80	1965	Under Construction
<u>Thermal</u>			
Istanbul Unit 1	110	1966	Under Construction
Istanbul Unit 2	110	1967	Under Construction
Tuncbilek Unit 3	60	1967	Under Construction

The Keban Project is the major step in this program, with construction simultaneous with Ciceroz, but with trial operation at a later date. This Project, its general features, its effect on meeting the increasing power demand and the prospect of adequate earnings and other benefits to cover costs of construction and operation are the subject of this report.

C - ESTIMATED COST AND CASH REQUIREMENTS

The table on the following page summarizes the estimated cost and cash requirements of the initial three-unit Keban Project and related transmission and substation facilities. Cost of the fourth Keban unit, recommended for installation in 1971, is also included.

D - CONCLUSIONS AND RECOMMENDATIONS

The studies and data contained in this report indicate that the Republic of Turkey will require the addition of large blocks of firm capacity starting in 1968 with the Ciceroz Project. It is recommended that the next capacity be provided by developing the Keban Dam and Hydroelectric Project on the Firat River by the construction of a rolled rockfill dam 155 m (510 ft) above river level, the creation of a large storage reservoir with maximum water level at El. 845 m, and the construction of a powerhouse with an initial installation, in 1970, of three units of 155 mw each plus related transmission facilities to load centers. To best fit system load requirements a fourth unit of 155-mw capability should be installed in 1971. These four should be followed by additional units as the load requires and as the Project firm energy is able to support such additional units, until a total of seven have been installed. Space should be provided, including an additional intake and penstock stub, for eventual installation of an eighth unit.

Northwest, West and East Anatolia Interconnected Systems
Keban Dam and Hydroelectric Project
ESTIMATED COST AND CASH REQUIREMENTS
(U.S.\$ and Turkish Lira in Millions)

	<u>Total</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
<u>Keban Dam and Hydroelectric Power Plant</u>										
Three Units (3 x 155 mw)										
Local Currency, TL	1636.7	8.0	49.0	135.5	219.8	373.6	402.4	335.5	112.9	
Foreign Currency, U.S. \$	46.1		1.0	5.6	9.5	10.3	7.9	7.8	4.0	
Total in TL	2052.0	8.0	58.0	185.8	305.1	466.6	473.2	406.0	149.3	
Total in U.S. \$	228.0	0.9	6.5	20.7	33.9	51.8	52.5	45.1	16.6	
Fourth Unit (155 mw)										
Local Currency, TL	29.0						1.0	16.0	10.0	2.0
Foreign Currency, U.S. \$	3.8						0.9	1.7	1.0	0.2
Total in TL	62.9						9.0	31.1	19.0	3.8
Total in U.S. \$	7.0						1.0	3.5	2.1	0.4
<u>Total Keban Dam and Hydroelectric Power Plant</u>										
Local Currency, TL	1665.7	8.0	49.0	135.5	219.8	373.6	403.4	351.5	122.9	2.0
Foreign Currency, U.S. \$	49.9		1.0	5.6	9.5	10.3	8.8	9.5	5.0	0.2
Total in TL	2114.9	8.0	58.0	185.8	305.1	466.6	482.2	437.1	168.3	3.8
Total in U.S. \$	235.0	0.9	6.5	20.7	33.9	51.8	53.5	48.6	18.7	0.4
<u>Transmission Lines and Substations</u>										
Local Currency, TL	522.3			29.0	49.2	94.3	120.0	115.1	114.7	
Foreign Currency, U.S. \$	51.1		0.1	2.7	4.5	9.1	11.9	11.8	11.0	
Total in TL	983.3		1.0	53.2	89.8	176.4	227.3	221.6	214.0	
Total in U.S. \$	109.0		0.1	5.9	9.9	19.6	25.2	24.6	23.7	
<u>Total Keban Dam and Hydroelectric Project</u>										
Local Currency, TL	2188.0	8.0	49.0	164.5	269.0	467.9	523.4	466.6	237.6	2.0
Foreign Currency, U.S. \$	101.0		1.1	8.3	14.0	19.4	20.7	21.3	16.0	0.2
Total in TL	3098.2	8.0	59.0	239.0	394.9	643.0	709.5	658.7	382.3	3.8
Total in U.S. \$	344.0	0.9	6.6	26.6	43.8	71.4	78.7	73.2	42.4	0.4

The Northwest and West Anatolia interconnected power system presently is supplied by hydro capacity of generally low capacity factor and by thermal capacity utilizing indigenous fuels and imported fuel oil. With the addition of the Ciceroz Hydroelectric Project, as recommended in a companion report, there will be need for the high capacity factor firm power initially available from Keban. As Keban Project reaches its ultimate potential it will be necessary to supplement its output by the addition of high capacity factor hydro or by thermal capacity, but at a date beyond the scope of this report.

It is proposed that a fifth unit be installed at Keban in 1972 and studies have shown that it would be useful in supplying peaking capacity to the system. However, prior to this date it will be necessary to initiate the development of additional resources, either thermal or hydro, and it may prove desirable to defer the fifth Keban unit until a later year.

The 1963-71 utility expansion program of Turkey, as evidenced in the first "5-Year Plan" and as extrapolated by EIE therefrom, will require an expenditure of TL 10 071 700 000. Approximately TL 3 098 000 000, or \$ 344 000 000 equivalent (31 percent of the total), would be required for Keban and related transmission. The foreign exchange portion of this amount would be approximately \$ 101 000 000 equivalent.

Data showing the financial aspects of the Project are set forth in this report. These show that the Keban Project is economically sound, that it will provide power and energy in quantity and at a rate cheaper than any available alternative source and that power from this Project is as cheap as, or cheaper than, any other existing project in Turkey.

The Keban Project and related transmission will require the expenditure of foreign exchange in an amount roughly equivalent to that which would be needed for alternative thermal capacity. The annual saving in foreign exchange during the Project life will amount to some \$ 18 500 000 per year.

Within the outline set forth in Senate Document No. 97, 87th Congress, 2nd Session, entitled "Policies, Standards, and Procedures in the Formulation, Evaluation and Review of Plans for Use and Development of Water and Related Land Resources," the Project has been treated on an independent basis as a part of a future comprehensive river basin plan. It has been demonstrated to be the logical, first choice among various hydroelectric

possibilities within and without the basin and to be so located and so sized as to take optimum advantage of the site possibilities and to permit optimum future development of power and irrigation projects both downstream and in other areas of Turkey. The Keban Project has demonstrated its worth on the basis of power benefits. Other benefits which accrue to the Project such as flood control, irrigation, and so forth, are recognized but no dollar value has been assigned.

In accordance with AID instructions and procedures as contained in the pamphlet titled "Feasibility Studies, Economic and Technical Soundness Analysis, Capital Projects," the feasibility study contained herein includes and describes the engineering, financial and other plans necessary to carry out the Project, and to develop a reasonably firm estimate of the cost. They are based on detailed investigations and surveys of the Project site and identify and fix the major construction problems in sufficient detail to provide a sound basis for the cost estimate. The Project has been evaluated and justified in accordance with criteria established in the AID booklet entitled "Benefit-Cost Evaluations as Applied to AID Financed Water or Related Land Use Projects" and meets the criteria established therein.

E - STATISTICAL SUMMARYDam

Type: Rolled Rock-Fill
 Height From River Bottom: 155 m
 Height From Foundation Rock: 205 m
 Crest Length: 1095 m
 Volume of Fill: 12 830 000 cu m

Spillway

Type: Gated Plus Fuse Plug
 Total Capacity: 17 500 Cumecs
 Fuse Plug Capacity: 5 500 Cumecs } With plug sill at 835, not 825
 Gated Spillway Capacity: 12 000 Cumecs (424,000 cfs)
 Number of Gates: 6 (15 x 16 m Each)

Reservoir

Capacity 30.6×10^9 cu m = 25,000,000 A.F. = 19" R.O.
 Area: 68 000 Hectares = 168,000 Acres = 263 Sq.mi.
 Length: 125 Km = 78 miles
 Drainage Area: 64 092 Sq Km = 24,800 S.m.

Power Plant

Type: Outdoor
 Ultimate Capacity: 1 085 000 Kw
 Number of Units: 7 (Provision for 8th)
 Capacity of Each Unit: 155 000 Kw
 Average Yearly Generation: 5871 Kmwh

380 Kv Transmission Lines

<u>Location</u>	<u>Length</u>	<u>Conductor Size</u>
Keban - Ankara	606 Km	2 - 954 Mcm ACSR
Keban - Ankara	606 Km	2 - 954 Mcm ACSR
Ankara - Ciceroz - Istanbul	369 Km	2 - 954 Mcm ACSR
Ankara - Istanbul	361 Km	2 - 954 Mcm ACSR

380 Kv Substations

<u>Location</u>	<u>Voltage</u>	<u>Capacity</u>
Keban	14.4/380 Kv	174 Mva Per Unit
Ankara	380/154 Kv	300 Mva
Istanbul	380/154 Kv	600 Mva

Project Estimated Cost

	<u>T. L. - Millions</u>	<u>U. S. \$ - Millions</u>
Keban Dam and Hyroelectric Power Plant (4 Units)	2 114.9	235.0
Transmission System	983.3	109.0
Total Keban Project	3 098.2	344.0

II - GENERAL AND ECONOMIC FACTORS

II - GENERAL AND ECONOMIC FACTORS

A - DESCRIPTION OF TERRITORY SERVED

1 - Geography

The Republic of Turkey is a peninsula about 1500 kilometers (900 miles) long and 600 kilometers (350 miles) wide, covering an area of approximately 770 000 square kilometers (296 500 square miles). A small portion of Turkey, about 3 percent of its over-all area, is in Europe and the balance is in Asia. Between the European and Asiatic sectors lie the very important Straits of Dardanelles, the Sea of Marmara, and the Bosphorus.

Turkey is situated at the eastern end of the Mediterranean Sea. As Gibraltar in the western Mediterranean is the gateway to the Atlantic, the Straits, as the Bosphorus and Dardanelles are jointly known, are the "Gateway to the East."

Turkey is bounded by the Mediterranean Sea, Syria and Iraq on the south; the Aegean Sea and Greece on the west; Bulgaria and the Black Sea on the north; and Russia and Iran on the east. Central Turkey is a vast plateau, ringed by high mountains to the south, north, and east. The mountains that fringe the central plateau are, in turn, fringed by a narrow strip of fertile plains.

The climate of Turkey varies from subtropical to temperate. The central plateau is subject to wide variations in temperatures. Generally summers are dry, and precipitation occurs during the winter and spring.

2 - Population

Turkey's population, which has doubled in the past 30 years, has been expanding at an increasing rate. The growth rate is presently approximating 3 percent annually, as shown in the table on the following page. This population growth rate is double that of the United States.

POPULATION OF TURKEY

1927-1960

	<u>1927</u>	<u>1935</u>	<u>1940</u>	<u>1945</u>	<u>1950</u>	<u>1955</u>	<u>1960</u>
Total Population (000)	14 250	16 158	17 821	18 790	20 947	24 065	27 830
Compound Rate of Growth (%)	1.58	1.98	1.07	2.20	2.82	2.95	
Male Ratio (%)	48.1	49.1	49.9	50.3	50.3	50.8	51.1
Rural Ratio (%)	82.2	80.1	79.0	78.7	78.3	74.4	71.3

Source: Prime Ministry of the Republic of Turkey; First Five-Year Development Plan, Vol. I

It also will be noted from the above table that over the long term there has been a shift of population from rural to urban areas. Turkey is primarily an agricultural country and that is why, despite the migration to the towns and cities, some 71 percent of the people still reside in rural areas.

According to the 1960 census, 8 700 000 people were employed in agricultural activities. This represented 76 percent of the total labor force of 11 400 000. Of the remaining labor force engaged in nonagricultural employment, the armed forces, services, and professions were the larger individual categories.

Population growth and the changes in its composition during the past decade are shown in the table below.

POPULATION COMPOSITION AND INCREASE

Year	Population (000)			Ratio of Urban to Total Population	Compound Rate of Growth			Active Population Aged 15 and Above (000)
	Total	Urban	Rural		Total	Urban	Rural	
1950	20 947	4 538	16 409	21.7%	2.82%	6.30%	1.76%	10 020
1951	21 536	4 824	16 712	22.4				
1952	22 142	5 128	17 014	23.2				
1953	22 765	5 451	17 314	23.9				
1954	23 406	5 794	17 612	24.8				
1955	24,065	6 159	17,906	25.6	2.95%	5.34%	2.08%	11,620
1956	24 775	6 488	18,387	26.2				
1957	25 506	6 834	18,672	26.8				
1958	26 258	7 199	19,059	27.4				
1959	27 033	7 583	19,450	28.1				
1960	27 830	7 984	19,845	28.7				

Source: Prime Ministry of the Republic of Turkey; First Five-Year Development Plan, Vol. I

The principal cities of Turkey, ranked by 1960 population, are as follows:

<u>City</u>	<u>1960 Population</u>
Istanbul	1 550 000
Ankara	646 000
Izmir	371 000
Adana	230 000
Bursa	153 000

3 - Natural Resources

a - Mineral Resources

Turkey has a great potential wealth of mineral resources. Chrome ore, bituminous coal, lignite, iron, copper, and salt deposits are being exploited in relatively sizable quantities. Other minerals, mined in smaller quantities, include sulphur, mercury, lead, zinc, manganese ore, antimony, and silver.

The table below will give an indication of some of the principal minerals produced in Turkey and their respective quantities.

PRODUCTION OF MINERALS IN TURKEY

	<u>1960</u>	<u>Metric Tons</u>
Abrasives, Emery		6 814
Antimony Concentrates		1 663
Asphalt		37 724
Boron Minerals		69 839
Cement		2 037 795
Chrome Ore		479 620
Coal, Bituminous, Mine-Run		6 307 057
Lignite, Mine-Run		3 410 712
Coke		713 058
Copper, Blister and Fire Refined		26 220
Iron		
Ore		734 590
Steel Ingots		266 018
Lead		1 772
Manganese Ore		28 224
Mercury		1 339 <u>a/</u>
Mineral Waters		10 325 903 <u>b/</u>
Pyrites		42 285
Salt		445 352
Sulphur, Refined		17 100
Zinc Concentrates		2 920

a/ Flasks b/ Liters

Source: Mining Department, Ministry of Industry

Turkey is also one of the world's leading producers of meerscham, which is used in the manufacture of high quality, distinctive pipes, and other objects such as artificial flowers and buttons.

In addition to those minerals listed in the preceding table, Turkey has known deposits of gold, bauxite, dolomite, graphite, gypsum, marble, mica, nickel, opal, alum, and tungsten, to mention a few.

Production in 1962 for some of the leading minerals is shown below.

	<u>Metric Tons</u>
Bituminous Coal	6 466 140
Lignite	3 989 040
Chrome	330 468
Iron Ore	781 668
Copper	24 036
Manganese	11 856
Sulphur	18 384

The minerals that are important export commodities for Turkey are chrome, copper and manganese ores.

Coal, as a source of fuel and power, is important to any nation's economy. Turkey's bituminous coal comes primarily from the Eregli-Zonguldak Mines on the Black Sea coast. Bituminous production in 1962 was 6.5 million tons, all of which goes to meet the increasing demands of Turkey's industry. With this need for energy, lignite production is being stepped up, increasing approximately 17 percent from 1960 to 1962. The best known deposits of lignite are in the Soma, Balikesir and Kutahya regions. Coal reserves are estimated to be 1-1/2 billion tons of bituminous and 847 million tons of lignite. A listing of determined reserves for minerals other than coal appears on the following page.

LIST SHOWING DETERMINED RESERVES OF MINERALS

<u>Locations</u>	<u>Kind of Mineral</u>	<u>Reserves (Proven and Probable) Metric Tons</u>
Camlica-Tokat <u>a/</u>	Antimony	20 000
Turhal-Tokat <u>a/</u>	Antimony	54 000
Bilir-Mus	Barit	3 000 000
Akseki-Antalya	Bauxite	3 200 000
Kokaksu-Zonguldak	Bauxite	1 400 000
Seydisehir-Konya	Bauxite	2 150 000
Akarsen-Artvin	Chalcopyrite	4 000 000
Kure-Kastamonu <u>c/</u>	Chalcopyrite	1 600 000
Tirebolu-Giresun <u>b/</u>	Chalcopyrite	11 500 000
Guleman-Elazig <u>c/</u>	Chromite	2 800 000
Uckopru-Mugla <u>c/</u>	Chromite	92 000
Emet-Kutahya <u>c/</u>	Colemanite (Borate)	7 793 000
Kuvarshan-Artvin <u>a/</u>	Copper	11 500
Murgul-Artvin <u>c/</u>	Copper	13 500 000
Murgul-Artvin <u>c/</u>	Copper	16 500 000
Bolkardag-Nigde	Gold - Silver - Lead	284 000
Avaik-Bingol <u>a/</u>	Iron Ore	3 000 000
B.Egmir-Balikesir	Iron Ore	15 000 000
Cankdag-Kocaeli <u>b/</u>	Iron Ore	41 000 000
Divrik-Sivas <u>a/</u>	Iron Ore	35 000 000
Elkondu-Sivas <u>a/</u>	Iron Ore	800 000
Hasancelebi-Malatya <u>a/</u>	Iron (Including Sidorite)	26 500 000
Karamadazi-Kayseri <u>a/</u>	Iron	3 000 000
Otlukilise-Sivas <u>a/</u>	Iron	3 000 000
Pinargozu-Sivas <u>a/</u>	Iron	11 276 000
Keban-Elazig <u>c/</u>	Lead-Zinc	87 000
Halikoy-Izmir <u>c/</u>	Mercury	80 000
Raman, Garzan-Siirt	Petroleum	10 000 000
Keciborlu-Isparta <u>c/</u>	Sulphur	630 000
Uludag-Bursa <u>b/</u>	Wolframite	10 000 000

a/ Mines in operation (by private enterprises)

b/ These mines will probably be the first ones to be operated by Etibank.

c/ Mines in operation (by Etibank)

Source: Mining Research and Prospecting Institute (MTA)

Turkey is not as fortunate as some of its Middle East neighbors when it comes to known petroleum resources. Petroleum exploration and exploitation are still in their infancy in Turkey. The principal oil fields are in the southeastern portion of the country, at Raman and Garzan, with a recent discovery at Bulgurdag in southcentral Turkey. The prospects for additional discoveries are promising, with 12 oil companies, including three American companies, conducting drilling operations. These explorations are concentrated along the southern tier of Turkey.

The petroleum industry in Turkey, being relatively undeveloped, has more than doubled crude petroleum production since 1955. Crude production in 1961 was sufficient to supply only about 25 percent of Turkey's estimated requirements of 125 000 metric tons per month. At present there are three oil refineries in Turkey. Of these, two are relatively new; the refinery at Izmit began production in mid-1961, and within the last year a new refinery was completed at Mersin.

To realize the potential wealth of its resources, Turkey must intensify exploration and development. However, to encourage exploration and development there should be more favorable taxation on mineral production and exportation, and a reduction of freight rates for bulk ores. Further, there is a need to attract technical personnel to outlying mineral deposit areas and for the construction of access roads to these locations.

b - Forestry

Turkey's forests are of relatively minor importance to the economy as a whole. Virtually all requirements of construction timber and pulpwood, being rather limited, are supplied locally. The majority of timberland is in a 160-kilometer (100-mile) belt along the Black Sea coast in the north. The forests are under Government conservation control in order to ensure the greatest efficiency in exploitation.

c - Marine Resources

The coastal waters of Turkey are important sources of fish. The Straits benefit from the seasonal migration between the Black Sea and the Aegean and Mediterranean Seas. It is estimated that some 500 000 metric tons of fish make the semiannual migrations through the Straits. Turkey's fishing industry produces over 100 000 metric tons annually.

Among the migratory species, mackerel and bonita account for almost 70 percent of the catch. Others include swordfish, pelamid, anchovy and pilchard. Other marine products are lobsters, prawns, edible crabs, shrimp and various shellfish, and sponges.

The Turkish fish-canning industry, which has expanded in recent years, is concentrated in the Istanbul and Sea of Marmara region where up to 2000 metric tons of fish are canned annually. The fish-canning segment of the fishing industry is quite negligible, amounting to only 2 percent of the total production.

4 - Economy

a - General

Prior to the establishment of the Republic in 1923, Turkey had practically no industrial activities, depending upon imports for its industrial goods requirements. The period up to World War II was devoted to establishing a modern, western-oriented country. Considerable progress was achieved with a build-up in foreign trade. As the war approached, foreign trade slackened, creating shortages and imposing a burden on Turkey's economy. Nonetheless, Turkey's economy emerged from World War II with a reserve of gold and foreign exchange, even after discharging all external debts. These reserves were sufficient to resume limited development.

Starting in the early 1950's, Turkey's economy spurred under the impetus of foreign aid and availability of needed imports. However, the conditions that expanded the economy also gave rise to accelerated inflation and steadily growing deficits in the balance of payments.

The impact of inflationary factors upon the Turkish lira is seen in the official conversion rate of the U.S. dollar. Before 1946 the rate was 1.32 lira to \$1.00, and from 1946 to 1958 it was 2.8252 lira to \$1.00. However, by 1958, the dollar was commanding a premium of 6.20 lira. This premium was recognized by the Central Bank, and the rate of 9.0252 lira to \$1.00 was established in 1958 and officially adopted by an Act of Parliament in 1960.

Turkey has been plagued since the mid-1950's by what might be described as a "troubled economy." There have been many problem areas - for example, inflation, antiquated agricultural processes, and a rapidly

expanding population with its coincidental demand for consumer products. Underlying virtually all of Turkey's more recent economic problems have been chronic deficits in the international balance of payments and the rapid expansion of debts. The table on the following page depicts the annual balance of payments, expressed in U.S. dollars, for the period 1950 through 1962.

It is readily seen that at the crux of the imbalance of payments is lagging exports. Since 1950, imports increased 110 percent while exports increased only 45 percent. Although exports are increasing, the value in 1962 was still 4 percent below the peak year of 1953. There is no short-term solution to this problem. Until such time as industrial and agricultural output exceeds domestic demand, particularly for commodities for which a volume export market exists, a foreign trade deficit will remain.

The unbalanced economy resulted from the foreign trade deficits, coupled with a lack of private investment capital and the inability of debtors to repay their loans. This necessitated more and more Governmental controls. In 1958, a stabilization policy was adopted in an attempt to right the economy, both domestically and on an international level.

Stabilization measures undertaken include the previously mentioned devaluation of the Turkish lira, a tight curb on credit, and tighter controls on imports. The primary goal of this program was to end deficit financing and the expansion of the money supply.

The stabilization program succeeded in halting the inflationary spiral. Since mid-1959 the price level has remained relatively stable, as indicated by the Wholesale Price Index for the country and the Cost of Living Index in Ankara, shown in the table on page II-10.

REPUBLIC OF TURKEY

BALANCE OF PAYMENTS

1950-1962

(Millions of U. S. Dollars)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Current Account													
Total Imports (cif)	286	402	556	533	478	498	407	397	315	470	468	510	601
Total Exports (fob)	263	314	363	396	335	313	305	345	247	354	321	347	381
Trade Balance	(23)	(88)	(193)	(137)	(143)	(185)	(102)	(52)	(68)	(116)	(147)	(163)	(220)
Interest Payments	(15)	(10)	(12)	(18)	(18)	(21)	(16)	(14)	(8)	(22)	(29)	(30)	(30)
Other	(12)	4	7	(9)	(16)	29	43	2	12	(7)	37	23	29
Current Account Balance	(50)	(94)	(198)	(164)	(177)	(177)	(75)	(64)	(64)	(145)	(139)	(170)	(221)
Capital Account Receipts													
Marshall Plan and I.C.A. (A.I.D.)	98	112	66	51	51	66	95	70	76	95	80	93	69
PL 480	-	-	-	-	-	-	14	32	42	27	22	65	71
Private Long-Term Capital	2	7	10	8	8	3	2	17	13	7	24	34	36
Suppliers Credits	-	21	4	64	104	127	98	66	45	28	30	15	26
Export-Import Bank DLF, IBRD	5	1	5	11	14	15	8	5	4	1	2	7	26
European Monetary Agreement (EMA)	-	-	-	-	-	-	-	-	4	21	1	26	43
International Monetary Fund (IMF)	-	-	10	20	-	-	-	14	25	-	-	16	15
German Credit	-	-	-	-	-	-	-	-	-	-	35	25	25
Organ for Econ Coop and Devel (OECD) (OEEC)	-	-	-	-	-	-	-	-	21	52	-	-	-
Bank Credits - Short-Term (Net)	2	3	11	10	57	61	-	-	-	-	-	-	-
Commercial Credits - Arrears	-	-	81	41	22	-	45	21	-	-	-	-	-
Total Receipts	107	144	187	205	256	272	262	225	230	231	194	281	311
Capital Account Payments													
Government Debt	10	18	22	18	26	45	39	48	25	30	20	33	49
Suppliers Credits	NA	NA	NA	2	47	41	50	35	3	17	8	13	18
Consolidated Debt (Paris Agreement)	-	-	-	-	-	-	-	-	-	10	24	26	26
Other Debt Payments	5	-	-	-	-	20	-	-	41	3	13	12	4
Total Payments	15	18	22	20	73	106	89	83	69	60	65	84	97
Capital Account Balance	92	126	165	185	183	166	173	142	161	171	129	197	214
Total Balance of Payments	42	32	(33)	21	6	(11)	98	78	97	26	(10)	27	(7)

() Indicates red figure.

NA Not available.

Source: Turkish Ministry of Finance (Revised February 20, 1963).

GENERAL PRICE LEVEL INDICES

1950 = 100

<u>Year</u>	<u>Wholesale Price Index</u>	<u>Ankara Cost of Living Index</u>
1950	100	100
1951	107	103
1952	108	107
1953	110	110
1954	121	119
1955	131	141
1956	153	151
1957	181	174
1958	208	208
1959	250	258
1960	263	264
1961	271	264
1962	286	274

Sources: Wholesale Price Index - Ministry of Commerce;
Ankara Cost of Living Index - Central Statistical Office.

One further result of the stabilization program was the consolidation of the public debt. To implement the stabilization program, commercial debts owed to certain foreign nations and industrial organizations were consolidated under an agreement known as the "Paris Accord," dated August 1958. These debts exceeded 3.25 billion lira (\$ 360 million). Payments were to be made over a 12-year period, starting with \$ 15 million the first year; increasing \$ 5 million each year to \$ 35 million in the fifth year; and one-seventh of the balance each year thereafter (approximately \$ 33 million annually). The balance due at December 31, 1962 amounted to \$ 273 million.

Although debts from United States commercial organizations were not a part of the Paris Accord, agreement was reached through an exchange of letters between the two governments, and payments of these United States commercial loans are provided through the Paris Accord agreement. Payments of foreign commercial debts have been made on schedule, with instances of only very minor delay.

As a further step in the stabilization program relating to debt consolidation, internal debts were consolidated by Law No. 154 approved by Parliament on December 13, 1960. This law provides that all debts of the Treasury, and establishments, organizations, banks, and associations listed below owed to the Central Bank, the Pension Fund, the Amortization and Credit Fund, and the Workmen's Compensation Fund are consolidated, and are to be liquidated.

Debts to the Central Bank were consolidated by issuance of bonds by the Ministry of Finance to the Central Bank. These bonds are amortizable in 100 years with maximum interest rate of 0.5 percent.

Loans, together with interest to February 28, 1960, due to the Amortization and Credit Fund, the Pension Fund, and the Workmen's Compensation Fund were consolidated by the Ministry of Finance issuing 25-year 6 percent bonds to the creditors. Certain debts of the Treasury to the Pension Fund also were cleared by issuance of the 25-year 6 percent bonds of the Ministry of Finance.

Outstanding balances of payments made by the Pension Fund and the Workmen's Compensation Fund to Iller Bank, and credits (loans) by the Amortization and Credit Fund to this bank were consolidated for 25 years at 6-1/2 percent interest. Amortization of these debts is to be decided jointly by the concerned parties at the end of the consolidation period.

Debts and claims of establishments, organizations, banks and combines to each other (including municipalities and their organizations) were to be liquidated by means of compensation payments and deductions. The debts and claims which have been determined to have lost their flexibilities are consolidated and shall be paid in 20 years beginning five years after the date of this law, and bear interest at 6 percent.

The law also provides that funds required for amortization, interest and other expenditures of the bonds issued pursuant to this law shall be appropriated annually through the Public Debts section of the National Budget. The claims of establishments, organizations, banks and combines for which bonds were issued by the Treasury shall be taken over by the Treasury. However, a portion of the unpaid capital or certain losses shall be deducted from the debts taken over by the Treasury. The balance of debts taken over by the Treasury, among other things, may be added to

the capital of the organization concerned, thereby increasing its nominal capital. The required deposits to be maintained by the Pension Fund and the Workmen's Compensation Fund in the Amortization and Credit Fund shall be transferred from banks to the Ministry of Finance.

Bonds issuable under this law are limited to T.L. 7.5 billion. Bonds issued pursuant to this law outstanding at September 30, 1962 are as follows:

<u>Bonds Issued to:</u>	<u>Turkish Lira</u>	<u>U.S. Dollars *</u>
Central Bank	5 275 700 000	584 864 000
Amortization and Credit Fund	949 000 000	105 206 000
Pension Fund	655 600 000	72 680 000
Workmen's Compensation Fund	133 500 000	14 800 000

* Conversion rate T.L. 9.02 = \$1.00

Establishments, organizations, banks and combines included within the scope of Law No. 154 follow.

- | | |
|---|---|
| 1. Monopolies Administration | 12. Cellulose and Paper Plant |
| 2. Turkish State Railroads | 13. Iller Bank |
| 3. Turkish PTT Administration | 14. Emlak Kredi Bank |
| 4. Agricultural Bank | 15. Meat and Fish Organization |
| 5. Soil Products Office (Toprak) | 16. Petrol Office |
| 6. Agricultural Supply Office
(Donation) | 17. Maritime Bank |
| 7. Etibank | 18. Sugar Refineries of Turkey |
| 8. Sumerbank | 19. Cement Industry of Turkey |
| 9. Machinery and Chemical
Industry | 20. Turkish Airlines |
| 10. Coal Exploration Organization | 21. Nitrogen Industry |
| 11. Iron and Steel Plants | 22. Turkish Petroleum Admin-
istration |

A listing of Turkey's public debts, internal and external, at September 30, 1962, appears as Appendixes A-1 and A-2. External debts amounted to \$589 178 000 and internal debts amounted to \$971 696 000, or a total of \$1 560 874 000. The following tabulation compares the national debt of Turkey with that of the United States on a per-capita basis and in relation to Gross National Product.

	<u>Turkey</u>	<u>United States</u>
Estimated Population (000)	27 830	186 060
Gross National Product (000)	\$5 455 800	\$571 800 000
National Debt (000)	\$1 560 874	\$303 420 000
Per Capita	\$ 56	\$ 1,613
Percent of Gross National Product	28.6%	53.1%

Although the foregoing comparison is favorable to Turkey, it would be far more impressive if the debts of states, municipalities, corporations, and individuals in the United States were included. In Turkey there are practically no provincial or municipal debts. Corporate debts are largely held by the Government, and individual borrowings are insignificant.

Although progress has been made to industrialize the country, the foundation of Turkey's economy is still agriculture. As a result of this industrialization, however, agriculture's contribution to the national income is declining steadily, as shown in the table below.

SHARE OF AGRICULTURE, INDUSTRY AND
SERVICES IN NATIONAL INCOME

	<u>1927</u>	<u>1938</u>	<u>1948</u>	<u>1950</u>	<u>1958</u>	<u>1961</u>
Agriculture	67%	48%	53%	52%	44%	42%
Industry	10	16	14	16	22	23
Services	<u>23</u>	<u>36</u>	<u>33</u>	<u>32</u>	<u>34</u>	<u>35</u>
National Income	100%	100%	100%	100%	100%	100%

It can readily be seen from the above table that, while agriculture has been declining and services have remained virtually constant since 1938, industry in Turkey has been making rapid strides during the past decade.

Primarily as a result of inflationary conditions, the Gross National Product of Turkey has expanded rapidly since 1950, as shown in the following table.

GROSS NATIONAL PRODUCT

(Current Prices)

1950-1961

(Millions of Turkish Lira)

1950	10 384.3	1956	24 334.0
1951	12 270.8	1957	30 528.7
1952	14 320.5	1958	36 108.8
1953	16 821.0	1959	44 703.7
1954	17 114.8	1960	48 962.8
1955	21 059.5	1961	49 213.0

Source: Prime Ministry of the Republic of Turkey; First Five-Year Plan, Vol. I

Conversion of the lira into U.S. dollars presents a different picture. In 1950 Gross National Product amounted to \$ 3.7 billion. By 1957 the total was \$ 10.8 billion, or almost triple the 1950 figure. However, the effect of devaluing the lira under the stabilization program in 1958 checked the rampant inflation, and by the end of 1961 Turkey's Gross National Product was equivalent to \$ 5.5 billion.

The table on the following page shows the source of Turkey's national income for the period 1950 to 1961 at current prices. The table on page II-16 offers the same data at constant 1961 prices.

Despite the substantial growth in recent years, Gross National Product of Turkey for the year 1961, on a per-capita basis, only equaled \$ 196, which compares with \$ 3040 for the United States.

b - Agriculture

As previously noted, Turkey is predominately an agricultural nation. Approximately 30 percent of the total land area is under cultivation, as shown in the table below. More than 75 percent of the population is engaged in farming, and 85 percent of the country's exports consist of unprocessed and processed farm products. Through processing more of the basic products in Turkey, greatly added values would be available to improve the over-all unfavorable foreign trade balance.

CULTIVATED LAND IN TURKEY

(000 Hectares)

<u>Year</u>	<u>Cultivated Area</u>	<u>Fallow</u>	<u>Total</u>	<u>Cultivated Land as Percent of Total Land</u>
1950	9 868	4 674	14 542	18.7
1951	10 600	4 672	15 272	19.5
1952	11 775	5 586	17 361	22.3
1953	13 021	5 791	18 812	24.2
1954	13 208	6 408	19 616	25.2
1955	14 205	6 793	20 998	27.0
1956	14 556	7 897	22 453	28.8
1957	14 392	7 769	22 161	28.5
1958	14 764	8 001	22 765	29.2
1959	15 020	7 920	22 940	29.5
1960	15 305	7 922	23 264	29.9

Source: Prime Ministry of the Republic of Turkey; First Five-Year Plan, Vol. I

REPUBLIC OF TURKEY

NATIONAL INCOME ACCORDING TO PRODUCTION
SECTORS, AT CURRENT PRICES *

1950-1961

(Millions of U. S. Dollars)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Agriculture	\$ 1 585.7	\$ 1 973.0	\$ 2 196.1	\$ 2 565.4	\$ 2 101.8	\$ 2 708.5	\$ 3 225.5	\$ 4 256.9	\$ 1 523.9	\$ 1 813.3	\$ 1 997.3	\$ 1 931.3
Industry	388.1	443.4	528.7	652.4	797.3	914.3	1,166.7	1,474.3	600.7	753.6	793.7	800.5
Construction	113.2	135.0	184.4	245.7	302.2	376.7	438.9	593.0	226.7	281.9	245.7	262.2
Commerce	337.5	383.3	467.2	583.0	637.2	844.9	760.3	795.6	278.7	381.3	419.9	389.3
Transportation	169.1	198.4	280.8	306.0	365.6	440.9	515.1	629.2	222.6	271.0	321.1	313.0
Financial Institutions	54.2	76.7	86.3	107.6	141.3	184.9	227.9	279.4	105.8	108.3)	328.9	351.2
Professions	125.5	153.8	180.0	191.4	227.2	298.4	351.9	420.2	155.8	178.6)		
Income From Dwellings	89.3	98.7	110.1	125.6	170.1	188.2	252.7	314.5	132.6	139.0	158.5	175.2
Government Services	323.3	338.2	383.2	445.0	515.8	530.0	611.8	726.9	258.7	354.0	417.3	463.6
Domestic Income	\$ 3 185.9	\$ 3 800.5	\$ 4 416.8	\$ 5 222.1	\$ 5 258.5	\$ 6 486.8	\$ 7 550.8	\$ 9 490.0	\$ 3 505.5	\$ 4 281.0	\$ 4 682.4	\$ 4 686.3
Income From Abroad	(7.2)	(8.5)	(11.2)	(10.8)	(15.7)	(26.1)	(34.4)	(49.4)	(16.2)	(25.3)	(26.7)	(27.7)
Net National Product (at Factor Prices)	\$ 3 178.7	\$ 3 792.0	\$ 4 405.6	\$ 5 211.3	\$ 5 242.8	\$ 6 460.7	\$ 7 516.4	\$ 9 440.6	\$ 3 489.3	\$ 4 255.7	\$ 4 655.7	\$ 4 658.6
Indirect Taxes	359.6	395.9	480.6	539.9	578.1	685.8	723.6	948.9	342.0	491.8	543.2	554.0
Net National Product (at Market Prices)	\$ 3 538.3	\$ 4 187.9	\$ 4 886.2	\$ 5 751.2	\$ 5 820.9	\$ 7 146.5	\$ 8 240.0	\$ 10 389.5	\$ 3 831.3	\$ 4 747.5	\$ 5 198.9	\$ 5 212.6
Depreciation	144.0	163.3	191.9	213.5	248.0	321.2	388.8	436.0	171.7	208.3	229.1	243.2
Gross National Product (at Market Prices)	\$ 3 682.3	\$ 4 351.2	\$ 5 078.1	\$ 5 964.7	\$ 6 068.9	\$ 7 467.7	\$ 8 628.8	\$ 10 825.5	\$ 4 003.0	\$ 4 955.8	\$ 5 428.0	\$ 5 455.8
Index (1950 = 100)	100.0	118.2	137.9	162.0	164.8	202.8	234.3	294.0	108.7	134.6	147.4	148.2

() Indicates red figure.

* Turkish lira converted into U. S. dollars at following effective rates: 1950 through 1957 at 2.82; 1958 through 1962 at 9.02.

Source: Prime Ministry of the Republic of Turkey; First Five-Year Plan, Vol. I.

REPUBLIC OF TURKEY

NATIONAL INCOME ACCORDING TO PRODUCTION
SECTORS, AT CONSTANT 1961 PRICES *

1950-1961

(Millions of U. S. Dollars)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Agriculture	\$ 1 342.2	\$ 1 620.0	\$ 1 724.7	\$ 1 888.4	\$ 1 516.1	\$ 1 653.7	\$ 1 797.3	\$ 1 842.6	\$ 1 842.6	\$ 1 953.2	\$ 2 037.2	\$ 1 931.3
Industry	449.1	486.7	527.3	580.7	608.3	632.6	673.8	722.8	773.4	811.7	809.5	800.5
Construction	146.6	152.5	183.7	255.0	211.2	221.8	225.0	278.4	299.3	303.7	250.6	262.2
Commerce	252.3	298.9	319.0	349.8	295.8	319.5	345.7	358.0	410.1	410.7	428.3	389.3
Transportation	129.4	141.2	172.9	184.6	221.7	244.8	254.0	271.8	269.5	291.9	327.5	313.0
Financial Institutions and Professions	138.6	157.1	176.0	188.7	210.6	245.8	256.1	273.8	304.6	309.0	335.5	351.2
Income From Dwellings	63.9	68.2	73.8	79.4	85.5	94.5	109.2	129.3	137.3	149.6	161.6	175.2
Government Services	237.0	249.9	268.0	307.2	330.5	324.5	329.6	365.5	387.6	381.3	425.7	463.6
Domestic Income	\$ 2 759.1	\$ 3 174.5	\$ 3 445.4	\$ 3 833.8	\$ 3 479.7	\$ 3 737.2	\$ 3 990.7	\$ 4 242.2	\$ 4 424.4	\$ 4 611.1	\$ 4 775.9	\$ 4 686.3
Income From Abroad	(15.9)	(18.4)	(19.9)	(22.2)	(20.1)	(21.6)	(23.1)	(24.5)	(27.6)	(27.8)	(27.2)	(27.7)
Net National Product (at Factor Prices)	\$ 2 743.2	\$ 3 156.1	\$ 3 425.5	\$ 3 811.6	\$ 3 459.6	\$ 3 715.6	\$ 3 967.6	\$ 4 217.7	\$ 4 396.8	\$ 4 583.3	\$ 4 748.7	\$ 4 658.6
Indirect Taxes	303.5	351.5	381.4	424.2	382.7	411.8	439.7	467.1	524.2	529.8	554.1	554.0
Net National Product (at Market Prices)	\$ 3 046.7	\$ 3 507.6	\$ 3 806.9	\$ 4 235.8	\$ 3 842.3	\$ 4 127.4	\$ 4 407.3	\$ 4 684.8	\$ 4 921.0	\$ 5 113.1	\$ 5 302.8	\$ 5 212.6
Depreciation	111.8	125.0	138.9	151.1	154.6	167.6	180.2	195.7	209.7	224.4	233.7	243.2
Gross National Product (at Market Prices)	\$ 3 158.5	\$ 3 632.6	\$ 3 945.8	\$ 4 386.9	\$ 3 996.9	\$ 4 295.0	\$ 4 587.5	\$ 4 880.5	\$ 5 130.7	\$ 5 337.5	\$ 5 536.5	\$ 5 455.8
Index (1950 = 100)	100.0	115.0	124.9	138.9	126.5	136.0	145.2	154.5	162.4	169.0	175.3	172.7

() Indicates red figure.

* Turkish lira converted into U. S. dollars at the rate of 9.02 TL.

Source: Prime Ministry of the Republic of Turkey: First Five-Year Plan, Vol. I.

It will be noted that the cultivated area has remained practically constant in the five years 1955-1960. To enlarge the growing area an irrigation program has been initiated.

Principal crops are cereals, of which wheat accounts for more than half, sugar beets, potatoes, oilseeds, cotton, and tobacco. Fruits and nuts, namely, figs, grapes (raisins), olives, and hazelnuts, are important crops of Turkey. The table below shows agricultural production, by principal products, for the years 1958 to 1960.

AGRICULTURAL PRODUCTION

1958-1960

Metric Tons (000)

<u>Crop</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>
Wheat	6 500	5 800	7 000
Barley	2 800	3 000	3 100
Corn	625	600	750
Rye	332	500	600
Oats	280	300	500
Rice	75	90	95
Total Cereals	10 612	10 290	12 045
Sugar Beets	2 338	3 469	4 385
Potatoes	1 400	1 200	1 400
Oilseeds	471	547	630
Beans and Peas	369	391	396
Olives	452	281	350
Pulses	193	198	225
Cotton	130	171	160
Tobacco	115	122	139
Hazelnuts, Shelled	50	35	25

Source: U.S. Department of Commerce

Yields of agricultural products are far below those experienced in more progressive agricultural countries. This results from unimproved farming methods, overworked soils, and little use of fertilizers. As an illustration, wheat, the principal cereal grown, is the basic staple in the local diet. However, wheat yield per hectare has not shown any improvement in the past decade, as shown in the following table:

WHEAT PRODUCTIVITY PER HECTARE

<u>Year</u>	<u>Bushels Per Hectare</u>	<u>Kilograms Per Hectare</u>
1950	346	942
1951	446	1213
1952	456	1241
1953	476	1295
1954	314	854
1955	378	1029
1956	351	955
1957	439	1195
1958	441	1201
1959	405	1103
1960	432	1175
1961	361	983

Source: Prime Ministry of the Republic of Turkey;
First Five-Year Plan, Vol. I

The mild variations from year to year are primarily due to varying weather conditions. Turkey's internal demands for this staple has caused large quantities of wheat to be imported. One million metric tons were imported from the United States in 1961. Improved methods of farming would at least eliminate this unfavorable trade balance and might provide an additional source of exports.

Barley accounts for about 25 percent of total cereal production and is one of Turkey's export crops.

The sugar refining industry, under encouragement by the Government, has increased sugar beet production threefold since 1948. This has enabled Turkey to become self-sufficient for its sugar needs and permits a small surplus for export.

Turkish tobacco has been a major contributor to income from exports for many years. Tobacco is primarily grown along the fertile coastal areas of the Black, Marmara, and Aegean Seas.

Livestock in Turkey has been increasing over the past decade. Livestock population as of 1960 was as follows:

	<u>Livestock Population</u>		<u>Livestock Population</u>
Sheep	33 614 000	Donkeys	1 874 000
Goats	18 941 000	Horses	1 387 000
Cattle	13 076 000	Water Buffalo	1 229 000
Angora Goats	6 137 000		

Dairying has been a minor factor in the Turkish economy. Much of the country's milk requirements are obtained from sheep and goats; milk yields, therefore, are relatively low.

The Ministry of Agriculture, in order to maintain and improve the agricultural segment of the economy, has established educational and research programs and credit and price policies. The Agricultural Supply Office assists in importing needed machinery and fertilizers, while a special bank was established to extend short-term loans for the purchase of the machinery and fertilizers.

In addition, the Government guarantees price supports for such crops as cereals, sugar beets, tobacco, and others important to the nation's economy.

c - Industry

Industry, as a whole, accounted for 14 percent of national income in 1948, increasing to 23 percent by 1961. For an agricultural country, industrial growth of this magnitude indicates the interest and desire of the Government to raise the basic economy and standard of living.

Turkey, in its endeavor to add impetus to the industrial and social reforms inaugurated with the establishment of the Republic, and lacking private investment capital, assumed the task of supplying large-scale capital. In the mid-1930's, Turkey established several State Economic Enterprises for the purpose of accelerating and controlling the development of the country's economy. The first state enterprise was the Sumerbank, established in 1934, combining the functions of the State Industrial Office and the Industrial Credit Bank. The Sumerbank's scope of responsibility is quite broad, managing such industries as cotton and woolen textile mills, cement, paper, hemp, firebrick, and shoe plants, among others.

The Etibank was established in 1935 with a more limited sphere of activity, namely, mining and electricity. In 1937 the Agricultural Bank, already in existence, was converted into a State Economic Enterprise. The above-mentioned three, initially forming the nucleus of the State Economic Enterprises, helped finance many public ventures which were

created later. The table below lists the 12 existing State Economic Enterprises, which are subject to regulation and controls as provided by the laws creating them and also to Law No. 3460, in chronological order of their establishment or conversion to a State Enterprise.

STATE ECONOMIC ENTERPRISE

<u>Name</u>	<u>Date</u>
Sumerbank (SB)	1934
Etibank (EB)	1935
Agricultural Bank (ZB)	1937
Soil Products Office (TMO)	1938
Agricultural Supplies Organization (ZDK)	1944
Machine and Chemical Industries (MKEK)	1950
State Railways (DDY)	1953
Post, Telegraphs and Telephone (PTT)	1953
State Supplies Office (DMO)	1954
Cellulose and Paper Mills (SEKA)	1955
Iron and Steel Works (TDC)	1955
Coal Enterprises (TKI)	1957

Source: Prime Ministry of the Republic of Turkey;
First Five-Year Plan, Vol. I

There are other State Economic Enterprises subject to other laws, or which may be a subsidiary of one of the aforementioned enterprises. These, likewise, play an important role in the industrial economy.

There are approximately 15 organizations whose entire capital belongs to the State Economic Enterprises, and 57 companies with more than half of their capital being State controlled. There are also four ventures with virtually equal State and private capital structure.

In addition, there are approximately 63 organizations whose capital ownership is mixed but where private capital predominates. Through partial or complete ownership, the State has a direct participation in virtually all of Turkey's industrial activities.

While the basic concept of the State Economic Enterprises is very worthy from the standpoint of economic development, several factors have contributed to detrimental conditions which have hampered the economy as a whole.

A lack of clear definition concerning the proper organizational structure for a given type of enterprise has given rise to confusion. Furthering the confusion has been the rate of turnover in the directorships of many of the State Economic Enterprises. For example, in the last 10 years there have been nine Directors General in the Etibank and nine in the State Railways, eight in the Iron and Steel Enterprises, six in the Machine and Chemical Industries Organization, and five in the Sumerbank.

In some instances the public enterprises are not responsible to the ministry most concerned with their aims; and there is an overlapping of functions among the State Economic Enterprises. The Five-Year Plan, discussed in more detail in section (g) of this section, recognizes the inadequacies of not only the Economic Enterprises but also those existing in Governmental agencies. It recommends reorganization of these enterprises.

The principal industries of Turkey are iron and steel, metalworking, cement, building materials, and chemicals. Textiles, sugar, and paper are also important industries in Turkey today.

The table below shows production of the principal industries for 1962.

<u>Commodity</u>	<u>Metric Tons</u>
Cement	2 184 000
Sugar	450 000
Steel	246 468
Paper	60 000
Textiles (000)	
Cotton	686 000 meters (750 000 yards)
Woolen	29 000 meters (32 000 yards)

Cement production has increased fivefold in the past decade, as the following table shows. The cement industry, through this rapid

expansion, has managed to supply virtually all domestic needs, thereby reducing the foreign trade deficit.

CEMENT

(000 Metric Tons)

<u>Year</u>	<u>Production</u>	<u>Imports</u>
1950	395	135
1951	396	243
1952	459	389
1953	531	537
1954	703	629
1955	819	811
1956	970	293
1957	1261	299
1958	1517	20
1959	1734	2
1960	2038	4

Source: Prime Ministry of the Republic of Turkey; First Five-Year Plan, Vol. I

d - Foreign Trade

The foreign trade deficit, that is, the excess of imports over exports, has grown to substantial proportions, amounting to \$220 million for the year 1962. There are several reasons for these chronic deficits. The Government's program for industrialization has created a demand for foreign commodities such as machinery and related supplies, transportation equipment, petroleum, and chemicals. Until such time as the newly developed industries expand to the point of volume production for export, they will continue to create a foreign trade deficit.

As previously noted, the local oil industry currently supplies only 25 percent of domestic fuel needs, thereby requiring imports of petroleum.

The imbalance of foreign trade is furthered by the "nonessential" nature of Turkey's exports, such as tobacco, fruits, and nuts, as opposed to the essential commodities that Turkey imports, machinery, petroleum, and chemicals.

The following table portrays the import-export situation in Turkey since 1950:

TURKISH FOREIGN TRADE

1950-1962

(Millions of U.S. Dollars)

<u>Year</u>	<u>Imports</u>	<u>Exports</u>	<u>Deficit</u>
1950	285.7	263.4	22.3
1951	402.1	314.1	88.0
1952	555.9	362.9	193.0
1953	532.5	396.1	136.4
1954	478.4	334.9	143.5
1955	497.6	313.3	184.3
1956	407.3	305.0	102.3
1957	397.1	345.2	51.9
1958	315.1	247.3	67.8
1959	470.0	353.8	116.2
1960	468.2	320.7	147.5
1961	509.5	346.7	162.8
1962	601.0	381.0	220.0

Source: Prime Ministry of the Republic of
Turkey; First Five-Year Plan,
Vol. I

The pattern of imports and exports by commodities for 1958-1960 is shown in the table on the following page.

Turkey carries on more foreign trade, both imports and exports, with the United States than any other country. West Germany is a strong second in both categories. For example, of Turkey's 1960 imports, 26 percent were supplied by the United States and 21 percent by West Germany. Of 1960 exports, 18 percent went to the United States and 15 percent to West Germany.

Turkey also trades with Italy, United Kingdom, and Soviet bloc countries, among others. As for principal commodities imported, machinery mainly comes from the United States and West Germany; petroleum products from the United States, Saudi Arabia, and Great Britain; and iron and steel from Western Europe, the United States, and Poland.

TURKISH FOREIGN TRADE BY
PRINCIPAL COMMODITY GROUPS

1958-1960

(Millions of U.S. Dollars)

<u>Commodity Group</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>
<u>Imports</u>			
Machinery and Transport Equipment	106.3	162.4	194.0
Manufactured Goods	78.7	119.2	122.1
Crude Materials, Except Fuels	21.2	26.7	28.0
Mineral Fuels, Lubricants, and Related Products	40.4	65.8	52.0
Chemicals	35.7	55.8	40.0
Animal and Vegetable Oils and Fats	19.8	27.5	16.3
Food, Beverages and Tobacco	<u>13.0</u>	<u>12.4</u>	<u>15.6</u>
Total Imports	315.1	469.8	468.0
<u>Exports</u>			
Tobacco	84.0	91.5	65.0
Cotton	22.4	54.4	46.0
Hazelnuts	29.5	43.0	39.0
Raisins	18.8	18.2	17.8
Wool, Mohair	7.5	20.3	14.5
Chrome Ore	18.7	10.1	12.0
Wheat	2.8	22.1	2.0
Other	<u>63.5</u>	<u>95.5</u>	<u>124.7</u>
Total Exports	247.2	355.1	321.0

Source: Central Statistical Office, Monthly Bulletins of Statistics

e - Communications

As of 1960 there were 7855 kilometers (4881 miles) of railway in Turkey. This railway system links most of the important economic centers of the country. The Government-owned system, operated by the State Railways (DDY), plays an important role internationally by linking Europe and Asia. At present, rail connections between the two continents are interrupted at the Bosphorus, where all traffic must be transshipped by ferry. A dieselization program is in progress to modernize and further the railway's capacity for transporting passengers and freight as the country continues to industrialize. It is also planned to electrify the railway system from Istanbul to Ankara.

A network of highways complements the railway system. In 1960, a total of 60 000 kilometers (37 284 miles) of all-weather roads linked major cities and towns. Approximately 15 percent of this highway system is asphalt-paved and this percentage is increasing annually. As of December 1960 a total of 102 806 motor vehicles were registered in Turkey, exclusive of military vehicles. Of this total there were approximately 48 100 trucks; 25 600 passenger cars; 12 000 taxis; 8900 buses; and 8200 motorcycles.

Shipping is an important factor in the Turkish economy. As previously noted, Turkey's geographical location at the eastern end of the Mediterranean Sea provides the gateway to the East. An extensive modernization and development program of port facilities resulted in an increased cargo-handling capacity of 5 000 000 metric tons in 1960. Istanbul is by far the principal port in Turkey for both passenger and import cargo traffic. Other major ports are Izmir on the Aegean Sea, Samsun and Trabzon on the Black Sea, and Iskenderun and Mersin on the Mediterranean Sea. Eregli and Zonguldak, principally coal-handling ports, are also located in the northwestern portion of Turkey on the Black Sea. In 1960 the merchant marine fleet had a total gross tonnage of 799 000 metric tons.

Turkey's major international airports are at Istanbul, Ankara, and Izmir, as well as Adana in the south near Syria. Thirteen foreign airlines provide scheduled international air service to and from Turkey. The Turkish Airways Corporation (THY), controlled by the Government, provides domestic air service to some 30 Turkish cities. Flights are also available to Athens, Rome, Frankfurt, Beirut and Cypress.

Telephone, telegraph, and postal service is provided by a State Enterprise (PTT). The number of telephone subscribers amounted to 178 665 in 1960. Local telephone service has been extended to all cities in Turkey and many have automatic exchanges. Long-distance telephone service is provided between all principal Turkish cities, and international service is available to the United States, principal countries in Europe, and Middle Eastern countries such as Iran, Syria, and Israel.

Radio broadcasting is controlled by the Government with commercial stations in Istanbul, Izmir, Ankara, Adana, Gazi-Antep, and Erzurum. As of 1960, there were approximately 1 400 000 radio sets in Turkey. Television, however, has not been introduced in Turkey on a commercial basis.

f - Tourism

Turkey has a potential source of foreign exchange by development of the tourist trade. In the last 10 years the number of foreign tourists visiting Turkey has increased 12 percent annually, despite the fact that little or no effort had been made to attract the tourist. In 1961, 129 000 tourists visited Turkey and spent approximately \$7.5 million in foreign exchange. It has been estimated that with proper promotion and investment the annual growth in number of tourists could be increased to 20 percent within a year or two. At present the average tourist stays in Turkey 4 days and spends \$60. The First Five-Year Plan anticipates an average stay of 6 days and an expenditure of \$100 by 1967.

Istanbul, and its surroundings, can offer historical tourist attractions, fine facilities for bathing and boating, pleasant weather, and modern hotels. However, deterrents to expanding tourism to other regions of the country are the lack of adequate hotel and motel facilities and good access roads to areas of interest. An example is the Antalya region along the Mediterranean Sea coast which offers caverns and ruins of historical interest, fine beaches, and pleasant seasonal weather, but lacks the hotels and roads so necessary to develop a tourist trade. The revenue from an expanding tourist trade could further reduce the foreign exchange deficit.

g - The Development Plan

In late 1960 the State Planning Organization was created to review the economy of the country and establish long-range plans for economic development. This study resulted in preparation of the Development Plan. The Plan is to be a 15-year program, divided into three integrated 5-year segments. The program aims at achieving a 7 percent annual increase in National Income, solving the unemployment problem, and reaching a balance in the external payments. To attain this goal, 18 percent of the Gross National Product must be invested annually. This compares with approximately a 15 percent rate in recent years.

The First Five-Year Plan covers the years 1963-1967 with emphasis on housing, agriculture, electricity, and industry. The First Five-Year Plan in some respects appears contradictory to the over-all targets of the 15-year program. To set the long-term plan in motion certain sacrifices must be made in the initial short-term period. Foreign aid must be

sought which will have the immediate effect of creating an even greater deficit than currently exists in the balance of payments.

A consortium, Organization for Economic Cooperation and Development (OECD), of 13 western nations, including the United States, together with the International Bank for Reconstruction and Development, was formed to raise foreign aid to finance the Plan. The consortium has agreed to cooperate with the Plan, providing Turkey undertakes fiscal reforms. Since the beginning of 1963 Turkey has received \$250 million in new funds to aid the programs. In July, France increased its contribution from \$22 million to \$25 million and West Germany raised its contribution by \$12 500 000 to \$40 million.

A report issued by OECD in July 1963, according to a press article, praised the 1963-1967 development plan but listed the problems the country faces, starting with backward agriculture, rapid population growth, and ending with poor statistics and insufficient taxation. The worst problem, the report stated, was the chronic deficit in balance of international payments, now burdened by a large annual debt payment. The report said "during much of the 1950's Turkey suffered heavily from inflation and from economic policies which ill-served the Country's basic economic problems." Apart from internal difficulties and mismanagement, the report pointed to one major external problem, the failure of exports to grow, which is the heart of the Turkish balance of payment problems.

To foster economic reforms, the Turkish Parliament anticipates enactment of certain financial and economic laws in 1963. These include reforming the tax laws, together with other measures including reorganization of credit institutions, the Central Bank, and State Economic Enterprises.

h - Climate for Foreign Investment

In recent years the Government has taken steps to stimulate the investment of private capital in industry. The Industrial Development Bank was established, credit facilities were expanded, and guaranteed returns on investment were offered in favored industries.

The foreign investment law of 1954 guaranteed unlimited transfer of profits and capital investments approved by the Government. At the end of 1960, direct private investment in Turkey by United States interests amounted to \$65 000 000..

However, further industrial development is impeded by the lack of internal capital and foreign exchange shortages. This limits the amount of raw materials and machinery that can be imported. A further hindrance to industrial development is the insufficiency of managerial and technically trained personnel.

B - ELECTRIC POWER INDUSTRY IN TURKEY

1 - Early History

Inauguration of electric service in Turkey was somewhat belated in relation to European countries. The first power plant was installed at Tarsus in 1902, and the first service to a large community was at Istanbul in 1913. Development of the industry was continued at a very modest pace until the establishment of the Republic in 1923, at which time the total installed capacity approximated 33 000 kilowatts.

In an endeavor to implement the social and industrial reforms undertaken by the new government, franchises were granted to foreign financial companies to construct and operate electric systems in a number of communities. These facilities ultimately were purchased by the government and turned over to the local municipalities. As local requirements continued to rise the municipalities, lacking adequate financial resources, were unable to expand their facilities, although some progress was made.

The development of electric power after 1923 followed the trend toward industrialization. Many new industries undertaken during the early industrial development period, unable to obtain electric power from existing plants, installed generating facilities for their own requirements. These plants, called Auto-Producers, sell any available surplus energy for local distribution.

Following World War II, when capacity totaled 246 000 kilowatts in 1945, expansion accelerated with the installation of larger regional plants. In the next decade, capacity more than doubled to 611 000 kilowatts, and in the seven-year period 1956-62 more than doubled once again to 1 330 000 kilowatts at the end of 1962.

2 - Electric Industry Organization

At present, more than 95 percent of the electric power industry is owned and operated by agencies or departments of the National government or by municipalities.

The Ministry of Industry is charged with the duties and responsibilities for the organization, control and coordination of the country's energy problems. The Energy Department of the Ministry of Industry has been delegated the responsibility for communications and cooperation among the government administrations, organizations, municipalities, and private companies concerning energy activities. The Energy Department has jurisdiction over

contracts, concessions, licenses and permits relating to energy matters. The design, construction, and management of energy projects are subject to review and approval of the Energy Department. This department also establishes regulations pertaining to energy matters, including structures for tariffs.

Elektrik Isleri Etut Idaresi (EIE), was created in 1935 by Law No. 2819. It is subject to the Ministry of Industry. Its principal functions are as follows:

- Survey water and other power resources of the country and determine those most suitable for power generation;
- Prepare studies and estimates justifying the most economical and efficient production of electric power requirements of the country;
- Prepare the electric power sections of future industrial programs;
- Assist in training programs of electrical engineers and technical personnel;
- Prepare statistics pertaining to the electric industry; and
- Analyze cost and operating data of electric plants to test efficiencies, and compare operations with those of other countries.

Etibank, a State Economic Enterprise, was created in 1935 by Law No. 2805 to develop energy production, and is also subject to Law No. 3460 which relates to the organization, administration and control of State Economic Enterprises established with capital fully supplied by the State. In 1956, an amendment to the Etibank law granted it full general banking operations. Etibank is engaged primarily in mining activities, except coal and iron mining which it once controlled but which have been established as separate enterprises. It also conducts commercial banking activities, constructs and operates electric plants and transmission facilities, and participates in development of commercial and industrial enterprises.

Etibank has set up an Electricity Directorate, Elektrik Isletmeleri Muessesesi (EEIM), to operate its power facilities, and distribute its output and that of the State Hydraulic Works (DSI).

Etibank also has participations in three private companies engaged in the electric power industry, as well as in 25 commercial and financial companies.

The General Directorate of Devlet Su Isleri (DSI), the State Hydraulic Works, was created under Law No. 6200 in December 1953, and is subject to the jurisdiction of the Ministry of Public Works. Its principal functions relate to flood control, irrigation, water supply and sewerage, and construction and operation of hydroelectric power facilities.

It is the function of the Ministry of Reconstruction and Settlement, created by Law No. 7116 of May 9, 1958, to plan and supervise construction, including electric power facilities, within provinces and municipalities. These duties previously were assigned to the Ministry of the Interior.

Iller Bankasi (Iller Bank) was created by Law No. 4759 enacted on June 13, 1945 and is subject to the jurisdiction of the Ministry of Reconstruction and Settlement. It is the function of Iller Bank to supply credit (loans) in connection with reconstruction of municipalities, including installation of electric, water and other facilities. It is empowered to conduct the planning, construction and supervision of such facilities.

With the exception of several private companies, electric power is distributed by some 600 municipalities. Although some municipalities extend service beyond corporate limits, many are reluctant, or do not have resources to extend facilities, which retards expansion of service in outlying areas.

3 - Power Policy of Government and Pending Legislation

It is apparent from the number of agencies and organizations involved with electric power that the government recognizes the importance of electric power in furthering its social and economic progress, especially in expanding industrial development of the country. However, the complexity of the present setup is also recognized. In 1959, a bill which was introduced in Parliament to consolidate the functions of those engaged in the electric industry was defeated. There is presently pending before the legislature a bill to establish "Turkish Electric Association" (TEK). It would be subject to the jurisdiction of the Ministry of Industry. The duties of TEK would be to conduct all necessary research and studies relating to generation, transmission, distribution, and exports and imports of electric energy (except planning and construction of projects generating power from water resources); to establish all required electric generating plants (except DSI hydroelectric plants), transmission lines, distribution

systems, and export and import facilities. All hydroelectric plants would be the responsibility of DSI during planning and construction, and upon completion TEK would assume responsibility of operations of the power plant. At multipurpose installations the electric facilities, except dams, would be transferred to TEK at an assigned cost.

All rights previously given to municipalities would be transferred to TEK. Only the National government would be allowed to give rights for the generation and sale of electrical energy for public use. Provinces and municipalities would not be permitted to build or operate any electrical installation, except for pumping or irrigation. Electrification of villages would be the responsibility of TEK with budgeted funds from the National government.

4 - Power Supply Conditions in Municipalities

Distribution of electricity is handled by the local municipalities. The following tabulation shows the number of communities served with electricity at the end of 1961:

NUMBER OF MUNICIPALITIES

	<u>Total</u>	<u>With Local Governments</u>	<u>With Electric Service</u>
Provincial Centers	67	67	67
District Centers	570	553	369
Subdistrict Centers	923	196	56
Villages	<u>35,635</u>	<u>188</u>	<u>36</u>
Total	37,195	1,004	528

The dependability of electric service in the various municipalities from 1955 through 1961 is shown in the table on the following page. Although the country is steadily expanding electric service to new communities, power limitations exist in many places where continuous service is available, and only partial service is available to more than half the communities.

POWER SUPPLY CONDITIONS IN MUNICIPALITIES

1955-61

	<u>Continuous Service</u>		<u>Partial Service</u>		
	<u>No Power Limitation</u>	<u>Power Limitation</u>	<u>No Power Limitation</u>	<u>Power Limitation</u>	<u>Total</u>
Provincial Centers					
1955	28	27	4	7	66
1956	24	29	3	10	66
1957	31	21	7	8	67
1958	30	27	1	9	67
1959	22	35	3	7	67
1960	18	39	1	9	67
1961	29	30	1	7	67
District Centers					
1955	71	33	139	33	276
1956	60	42	128	54	284
1957	68	47	139	50	304
1958	62	56	99	94	311
1959	71	58	113	78	320
1960	59	78	113	92	342
1961	76	69	118	106	369
Subdistrict Centers					
1955	7	3	27	1	38
1956	4	3	27	8	42
1957	6	2	23	6	37
1958	10	3	19	7	39
1959	5	6	18	12	41
1960	10	5	21	14	50
1961	10	7	18	21	56
Villages (With Local Government)					
1955	5	-	3	1	9
1956	4	-	6	-	10
1957	6	1	7	-	14
1958	4	3	6	3	16
1959	8	2	3	4	17
1960	10	3	5	6	24
1961	15	4	10	7	36
Total					
1955	111	63	173	42	389
1956	92	74	164	72	402
1957	111	71	176	64	422
1958	106	89	125	113	433
1959	106	101	137	101	445
1960	97	125	190	121	483
1961	130	110	147	141	528

All places having electric service without interruption throughout the year, except during outages of short duration and during maintenance work, are classified as having "Continuous Service." Places having electric service only in some part of a day are considered as having "Partial Service."

If customers in a place are subject to power limitations in the course of a year, through voltage reduction or power cut, or no new customers are connected, this type of place is defined as having power supply with "Power Limitation." Places having no power limitations at the time of service are classified as having power supply with "No Power Limitation." Voltage drop due to insufficient distribution facilities is not considered as a power limiting factor.

5 - Consumers

The tabulation below shows the number of consumers of municipal utilities at the end of each year 1940 through 1962. In the 22 years since 1940, an 8.4 percent compound growth rate has been experienced in total customers. During World War II and the immediate postwar period this growth trend was at a slower pace, accelerating greatly in 1949 through 1955, and in the most recent period has ranged from 6.5 percent to 8.5 percent annually. The rate of growth in the number of domestic and commercial customers served with electricity has increased at the compound rate of 9.7 percent since 1946, in contrast to a 2.7 percent rate in population. Despite the substantial increases experienced in customers served over the years, electric service is available to only 31 percent of the population.

NUMBER OF CONSUMERS

1940-62

<u>Year</u>	<u>Domestic and Commercial</u>	<u>Offices</u>	<u>Industry</u>	<u>Total</u>	<u>Annual Percentage Increase</u>
1940	N R	N R	N R	275 434	5.8
1941	N R	N R	N R	293 649	6.6
1942	N R	N R	N R	315 527	7.5
1943	N R	N R	N R	333 015	5.5
1944	N R	N R	N R	342 771	2.9
1945	N R	N R	N R	354 734	3.5
1946	345 891	8 790	12 513	367 194	3.5
1947	360 723	9 790	13 619	384 132	4.6
1948	383 866	10 387	14 726	408 979	6.5
1949	424 914	10 182	16 541	451 637	10.4
1950	486 762	11 350	19 300	517 412	14.6
1951	561 653	11 141	21 967	594 761	14.9
1952	632 356	11 633	25 530	669 519	12.6
1953	728 703	13 492	31 393	773 588	15.5
1954	801 423	14 034	36 836	852 293	10.2
1955	917 618	13 098	40 956	971 672	14.0
1956	991 834	15 312	47 250	1 054 396	8.5
1957	1 076 161	15 350	53 030	1 144 541	8.5
1958	1 156 543	15 319	58 394	1 230 256	7.5
1959	1 235 125	15 324	60 057	1 310 506	6.5
1960	1 340 533	18 691	65 927	1 425 151	8.8
1961 *	1 430 000	22 000	71 000	1 523 000	6.9
1962 *	1 525 000	25 000	75 000	1 625 000	6.7

N R Not reported.

* 1961 figures are preliminary and those for 1962 are estimated.

6 - Power and Energy Resources of Present System

The number of generating plants and their installed capacities for the period 1940 through 1962 are shown in Appendix F-1. Except for the installation of 20 regional plants since 1950 with total generating capacity of 657 522 kilowatts and a few large plants serving the cities, these plants are small, and in many instances obsolete, with high operating costs. However, most of these small plants are not part of the interconnected system, and are the only source of power available in the municipalities where they are located.

Appendix F-2 shows the number and installed capacity of generating units by types of prime movers at December 31, 1960.

A brief description of each of the major plants, showing date of installation of each unit and output for the past five years, is given in Appendix F-3 and Appendix F-4.

The number of generating plants, total installed capacity and the nonsimultaneous peak load in the years 1950 through 1962 are shown below:

<u>Year</u>	<u>Number of Plants</u>	<u>Installed Capacity (Kilowatts)</u>	<u>Peak Load (Kilowatts)</u>
1950	355	407 781	190 000
1951	368	423 242	218 000
1952	382	437 836	268 000
1953	440	499 549	296 000
1954	489	516 894	335 000
1955	532	611 633	366 000
1956	575	886 058	399 000
1957	582	939 399	434 000
1958	637	1 029 971	501 000
1959	826	1 161 033	558 000
1960	934	1 272 432	617 000
1961	999	1 312 670	694 000
1962	1 015	1 330 170	802 000

7 - Transmission and Distribution Lines

Transmission lines at December 31, 1961 consisted of 2113 kilometers of 154 kv, 931 kilometers of 66 kv, 605 kilometers of 33 kv and 1840 kilometers of low-voltage lines. In 1940 only 14 kilometers of 33-kv line were installed. The first 66-kv line was placed in service in 1948 with a length of 99 kilometers. In 1952 the first phase of the 154-kv transmission system was installed, the length being 238 kilometers.

The following tabulation shows transmission and distribution lines operated at the end of each year 1957-61.

TRANSMISSION AND DISTRIBUTION LINES

1957-62

(Circuit Kilometers)

<u>Volts</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>
Transmission					
154 000	1 547.5	1 753.8	1 956.4	2 038.3	2 113.3
66 000	334.4	468.4	645.4	851.4	931.4
33 000	222.0	435.0	527.8	579.6	605.1
26 000	34.0	33.8	33.8	33.8	33.8
22 000	41.0	40.6	40.6	40.6	40.6
20 000	17.0	17.0	17.0	17.0	17.0
15 000	118.0	171.8	171.8	298.5	316.8
10 000	35.5	80.6	80.6	101.7	125.7
6 000	207.0	208.5	208.5	257.8	281.3
5 000	-	1.3	1.3	1.3	1.3
3 000	8.0	10.2	10.2	23.6	23.1
Total Transmission	2 564.4	3 221.0	3 693.4	4 243.6	4 489.4
Distribution					
High Voltage Overhead					
33 000	37.0	148.8	148.8	148.8	148.8
15 000	57.9	57.9	57.9	57.9	57.9
10 000	32.0	32.0	32.0	32.7	34.7
6 000	120.0	121.8	125.9	157.4	184.6
3 000	1.7	1.7	1.7	1.8	1.8
Low Voltage Overhead	8 590.0	9 072.0	9 950.0	10 732.0	11 500.0
High Voltage					
Underground Cables	1 085.0	1 990.0	2 100.0	2 193.0	2 315.0
Low Voltage					
Underground Cables	1 542.0	1 785.0	1 780.0	1 778.0	1 850.0
Total Distribution	11 465.6	13 209.2	14 196.3	15 101.6	16 092.8

The principal transmission systems of the country are operated by Elektrik Isletmeleri Muessesesi (EEIM). The systems are located in North-west Anatolia and West Anatolia and represent the main interconnected system. A list of EEIM transmission lines is shown in Appendix F-5.

8 - Transformers

Transformers at December 31, 1961 located at power plants numbered 485 with 1 137 016-kva capacity, and network transformers totaled 3650 having capacity of 2 253 770 kva. A list of the transformer stations of EEIM connected to high voltage transmission lines is given in Appendix F-6.

9 - Production

Gross production for the years 1940 through 1962 by type of plants is shown on the following page, and is summarized below:

MEGAWATT-HOURS

<u>Year</u>	<u>Thermal Plants</u>	<u>Hydro Plants</u>	<u>Total</u>	<u>Annual Increase</u>
1940	383 004	13 894	396 898	-
1945	504 046	23 762	527 808	-
1950	759 524	30 100	789 624	-
1951	843 415	44 507	887 922	12.4%
1952	961 579	58 669	1 020 248	14.9
1953	1 133 346	67 456	1 200 802	17.7
1954	1 319 557	82 885	1 402 442	16.8
1955	1 490 668	89 150	1 579 818	12.6
1956	1 656 248	162 908	1 819 156	11.5
1957	1 745 400	311 283	2 056 683	13.1
1958	1 646 141	657 301	2 303 442	12.0
1959	1 896 366	690 983	2 587 349	12.3
1960	1 813 661	1 001 410	2 815 071	8.8
1961*	1 773 500	1 276 500	3 050 000	8.3
1962*	2 436 400	1 117 000	3 553 400	16.5

Since 1950 production has been doubling every five and one-half years. The slowdown in the rate of growth in 1960 and 1961 reflects uncertainties created by the May 1960 revolution, but in 1962 the former rate of growth was re-established. Production from hydroelectric plants has increased importantly since 1955, and in recent years has contributed from 30 percent to 40 percent of the total energy supply. Of the total production in 1962, regional plants supplied 65 percent, municipal plants, 22 percent, and auto-producers, 13 percent.

* Preliminary

ELECTRIC POWER INDUSTRY IN TURKEY

GROSS PRODUCTION

(Megawatt-Hours)

1940-1962

Year	Municipal Plants			Regional Plants			Auto-Producers			Total All Plants		
	Thermal	Hydro	Total	Thermal	Hydro	Total	Thermal	Hydro	Total	Thermal	Hydro	Total
1940	205 789	11 109	216 898	-	-	-	177 215	2 785	180 000	383 004	13 894	396 898
1945	239 135	15 253	254 388	-	-	-	264 911	8 509	273 420	504 046	23 762	527 808
1950	387 221	21 464	408 685	105 835	-	105 835	266 468	8 636	275 104	759 524	30 100	789 624
1951	439 765	23 340	463 105	110 907	-	110 907	292 743	21 167	313 910	843 415	44 507	887 922
1952	470 407	28 455	498 862	164 687	-	164 687	326 489	30 214	356 699	961 579	58 669	1 020 248
1953	443 571	33 229	476 800	353 470	-	353 470	336 305	34 227	370 532	1 133 346	67 456	1 200 802
1954	556 089	41 910	597 999	373 727	10 097	383 824	389 741	30 878	420 619	1 319 557	82 885	1 402 442
1955	664 939	44 314	709 253	403 920	13 512	417 432	421 809	31 324	453 133	1 490 668	89 150	1 579 818
1956	650 089	45 750	695 839	596 062	84 497	680 559	410 097	32 661	442 758	1 656 248	162 908	1 819 156
1957	543 345	48 679	583 033	895 179	232 377	1 127 556	315 867	30 227	346 094	1 745 400	311 283	2 056 683
1958	496 329	55 206	551 535	790 599	569 324	1 359 923	359 213	32 771	391 984	1 646 141	657 301	2 303 442
1959	495 900	57 210	553 110	1 005 004	603 222	1 608 226	395 462	30 551	426 013	1 896 366	690 983	2 587 349
1960	496 908	63 626	560 534	920 353	901 880	1 822 233	396 400	35 904	432 304	1 813 661	1 001 410	2 815 071
1961*	400 000	63 600	463 600	974 100	1 176 300	2 150 400	399 400	36 600	436 000	1 773 500	1 276 500	3 050 000
1962*	726 380	62 220	788 600	1 280 220	1 013 880	2 294 100	429 800	40 900	470 700	2 436 400	1 117 000	3 553 400

* Preliminary

In 1962, production by regions was as follows:

<u>Region</u>	<u>Gross Production (Megawatt-Hours)</u>	<u>Percent of Total</u>
Northwest	2 341 691	65.9
West	451 292	12.7
South	252 291	7.1
Other	<u>508 126</u>	<u>14.3</u>
Total	3 553 400	100.0

On a per-capita basis for the entire country, 1962 production approximated 120 kilowatt-hours which is over three times that of 1950. Based on areas having an electric supply, 1962 production equalled 375 kilowatt-hours per capita or more than doubled the 1950 rate.

10 - Consumption

Sales of electric energy by consumer classifications for the years 1950 through 1962 are shown on the following page. The average annual growth rate since 1950 follows:

	<u>Percent</u>
Domestic and Commercial	15.0
Offices	12.2
Street Lighting	13.0
Industrial	13.0
Total Sales	13.3

The composition of sales in 1962 were 19.1 percent to domestic and commercial customers, 2.8 percent to offices, 3.1 percent for street lighting, and 75.0 percent to industrial users. The foregoing sale relationship is in contrast with sales in United States where each class of customer, i.e., residential, commercial, and industrial, use about one-third of the supply.

The tabulation on page II-42 shows sales to industrial customers by type of industry for the five years 1956 through 1960.

ELECTRIC POWER INDUSTRY IN TURKEY
CONSUMPTION BY CONSUMER CLASSIFICATIONS,
NETWORK LOSSES AND PLANT USE

1950-1962
(Megawatt-Hours)

Year	Domestic and Commercial	Offices	Street Lighting	Industrial	Total Sales	Network Losses	Net Production	Plant Use	Gross Production
1950	108 655	21 397	22 008	526 746	678 806	49 374	728 180	61 444	789 624
1951	127 008	21 990	25 989	589 018	764 005	55 850	819 855	68 067	887 922
1952	148 851	24 908	31 192	673 576	878 527	61 147	939 674	80 574	1 020 248
1953	177 946	30 069	36 144	768 379	1 012 538	101 117	1 113 655	87 147	1 200 802
1954	214 310	33 551	42 667	900 988	1 191 516	112 753	1 304 269	98 173	1 402 442
1955	249 532	37 108	48 381	1 012 229	1 347 250	122 720	1 469 970	109 848	1 579 818
1956	278 489	37 059	53 241	1 176 050	1 544 839	146 611	1 691 450	127 706	1 819 156
1957	318 497	49 611	56 813	1 332 118	1 757 039	165 162	1 922 201	134 482	2 056 683
1958	358 737	55 352	62 829	1 484 622	1 961 540	201 626	2 163 166	140 276	2 303 442
1959	406 941	59 738	69 563	1 634 249	2 170 491	264 206	2 434 697	152 652	2 587 349
1960	460 435	68 496	76 774	1 790 020	2 395 720	278 920	2 674 640	140 430	2 815 070
1961 <u>a/</u>	500 000	76 000	84 000	1 950 000	2 610 000	300 000	2 910 000	140 000	3 050 000
1962 <u>b/</u>	582 000	85 000	95 000	2 277 000	3 039 000	369 400	3 408 400	145 000	3 553 400

a/ Preliminary.

b/ Estimated.

INDUSTRIAL CONSUMPTION BY CLASSIFICATIONS

1956-60

(Megawatt-Hours)

<u>Industry Classification</u>	<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>
Food, Brewery, Tobacco	95 820	116 537	134 772	168 590	199 139
Textile, Clothing	211 253	224 123	263 987	305 356	306 703
Cellulose Paper	64 215	71 628	73 210	81 498	84 461
Chemical	26 327	25 767	27 132	38 104	52 123
Coal Mining	187 426	200 140	209 138	234 332	246 658
Petroleum By-Product	7 012	7 880	8 031	8 128	6 851
Mining Metals, Melting	98 308	103 774	105 087	115 589	137 376
Metallic Goods	23 076	20 450	22 456	37 666	32 644
Stone, Earth, Glass, Cement	109 320	137 367	179 189	197 124	236 062
Transportation Facilities, Including Traction	72 616	74 877	79 711	95 284	94 881
Waterworks	49 960	52 292	78 228	85 039	81 438
Agriculture, Husbandry	13 489	13 947	21 659	26 420	14 278
Other Industries	37 043	25 532	20 096	37 078	45 538
Nonclassified	<u>180 185</u>	<u>257 804</u>	<u>261 926</u>	<u>204 041</u>	<u>251 868</u>
Total	1 176 050	1 332 118	1 484 622	1 634 249	1 790 020

11 - Personnel Employed

The table below shows the number of employees engaged in the electric industry at the end of 1961.

<u>Classification</u>	<u>Number</u>
Engineers with University Degree	195
Skilled and Ordinary Workers:	
Power Plants	5 174
Network	4 753
Administrative and Office	<u>4 974</u>
Total	15 096

Of the total personnel 18 percent is employed by auto-producers, 16 percent by regional utilities, and 66 percent by municipalities. One of the difficulties confronting the industry is retaining the trained personnel, particularly those with engineering degrees. These are attracted by private industry which offer higher remuneration and better social programs. Although those who receive state aid to further their education are required to work several years for governmental agencies, they frequently resign at the end of their employment period.

C - MAJOR ORGANIZATIONS ENGAGED IN ELECTRIC SYSTEM
PLANNING, CONSTRUCTION AND OPERATIONS

1 - Elektrik Isleri Etut Idaresi (EIE)
(Electric Power Resources Survey and Development
Administration)

a - Summary of Enabling Legislation

Elektrik Isleri Etut Idaresi (EIE) was created by Law No. 2819 in 1935, as the Electric Power Resources Survey and Development Administration. It is subject to the Ministry of Industry, subject to private law, and is managed according to commercial regulation. The principal duties of EIE include the following:

Article 2 provides:

- a) To survey water and other power resources and determine the most suitable for power generation;
- b) To make studies and estimates of the most economical and efficient production of electric power requirements;
- c) To prepare the electric power sections of future industrial programs;
- d) To assist in training programs of electrical engineers and technical personnel;
- e) To prepare statistics pertaining to the electric industry;
- f) To analyze cost and operating data of electric power plants to test efficiencies, and compare operations with those of other countries;
- g) To make studies relating to taxes and duties assessed on electric power;
- h) To make studies on amendments to customs law relating to electric equipment; and
- i) To make studies relating to electric power rates.

Article 6 provides that government-financed industries ascertain from EIE the electric power supply conditions before installing their own generating facilities.

According to Article 7, Municipalities, before constructing power plants or granting concessions for this purpose, are required to obtain from EIE the electric power supply conditions in their regions.

EIE is managed by a General Director, nominated by the Ministry of Industry, and appointed by the Council of Ministers upon approval of the

President of the Republic. A deputy director is nominated by the General Director and appointed by the Ministry of Industry. Consultants, Specialists, and Engineers are appointed by the General Director.

An estimate of expenses and costs of installations to be allocated to EIE from the general budget is submitted to the Ministry of Industry, and work is performed upon approval of such ministry. A general committee is provided consisting of three delegates from the Prime Ministry, and members of the Budget and Economics Committees and Court of Accounts of the National Assembly.

b - Organization

An organization chart appears on the next page.

A brief description of the directors and key personnel is shown in Appendix B-1.

The number of personnel of EIE is shown below:

	<u>Civil</u>	<u>Mechanical</u>	<u>Electrical</u>	<u>Total</u>
Engineers, M.S.	19	7	25	51
Engineers	8	3	15	26
Geologists				12
Agricultural Engineer				1
Forestry Engineers				4
Topographers				23
Draftsmen				10
Hydrologists				43
Technicians				149
Stream Gauging				282
Administrative (Office)	—	—	—	166
Total				767

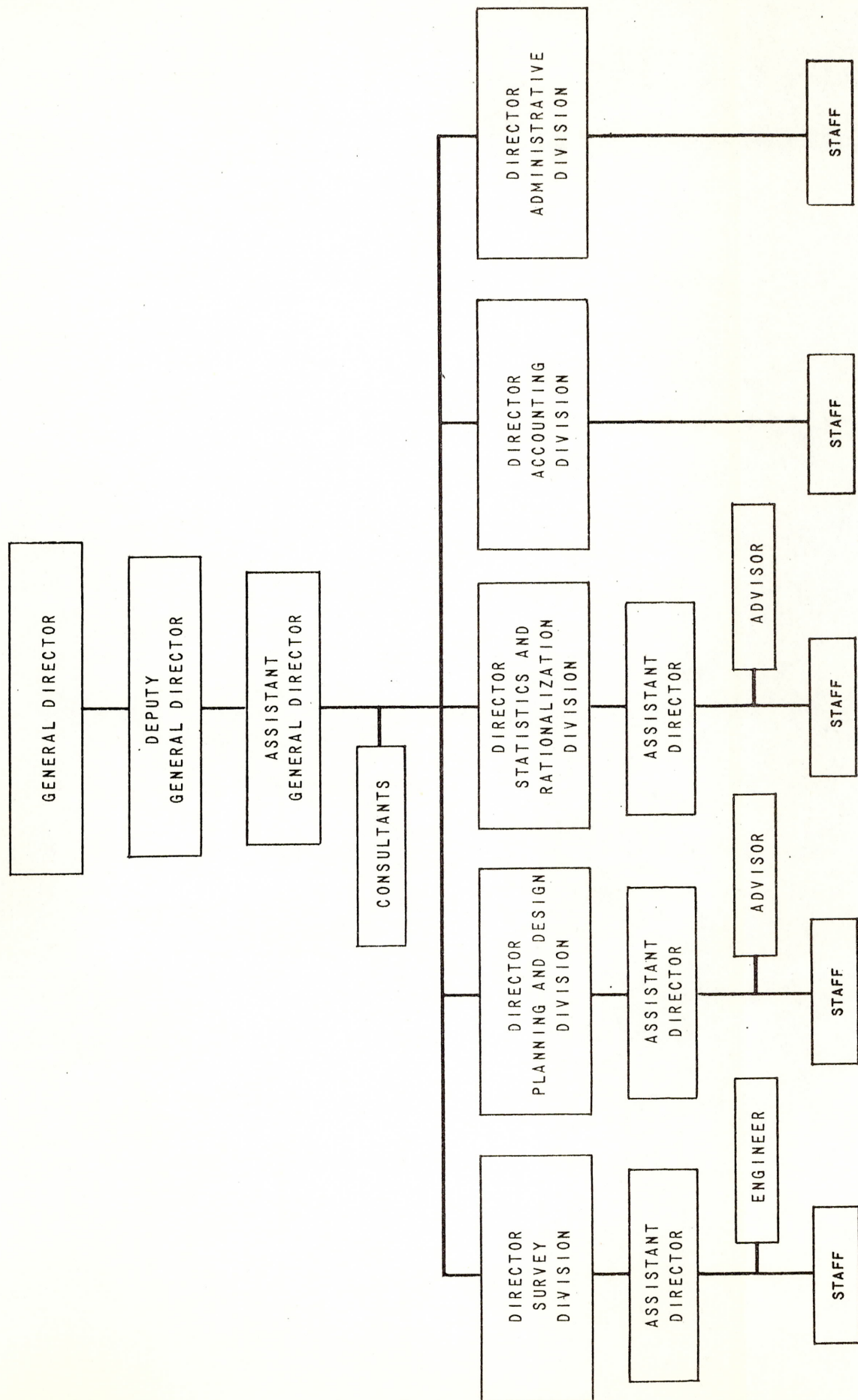
2 - Devlet Su Isleri (DSI) (State Hydraulic Works)

a - Summary of Enabling Legislation

The General Directorate of Devlet Su Isleri (DSI), the State Hydraulic Works, was created under Law No. 6200 in December 1953, and is subject to the Ministry of Public Works. Its principal duties and authorities, among other things, include the following:

ELEKTRIK ISLERI ETUT IDARESİ - (EIE)
(ELECTRIC POWER RESOURCES
SURVEY AND DEVELOPMENT ADMINISTRATION)

ORGANIZATION CHART



Article 2 provides:

- a) To build flood control protective works;
- b) To build irrigation systems and provide plans and maps pertaining thereto;
- c) To drain swamps;
- d) To develop electric power from water sources provided it relates to above-mentioned activities;
- e) To supervise the water supply and sewerage designs for cities and towns. To provide the technical organization and supervision for water supply projects of villages and train personnel to operate such systems;
- f) To improve streams and make navigable those deemed necessary;
- g) To provide for operation and maintenance of the above-mentioned projects;
- h) To prepare river basin development plans, and evaluate the agricultural and economic benefits;
- i) To cooperate with Electric Power Resources Survey and Development Administration (EIE) on power generating projects; and
- j) To investigate various types of financing for realization of projects, and to obtain long-term or external loans with the approval and guarantee of the Ministry of Finance and by decision of the Council of Ministers.

According to Article 3, the organization of DSI shall be administered by a General Director, and consist of a central organization, regional directorates, and operating organizations.

Article 4 provides that the central organization shall consist of:

- An Assistant General Director;
- Directors of Investigation and Planning Department;
- Design and Construction Department;
- Operating Department;
- Administrative Services Department;
- Technical, Legal, Agricultural and Economical Consultants Sections; and
- Mechanical and Accounting Divisions.

Article 21 provides that projects included in (a), (b), (c), (d) and (f) of Article 2 and the order of construction shall be determined jointly by representation of the Prime Minister's Office, and the Ministries of Finance,

Public Works, Economy and Commerce, Agriculture, Health and Social Welfare, and Enterprises, and shall become decisive by decision of the Council of Ministers upon proposal of the Ministry of Public Works.

Article 23 provides that the performance of the projects in Article 2 shall be subject to the following:

- a) Annual portions of the necessary expenditures, and installments and interest on loans received, shall be met by appropriations in the National budget of that year;
- b) Construction charges of work built by corporations shall be met by parties in accordance with the terms of the contracts, and that portion which falls on the General Directorate shall be met by appropriations in the budget; and
- c) Construction costs of multipurpose works to be allocated to each purpose by the Council of Ministers upon proposal of the Ministry of Public Works.

Article 25 provides for annual amortization of installments. Item (d) "In power installations, the amortization rate for each kilowatt-hour shall be determined as follows: The total amount expended shall be divided by the power produced and the number of years which is determined as the duration of the payment."

Article 26 provides that "All expenditures, incurred for the operation of the works (excluding the works for flood control, improvement, and navigation) shall be borne by the beneficiaries."

b - Organization

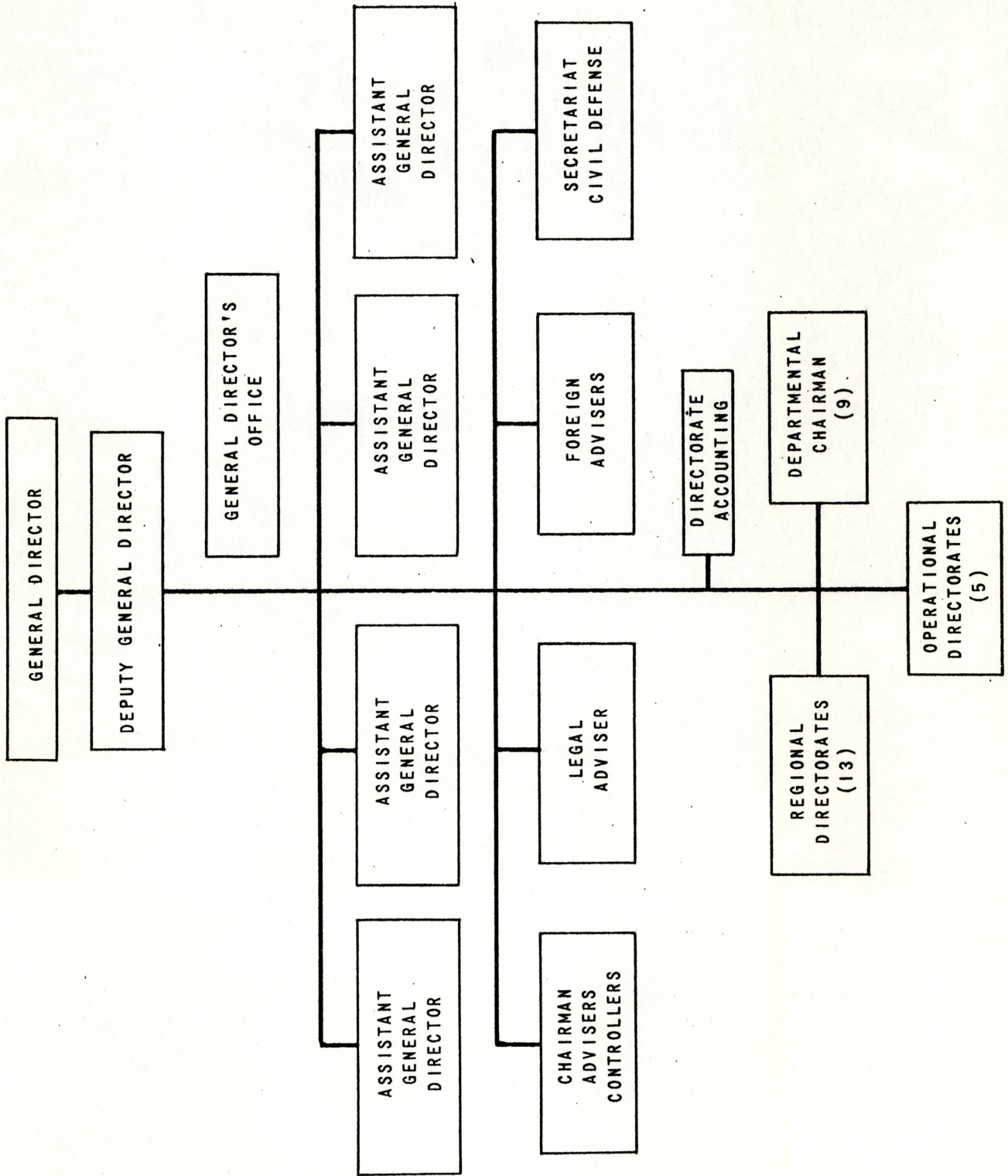
An organization chart appears on the next page.

A brief description of the directors and key personnel is shown in Appendix C-1.

The State Hydraulic Works (DSI) has a total personnel of 12 901 of which 1,896 are qualified technical personnel. The number of personnel of the Dams and Hydroelectric Plants Division, and the Operational Division, are shown on page II-50.

DEVLET SU ISLERI (DSI)
(STATE HYDRAULIC WORKS)

ORGANIZATION CHART



PERSONNEL IN DAMS AND
HYDROELECTRIC PLANTS DIVISION

(Central Office)

<u>Year</u>	<u>Administrative</u>	<u>Technical</u>	<u>Total</u>
1958	30	21	51
1959	30	23	53
1960	30	24	54
1961	30	37	67
1962	33	38	71
1963*	42	45	87

* Of the Administrative personnel, 25% have college degrees and 50% high school degrees. Three have been trained under AID program. Of the technical personnel, two-thirds are graduate engineers and have been trained in U. S. Bureau of Reclamation, four have been educated in France, one in Japan, and one in Italy.

PERSONNEL IN THE OPERATIONAL DIVISION

<u>Year</u>	<u>Officers Engineers</u>	<u>Engineers of Agronomy and Forestry</u>	<u>Administrative Personnel (Staff)</u>	<u>Total</u>
1958	9	4	73 3% College 20% High School	86
1959	9	22	92 5% College 20% High School	123
1960	27	44	526 5% College 20% High School	597
1961	33	43	508 6% College 20% High School	584
1962	30	41	506 7% College 21% High School	577
1963	27	51	502 7% College 23% High School	580

The plans for recruiting and training personnel by DSI are given hereunder:

- 1) The recruiting of new technical personnel is practiced as follows:

Contact has been made with the universities and technical high schools of Istanbul and Ankara, as well as with the Engineering Department of Robert College - Istanbul.

Twice a year the graduates apply to the various divisions of DSI, and each division hires the required number of newly graduated engineers, architects, geologists, etc.

Besides the above system, advertisements and announcements are being given through the Turkish press if urgently needed.

Through scholarship 83 students are doing their professional studies for the account of DSI; 15 of them are doing their studies in Europe and the United States, and the remaining 68 in the universities and technical high schools of Turkey.

2) The training scheme is carried out as follows:

Local courses. The DSI has established courses for training technical personnel. The candidates are selected from high school students. The graduates from these courses are being appointed to different divisions or job sites. Their number averages from 350 to 400 each year.

Foreign courses through AID and European scholarship. Their number averages 45 each year.

c - Description of Electric Properties

i - Hydroelectric Plants

The State Hydraulic Works (DSI) owns the following hydroelectric plants:

<u>Name</u>	<u>Nameplate Capacity (Kw)</u>	<u>Year Installed</u>
Hirfanli	96 000	1959
Demirkopru	69 000	1959
Kemer	48 000	1958
Girlevik	2 000	1953
Durucasu	800	1955

DSI also built the Seyhan Plant with 36 000-kw nameplate capacity. This plant was transferred to Cukurova Electric Jointstock Co., in which Etibank and the Municipality of Seyhan have participations.

ii - Transmission Lines and Substations

DSI built the transmission lines from Seyhan Plant to Mersin, 71 kilometers, and Incirlik, 10 kilometers, and these lines together with substation facilities were transferred to Cukurova Electric Jointstock Co.

The transmission lines from Girlevik Plant to Erzincan, 28 kilometers, and to the pumping station, 9 kilometers, as well as the line from Durucasu Plant to Amasya, 30 kilometers, and related transformer stations are owned and operated by DSI.

d - Invested Capital

State Hydraulic Works (DSI), an agency of the National Government, does not prepare balance sheets. The cost of investment (Turkish lira and U.S. dollars) in hydroelectric dams, power plants and auxiliary facilities is shown below for each major installation:

<u>Plant</u>	<u>Expenditures</u>		<u>U.S. Dollars c/ Equivalent of Turkish Lira Expenditures</u>
	<u>U.S. Dollars</u>	<u>Turkish Lira</u>	
Hirfanli	25 311 150	202 126 793	22 383 461
Demirkopru	28 902 618	219 140 389	24 280 755
Kemer	23 933 793	147 487 937	16 341 663
Seyhan a/	22 844 000	107 736 763	11 937 233
Almus b/	1 950 046	126 653 004	14 033 152
Kesikkopru b/	5 018 550	67 789 357	7 511 608

a/ Built by DSI.

b/ Under construction by DSI. Figures above represent total costs to completion.

c/ Converted at 9.0252 T. L. = \$ 1.00.

The percentage of cost of multipurpose installations assigned to various classifications is as follows:

<u>Classification</u>	<u>Kemer</u>	<u>Demirkopru</u>	<u>Hirfanli</u>
Irrigation	19.1%	25.5%	7.2%
Flood Control	26.0	18.8	8.8
Energy	54.9	55.7	84.0
Total	100.0%	100.0%	100.0%

e - Statement of Income

A comparative statement showing the source of income of the State Hydraulic Works (DSI) for the fiscal years ended February 28, 1959-1963, and an estimate for the year ending February 28, 1964, expressed in Turkish

lira and U. S. dollars, appears as Appendix C-2. The following tabulation shows the data for the fiscal year 1963 and the fiscal year 1964 estimate.

Source of Income	(000)			
	Turkish Lira		U. S. Dollars a/	
	Actual 1963	Estimate 1964	Actual 1963	Estimate 1964
DSI Operated Projects <u>b/</u>	568	300	63	33
Transfer of Installations	50	5 700	6	632
Hydroelectric Plants <u>c/</u>	-	30 000	-	3 324
Collected From Users as Amortization and Operation Fees	7 721	13 000	855	1 440
Rentals and Sale of Property	590	1 000	65	111
Indemnities Received From Contractors and Revenues From Performance Bonds	990	1 000	110	111
Equipment and Land Sold to Contractors	216	4 500	24	499
Laboratory and Other Income	2 277	3 000	253	332
From the National Budget	<u>626 538</u>	<u>669 578</u>	<u>69 420</u>	<u>74 189</u>
Total	638 950	728 078	70 796	80 671

a/ Conversion Rate - 9.0252 T.L. = \$1.00.

b/ Includes income from small hydroelectric plants.

c/ See subsequent section relating to sales to Etibank.

f - Statement of Expenditures

A comparative statement of actual expenditures pursuant to the current and the investment budgets of State Hydraulic Works (DSI) for the fiscal years ended February 28, 1959-1963, and an estimate for the fiscal year ending February 28, 1964, expressed in Turkish lira and U. S. dollars is shown in Appendix C-3. The principal items of each of the budgets for the fiscal year ended February 28, 1963, and the estimate for the fiscal year ending February 28, 1964 are shown on the following page:

Expenditures	(000)			
	Turkish Lira		U. S. Dollars <u>a/</u>	
	Actual <u>b/</u> 1963	Estimate 1964	Actual <u>b/</u> 1963	Estimate 1964
Current Budget				
Salaries	4 121	6 100	457	677
Wages	12 545	16 989	1 390	1 883
Pension Fund Contributions	1 112	1 638	123	181
Rent	1 700	2 000	188	222
All Other	6 028	7 801	668	863
Total Current Budget	25 506	34 528	2 826	3 826
Investment Budget				
Expropriations and Purchase of Land	58 278	50 000	6 457	5 540
Construction	302 323	326 809	33 497	36 211
Repairs	22 525	24 000	2 496	2 659
Purchase of Machines and Vehicles	80 873	108 650	8 961	12 038
Survey Expenses	52 750	74 800	5 845	8 288
Contributions to Villages for Drinking Water Installations	64 218	70 000	7 115	7 756
All Other	36 562	39 291	4 051	4 353
Total Investment Budget	617 529	693 550	68 422	76 845
Grand Total	643 035	728 078	71 248	80 671

a/ Conversion Rate - 9.0252 T.L. = \$1.00.

b/ Represents budget figures. Funds appropriated are 4 085 T.L. (\$453) less than budgeted.

g - Transactions with Etibank

The output of the three major generating plants of DSI is delivered to Etibank for transmission to ultimate consumers. There is no contractual arrangement between the two parties. DSI has calculated the rates for the output it delivered to Etibank. These rates have been disputed by Etibank and it has never paid for the energy received since the plants were built. Based on the DSI calculated rates the cost of power to Etibank from these plants, from their initial operation until December 31, 1962, would have been as shown on the following page.

<u>Plant</u>	<u>Kurus a/ Per Kwh</u>	<u>Total Kwh</u>	<u>Turkish Lira</u>	<u>U. S. Dollars b/</u>
Hirfanli	6.09	549 390 721	33 457 895	3 707 135
Demirkopru	7.50	405 752 740	30 431 455	3 371 804
Kemer	7.58	522 421 450	39 599 546	4 387 630
Total		1 477 564 911	103 488 896	11 466 569

a/ 100 Kurus = 1 Lira.

b/ Conversion Rate - 9.0252 T.L. = \$1.00.

Etibank in its planning assumes a cost of 3 kurus per kilowatt-hour for energy from DSI. At this rate the total kilowatt-hours to Etibank from DSI would have cost 44 326 947 T.L. or \$4 911 464, approximately 3 years' revenues.

The division of costs of multipurpose installations pursuant to Article 23 of Law No. 6200 (DSI Law), and the calculation of amortization rate per kilowatt-hour as provided in Article 25 of Law No. 6200, have not been determined. Application has been made to the Ministry of Industry to obtain approval of the Council of Ministers to establish tariffs for this energy. The Ministry of Industry has referred the application to the Prime Minister.

3 - Etibank (Etibank)

a - Summary of Enabling Legislation

Etibank, a State Economic Enterprise, was created by Law No. 2805, which was ratified on June 14, 1935, to develop energy production. It is subject to the Ministry of Industry, and is also subject to Law No. 3460, which relates to the organization, administration and control of State Economic Enterprises established with capital fully supplied by the State. In 1956, an amendment to the Etibank law granted it full general banking operations.

The authorized activities and duties of Etibank, as provided in Article 4 of Law No. 2805, are divided into four broad classifications as follow:

- 1) Extraction, processing, and distribution of mineral products;
- 2) General banking transactions;

- 3) Construction and operation of electric power plants and electric lines, and transmission of electric energy; and
- 4) Participation in industrial and commercial enterprises engaged in activities relating to mining or electric operations.

According to Article 5, exploration work of prospective mining undertakings developed by The Mineral Research and Exploration Institute, if approved by the Ministry of Industry, will be performed by Etibank.

Article 6 provides that electric power projects submitted by The Electric Power Resources Survey and Development Administration (EIE) to the Ministry of Industry, if approved, will be constructed and operated by Etibank or an organization established by it.

The capital of Etibank is provided by the National Government. The nominal capital of Etibank is T.L. 500 million. It may also borrow up to one-half its nominal capital.

Etibank is managed by a management committee consisting of five persons composed of a chief and four members including the General Director. The General Director has two technical assistants, one a mine specialist and one an electric specialist, and a third assistant who is a banking specialist.

b - Organization

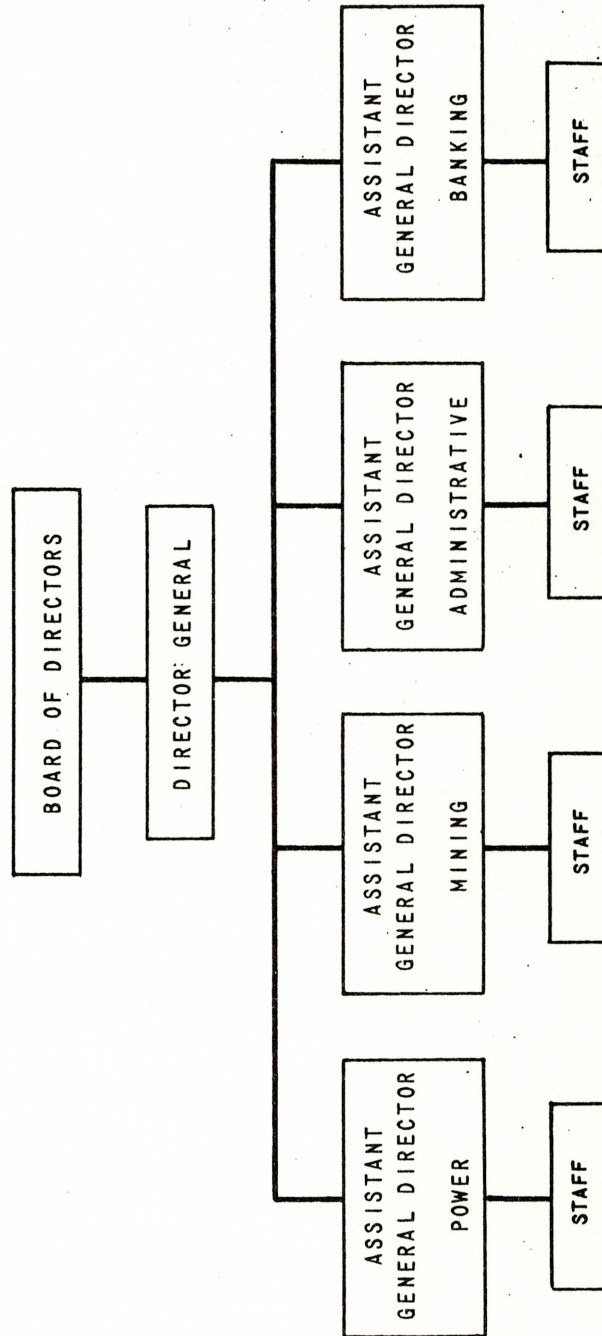
Organizational charts of Etibank, and its electric operations affiliate, Elektrik Isletmeleri Muessesesi (EEIM) are shown on the following two pages. A brief description of the officers and key personnel of Etibank and EEIM appear in Appendixes D-1 and D-2.

The number of electrical engineers employed by EEIM follows:

	<u>Central Office</u>	<u>Field</u>
Electrical Engineers - Masters Degree		
Graduated Abroad	12	1
Graduated in Turkey	35	22
Electrical Engineers		
Graduated Abroad	3	-
Graduated in Turkey	<u>6</u>	<u>9</u>
Total	56	32

ETIBANK

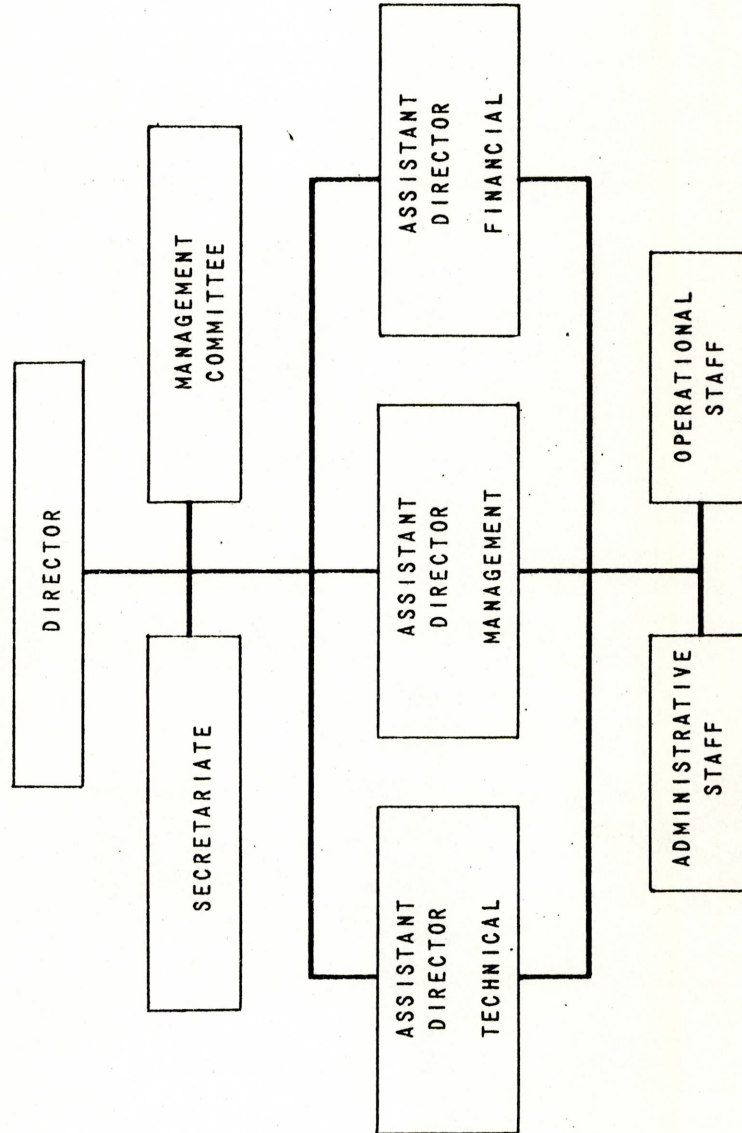
ORGANIZATION CHART



ELEKTRİK İŞLETMELERİ MÜESSESESİ (EİİM)
(ETİBANK)

(ELECTRIC OPERATIONS DIRECTORATE)

ORGANIZATION CHART



There are seven students in electrical schools abroad being sponsored by EEIM. It was stated by administrative personnel of EEIM that the organization could use double the number of electrical engineers it now employs.

c - Business of Etibank

Etibank is engaged primarily in mining activities, except coal and iron mining which it once controlled but which have been established as separate enterprises. It also conducts a general commercial banking business. It has participations in 25 different commercial and financial companies or enterprises, including companies producing transformers and poles.

Etibank has set up an Electricity Directorate, Elektrik Isletmeleri Muessesesi (EEIM), to operate its electric power facilities and distribute its own generated power and that of DSI. In 1962, over 1.8 billion kwh, or more than 50 percent of the total generated electric power in Turkey, was distributed by EEIM.

Etibank also has an electric construction division which plans, designs and constructs power plants and transmission systems. These electric facilities, when completed, are transferred to EEIM at cost.

Participations of Etibank in three private companies engaged in the electric power industry follow:

	Capital (T.L.)	Owned by Etibank	
		Amount (T.L.)	Percent
Cukurova Electric Jointstock Co.	35 000 000	15 182 000	43.4
Jointstock Co. of Kepez and Antalya	30 000 000	25 658 250	85.5
Ege Jointstock Co. of Electricity	26 000 000	1 050 000	4.0

d - Description of Electric Properties

i - Generating Plants

The Electricity Directorate of Etibank (EEIM) at May 31, 1963, owned and operated the following power plants:

<u>Name</u>	<u>Type</u>	<u>Nameplate Capacity (Kw)</u>	<u>Year Installed</u>
Sariyar	Hydro	80 000	1956
Hazar	Hydro	13 120	1957
Catalagzi	Steam	120 000	1948-1956
Tuncbilek	Steam	64 000	1957
Soma	Steam	44 000	1957

ii - Transmission Lines

A list of transmission lines owned and operated by EEIM, at May 31, 1963, is given in Appendix F-5. A summary appears in the table below.

<u>Circuit</u>	<u>Voltage</u>	<u>Length (Kilometers)</u>
Double	154 000	640.3
Single	154 000	1 426.6
Double	66 000	129.8
Single	66 000	186.4
Single	35 000	213.6

iii - Substations

The substations (major transformer stations) owned and operated by EEIM at May 31, 1963 are shown in Appendix F-6.

e - Balance Sheets

As previously stated, Etibank is engaged in banking and mining activities as well as in the electric business. Its consolidated balance sheet at December 31, 1962, combining the various types of businesses, shows total assets of T.L. 1.9 billion, or \$200 million. Etibank debt obligations amount to T.L. 730 million or \$80 million, and its nominal capital, reserves, and undistributed surplus amount to T.L. 730 million or \$80 million.

Prior to enactment of Law No. 154 in December 1960, Etibank obtained funds from the Central Bank of Turkey on short-term loans. These loans amounted to T.L. 643 788 692 or \$71 332 346 as of March 7, 1961, the effective date of debt consolidation. As other State Economic Enterprises had loans from Etibank which were taken over by the Treasury, the net debt of Etibank to the Treasury became T.L. 345 147 146 or \$38 242 603. However, T.L. 249 185 586 or \$27 609 979 was charged against unpaid

capital of Etibank, and the debt of Etibank to the Treasury was reduced to T.L. 95 961 559 or \$10 632 624.

There is a bill pending before Parliament which, if enacted, would dispose of the T.L. debt of Etibank to the Treasury through cancellation as follows: Losses of EEIM resulting from reduction of electric rates ordered by the Government (representing T.L. 96 879 000 at December 31, 1962); T.L. 38 million representing the Government's share in the cost of the Sariyar Dam as flood protection; T.L. 4.6 million for having turned over the Seyitomer Railroad to the Ministry of Public Works.

A comparative balance sheet at December 31, 1958 through 1962, expressed in Turkish lira and U. S. dollars, of EEIM is shown in Appendix D-3. The balance sheet as of December 31, 1962, in condensed form, appears below:

Elektrik Isletmeleri Muessesesi
CONDENSED BALANCE SHEET

December 31, 1962
(000 Omitted)

	<u>Turkish Lira</u>	<u>U. S. Dollars*</u>
<u>Assets</u>		
Current Assets		
Cash	1 690	187
Accounts Receivable - Customers	176 596	19 568
Prepayments	24 244	2 686
Materials and Supplies	32 160	3 563
Other Current Assets	7 972	883
Total Current Assets	242 662	26 887
Net Fixed Assets	633 769	70 221
Other Assets	20 239	2 243
Losses	96 879	10 734
Total Assets	993 549	110 085
<u>Liabilities and Capital</u>		
Current Liabilities		
Borrowings From Etibank	355 952	39 439
Accounts Payable - Purchases	35 074	3 886
Other	24 841	2 752
Total Current Liabilities	415 867	46 077
Long-Term Debts	257 727	28 556
Other Liabilities	11 575	1 283
Reserves	58 380	6 469
Capital	250 000	27 700
Total Liabilities and Capital	993 549	110 085

* Conversion rate - 9.0252 T.L. = \$1.00.

The investment in electric power facilities of EEIM at December 31, 1962, expressed in Turkish lira and U. S. dollars, is shown below:

	<u>Original Value</u>	<u>Depreciation Reserve</u>	<u>Net Value</u>
	<u>Turkish Lira (000)</u>		
Central Office	1 695	688	1 007
Catalagzi Plant	72 946	30 167	42 779
Tuncbilek Plant	62 193	17 896	44 297
Sariyar Plant	230 216	31 314	198 902
Soma Plant	52 223	12 501	39 722
Hazar Plant	17 727	2 618	15 109
Transmission Systems			
Northwest Anatolia	229 904	37 344	192 560
West Anatolia	43 333	5 952	37 381
Rural Electrification	1 169	852	317
Total*	711 406	139 332	572 074
	<u>U. S. Dollars (000)**</u>		
Central Office	187	76	111
Catalagzi Plant	8 082	3 342	4 740
Tuncbilek Plant	6 891	1 983	4 908
Sariyar Plant	25 508	3 470	22 038
Soma Plant	5 786	1 385	4 401
Hazar Plant	1 966	291	1 675
Transmission Systems			
Northwest Anatolia	25 473	4 138	21 335
West Anatolia	4 801	659	4 142
Rural Electrification	130	94	36
Total	78 824	15 438	63 386

* Excludes Work in Progress: Original Value TL 69 784; Depreciation Reserve TL 6 089; Net Value TL 61 695.

Accounts Receivable - Customers has shown a steady increase since 1958. This reflects the nonpayment by Istanbul Municipality for electric power received from EEIM. Istanbul at the time was undergoing a major construction and improvement program. However, since 1961, Istanbul has been paying its electric bill on time. Certain other municipalities starting in 1960, failed to pay for power received, but are now paying on a current basis.

The principal receivables at December 31, 1962 due to EEIM are from Istanbul amounting to T.L. 136 762 291 or \$15 153 262, and from Izmir

** Conversion Rate 9.025 TL = \$ 1.00.

amounting to T.L. 16 627 843 or \$1 842 365 for power and properties. There is a receivable of about T.L. 9 million or \$1 million from Ankara for properties. The debt consolidation Law No. 154 contained provisions to liquidate these debts in 20 years beginning 5 years from the date the law passed December 13, 1960. However, another bill is currently pending before legislature pertaining to further consolidation of municipal debts to State Economic Enterprises.

f - Income Statement

A comparative statement of income of EEIM for the calendar years 1958 through 1962, expressed in Turkish lira and U. S. dollars appears in Appendix D-4. Data for the year 1962 are shown below:

	(000) Omitted	
	Turkish Lira	U. S. Dollars*
Income		
Municipalities	178'093	8 653
Industrial	80 453	8 914
Small Customers	464	51
Total - Sales of Electricity	159 010	17 618
Other Income	2 311	256
Total Income	161 321	17 874
Expenses		
Operating Expenses	89 116	9 874
Administrative	14 796	1 639
Amortization (Depreciation)	28 255	3 131
Total Expenses	132 167	14 644
Gross Income	29 154	3 230
Interest - Net	40 087	4 441
Profit	(10 933)	(1 211)

() Indicates red figure.

* Conversion rate - 9.0252 T.L. = \$1.00.

g - Transactions With State Hydraulic Works (DSI)

The electric energy generated at Demirkopru, Hirfanli, and Kemer hydroelectric plants owned by DSI is transmitted to ultimate consumers

by EEIM. There is no contractual arrangement between the two parties. EEIM has disputed the rates as calculated by DSI, and EEIM has never paid for energy received from plants of DSI. Based on DSI calculated rates the cost of power to EEIM from these plants, from their initial date of operation until December 31, 1962, would have been as follows:

<u>Plants</u>	<u>Kurus Per Kwh a/</u>	<u>Total Kwh</u>	<u>Turkish Lira</u>	<u>U. S. Dollars b/</u>
Hirfanli	6.09	549 390 721	33 457 895	3 707 135
Demirkopru	7.50	405 752 740	30 431 455	3 371 804
Kemer	7.58	522 421 450	39 599 546	4 387 630
Total		1 477 564 911	103 488 896	11 466 569

a/ 100 Kurus = 1 T.L.

b/ Conversion rate - 9.0252 T.L. = \$1.00.

EEIM in its planning assumes a cost of 3 kurus per kilowatt-hour for energy from DSI. At this rate the cost of DSI energy would have been T.L. 44 326 947 or \$4 911 464 (approximately 3 years' costs).

The division of costs of multipurpose installations pursuant to Article 23 of (Law No. 6200-DSI Law), and the calculation of amortization rate per kilowatt-hour as provided in Article 25 of (Law No. 6200-DSI Law), have not been determined. Application has been made to the Ministry of Industry to obtain approval of the Council of Ministers to establish tariffs for this energy. The Ministry of Industry has referred the application to the Prime Minister.

h - Discounts for Prompt Payment of Bills

The Ministry of Industry has issued two decrees relating to discounts for prompt payment of bills by customers of EEIM, i.e., Decree No. 5253, dated July 15, 1959, and Decree No. 2265, dated March 7, 1961. Under these decrees, discounts of 20 percent for industrial customers and 30 percent for municipalities are available if bills are paid within a specified period.

i - Rates for Electric Power Sales

The average rates received for electric energy sold by EEIM in the past 4 years were as follows:

		<u>Kurus Per Kwh</u>
1959	-	8.86
1960	-	8.20
1961	-	8.72
1962	-	8.94

The above figures reflect the impact of the aforementioned 20 and 30 percent discounts. The average rate charged was higher but no figures are available as to the actual billing or the extent to which the discounts were applied.

The following rates have been applied since March 1, 1959 by EEIM for all electric power sales to all customers:

EEIM ELECTRIC RATE SCHEDULE

Rate for Capacity (Kilowatts)

- a) For first 5000 kw
T.L. 17.50 per month per kilowatt or
T.L. 210 per month per kilowatt
- b) For following 50 000 kw
T.L. 15 per month per kilowatt or
T.L. 180 per year per kilowatt
- c) For each kilowatt after 55 000 kw
T.L. 7.50 per month per kilowatt or
T.L. 90 per year per kilowatt

Rate for Consumption (Kilowatt-Hours)

- a) Up to first 5 million kwh consumption (in a year)
10 kurus per kilowatt-hour
- b) Following 50 million kwh consumption (in a year)
8 kurus per kilowatt-hour
- c) Following 200 million kwh consumption (in a year)
6 kurus per kilowatt-hour
- d) Consumption exceeding 255 million kwh in a year
4 kurus per kilowatt-hour (for each additional kilowatt-hour)

The rates shown above shall be applied to the customers getting service at 35 000 volts or at 66 000 volts. The customers who will get service at 15 000 volts, 10 000 volts, 6 000 volts and 3 000 volts will be charged 10 percent extra, and the customers who will get service at higher voltages than 66 000 volts and at 154 000 volts will get 10 percent reduction.

If coal prices are increased the electric power rates from thermal power plants will be adjusted in accordance to the following formula:

T.L. 2 increase in coal price per ton (for coal containing 4 000 kilogram calories) will cause 0.1 kurus per kilowatt-hour increase in electric power rate (based on 50 kurus per million kilogram calories).

Note: If the customer pays the bills on time there will be a 30 percent reduction made for municipalities and 20 percent reduction for industry. Retail selling price of power is 20 kurus per kilowatt-hour. (100 kurus = 1 T.L.)

j - Contracts for Electric Power Sales

At December 31, 1962, EEIM had contracts with 160 municipal and industrial customers relating to sales of electric power. These contracts are for a one-year period and continue in effect thereafter unless terminated on 30 days' notice by either party. A copy of a typical contract is shown in Appendix D-5.

4 - Iller Bankasi
(Iller Bank)

Iller Bank, a State Economic Enterprise, was created by Law No. 4759, enacted on June 13, 1945. It is subject to the Reconstruction and Settlement Ministry, which was created by Law No. 7116 on May 9, 1958, and which was conceded all powers and duties previously granted to the Interior Ministry.

The principal functions of Iller Bank are to assist provincial governments, municipalities, and village administrations with planning and construction of local public services. It supplies funds to finance the construction of such installations, and it also conducts a general banking service. Iller Bank also owns and operates a construction firm, a design and engineering firm, and a foundation drilling firm.

Since inception in 1945, Iller Bank has made total construction loans of over 733 million Turkish lira or 81.3 million U.S. dollars, of which 310 million Turkish lira or 34.3 million U.S. dollars were for electric facilities. In the period 1945 through 1962, Iller Bank has completed electric installations in 473 towns at a cost of 342 million Turkish lira, or 37.9 million U.S. dollars.

At December 31, 1962, Iller Bank had loans and advances receivable as follows:

	<u>Turkish Lira</u>	<u>U. S. Dollars*</u>
Construction Loans (Electric and Other Public Services)		
Municipalities	473 044 188	52 413 296
Villages	1 978 750	219 245
Townships	<u>9 788 429</u>	<u>1 084 558</u>
	484 811 367	53 717 099
Other Loans		
Reconstruction and Settlement Ministry	<u>398 022 851</u>	<u>44 100 932</u>
Total	882 834 218	97 818 031

* Conversion Rate - 9.0252 T.L. = \$1.00.

The nominal capital of Iller Bank at December 31, 1962 amounted to 600 million Turkish lira, of which 285 134 909 Turkish lira was unpaid, leaving net capital of 314 865 091 Turkish lira or 34.9 million U. S. dollars.

Debts of Iller Bank at December 31, 1962 amounted to 583 029 758 Turkish lira, or 64 599 696 U. S. dollars. Of the total debt, 134 998 081 Turkish lira or 14 957. 787 U. S. dollars owed to the Central Bank was assumed by the Treasury, which issued an equal amount of 100-year 0.5 percent bonds, pursuant to Law No. 154.

The following debts of Iller Bank were consolidated and extended for 25 years by Law No. 154, and interest shall accrue at the rate of 6.5 percent. Amortization shall be determined at the end of the consolidation period.

<u>Due</u>	<u>Turkish Lira</u>	<u>U. S. Dollars*</u>
Pension Fund	127 000 000	14 071 600
Workmen's Compensation Fund	91 331 700	10 119 552
Amortization and Credit Fund	<u>140 855 381</u>	<u>15 606 776</u>
Total	359 187 081	39 797 928

* Conversion Rate - 9.0252 T.L. = \$1.00.

No provisions were made in Law No. 154 for the following Iller Bank debts, and the payments of these debts are to be determined by the parties involved.

	<u>Turkish Lira</u>	<u>U. S. Dollars*</u>
Amortization and Credit Fund	76 355 322	8 460 170
Iron and Steel Agency	8 524 521	944 517
For Material From Abroad	1 256 905	139 265
Etibank DLF Credit	<u>2 707 848</u>	<u>300 029</u>
Total	88 844 596	9 843 981

* Conversion Rate - 9.0252 T.L. = \$1.00.

A summary of the income statement of Iller Bank for the 5 years 1958-1962 is shown below in Turkish lira and U. S. dollars.

<u>Year</u>	<u>Turkish Lira</u>			<u>U. S. Dollars*</u>		
	<u>(000)</u>			<u>(000)</u>		
	<u>Income</u>	<u>Expenses</u>	<u>Profit</u>	<u>Income</u>	<u>Expenses</u>	<u>Profit</u>
1958	33 709	23 822	9 887	3 735	2 639	1 096
1959	48 728	32 700	16 028	5 399	3 623	1 776
1960	58 113	52 459	5 654	6 439	5 813	626
1961	70 339	47 377	22 962	7 794	5 249	2 545
1962	67 052	44 702	22 350	7 429	4 953	2 476

* Conversion Rate - 9.0252 T.L. = \$1.00.

III - LOADS AND RESOURCES

III - LOADS AND RESOURCES

A - GENERAL DISCUSSION

The area studied in this report includes 45 of Turkey's 67 provinces and comprises 70% of the total area of the country. Approximately 78% of the total population live in this area. The frontispiece map shows the six study areas (A, B, C, D, E and F) covered by this survey. Although all of Area F was studied, as shown by the map, only the provinces of Adiyaman, Diyarbakir, Elazig, Malatya Gaziantep and Urfa are included in the final forecast. It was decided after the study was completed that the Cukurova area and Hatay province would have amply capacity to meet their own requirements to the end of the forecast period. It was also determined that it would not be feasible to connect the province of Maras to the interconnected system during the forecast period. The area is primarily agricultural. However, the industrial development program of the government and of private individuals accounts for the greatest part of the electricity now being consumed. The forecast period is for the years 1963 through 1973 and the tabulation on the next page is the forecast of the interconnected system's growth. Separate forecasts for each area are given in the Appendix.

The forecast is based upon a plan for the expansion of the existing electric utility systems. For the period 1963 through 1967 the expansion is in accordance with the Development Plan, First Five Years, of the Republic of Turkey State Planning Organization. For the years 1968 through 1973 the forecast is based on a plan prepared by Elektrik Isleri Etut Idaresi (EIE).

The area under study is now supplied with electricity by various electric systems operated by Etibank Elektrik Isletmeleri Muesseesi (Etibank), Devlet Su Isleri (DSI), industrial auto-producer plants, Municipal generating systems and the Cukurova Electric System. The largest of these systems is the Etibank Interconnected System serving Northwest and West Anatolia.

The general use of electricity in the area under study is low. Many of the isolated Municipal generating plants are old and inadequate to meet the demand for electric service. In many of the other electric systems

Northwest, West and East Anatolia Interconnected Systems

CUSTOMERS, ENERGY SALES AND KW DEMAND

Classification	Actual		Estimated											
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	
	Customers													
Domestic and Commercial	753 083	801 377	878 512	1 007 092	1 201 462	1 413 182	1 651 242	1 804 912	1 983 772	2 305 722	2 475 242	2 625 812	2 767 842	
Governmental	9 229	10 139	11 580	14 390	17 690	22 370	27 390	30 290	34 250	39 790	42 800	45 530	47 950	
Street Lighting	54	65	82	243	760	1 496	2 545	3 489	4 458	5 844	6 567	7 093	7 133	
Industrial	38 550	41 110	45 570	51 990	62 060	71 840	82 080	89 590	97 380	111 459	119 930	128 040	135 170	
Total	800 916	852 691	935 744	1 073 715	1 281 972	1 508 888	1 763 257	1 928 281	2 119 860	2 462 815	2 644 539	2 806 475	2 958 095	
	Energy Sales (1 000 Kwh)													
Domestic and Commercial	361 400	380 027	434 120	496 660	591 120	681 770	782 910	875 680	980 000	1 135 740	1 264 170	1 400 300	1 548 780	
Governmental	80 492	94 620	104 310	132 220	165 470	194 200	211 430	223 900	237 880	275 590	289 330	303 480	316 790	
Street Lighting	53 493	56 336	62 230	70 910	84 210	96 950	111 040	121 460	134 070	152 500	164 560	175 910	186 410	
Industrial	1 339 976	1 638 440	1 992 740	2 468 500	2 983 960	3 576 990	4 355 720	4 745 120	5 032 000	6 407 920	6 961 150	7 309 880	7 628 520	
Total	1 835 361	2 169 423	2 593 400	3 168 290	3 824 760	4 549 910	5 461 100	5 966 160	6 383 950	7 971 750	8 679 210	9 189 570	9 680 500	
Kw Demand Based on Kwh Sales	434 810	489 330	580 150	701 490	853 990	1 000 650	1 177 650	1 278 810	1 377 170	1 693 100	1 822 600	1 935 900	2 046 600	

the generation facilities have not kept up with the area growth and the use of electricity has to be curtailed. Distribution systems, mostly operated by the Municipalities, in many cases do not cover the entire Municipal area and are inadequate to supply the area they serve. Several of these systems are in the process of being rebuilt to eliminate this condition.

B - LOADS AND LOAD FORECASTS

1 - Historic Growth of Electric Load

The first step toward an interconnected electric power system in Turkey was taken in 1948 in Northwest Anatolia, with the completion of the Catalagzi steam-electric station and the construction of the 66-kv lines in the Zonguldak area.

In 1952, the transmission system was extended to Istanbul and in 1956 to Ankara and some other large centers. Expansion of this system has continued since 1956.

The interconnected system in Western Anatolia had its beginning with the connection of the Izmir Municipal system with Manisa in 1956 and the connection of the Soma steam-electric station with Izmir in 1957.

In late 1962 the systems in Northwest Anatolia and Western Anatolia were tied together making one large interconnected system. Several other smaller systems have been and are being developed in the area covered in this report and the plan is that all of these systems eventually will be tied together to make one large interconnected system.

Appendix E-7 is a table showing the kwh growth of the Northwest and West Anatolia Interconnected Systems from 1950 through 1962. Total sales in 1950 of approximately 129 million kwh increased about 17 times to 2169 million kwh in 1962.

Appendix E-8 is a table showing the kwh growth of all utilities in the study area. Total sales of energy increased from 530 million kwh in 1950 to 2220 million kwh in 1961, or about 4.2 times the 1950 usage, an annual growth rate of 14 percent. Energy sales for all utilities were not yet available for the year 1962.

2 - Present Availability and Use of Electric Service

At the end of 1962 electric service, in the study area, was available to 7 808 000 people or 33.9% of the total estimated area population of 23 029 000.

Of the total people to whom electric service was available 3 953 000 or 50.6% were supplied by the Northwest and West Anatolia Interconnected Systems and 3 855 000 or 49.4% were served by isolated systems, industrial plants or Municipal combustion engine generating stations. The largest of these isolated systems is that of the Cukurova Electric Company, which operates a hydroelectric system in the vicinity of Adana and serves 400 000 people or about 30% of the population in Area F.

The following table shows the number of people and the percentage in each study area that have electric service and those that are without electricity in 1962.

ESTIMATED POPULATION OF STUDY AREA
IN THOUSANDS 1962

Area	Served by Northwest and West Anatolia Inter- connected System	Percent of Total With Electricity	Served by Other Utilities	Percent of Total With Electricity	Total With Electric Service	Percent of Total Popula- tion	Total Without Electric Service	Percent of Total Popula- tion	Total Popula- tion
A	1 544	84.9	275	15.1	1 819	63.4	1 048	36.6	2 867
B	915	69.8	395	30.2	1 310	32.4	2 727	68.6	4 037
C	802	56.6	615	43.4	1 417	33.9	2 758	66.1	4 175
D	21	3.5	585	96.5	606	18.4	2 694	81.6	3 300
E	671	51.5	632	48.5	1 303	31.2	2 872	68.8	4 175
F	-	-	1 353	100.0	1 353	30.2	3 122	69.8	4 475
Total	3 953	50.6	3 855	49.4	7 808	33.9	15 221	66.1	23 029

Distribution of electricity in cities, towns and villages, with very few exceptions, is by the Municipality or village Council. The electric systems sell electricity to the Municipalities, villages and to industrial customers.

In many instances, restrictions are placed on the use of electricity because of lack of generating capacity. This applies in many areas regardless of what organization supplies the electricity.

Inadequate distribution systems are a problem in most places offering electric service at this time. Some effort is being made to correct this situation in a few places but generally this is the greatest deterrent to the use of electricity.

When communities are supplied by a local utility having its own isolated station, the hours of operation are so restricted that most industries operate power plants to supply their own requirements. Where industries are served the hours they may operate are often restricted.

Statistical data relating to production and consumption of electric energy in Turkey are compiled and maintained by Elektrik Isleri Etut Idaresi (EIE). These records, the records of Etibank Elektrik Isletmeleri Muessesesi (Etibank) and the Cukurova Electric Company were used to study the past growth and present use of electricity in the study area. Generally these records are fairly complete for the larger locations. However, some deficiencies were found in the case of the smaller utilities which do not keep their records in accordance with the method suggested by Elektrik Isleri Etut Idaresi. It is believed, however, that these statistics are sufficiently accurate for the purpose of this study.

In areas not served by one of the electric systems utility service is principally for lighting purposes. After towns are connected to a system, however, industries shut down their generating plants and the use is predominately industrial. The following table shows by study areas the actual energy used for lighting and industrial purposes in 1961, the last year for which complete figures were available.

USE OF ELECTRICITY IN STUDY AREA FOR 1961
SERVED AT RETAIL BY ISOLATED STATIONS

<u>Area</u>	<u>1000 Kwh Lighting</u>	<u>Percent of Total</u>	<u>1000 Kwh Industrial</u>	<u>Percent of Total</u>	<u>1000 Kwh Total</u>	<u>Percent of Total</u>
A	9 582	69.4	4 220	30.6	13 802	100.0
B	17 413	71.5	6 945	28.5	24 358	100.0
C	15 729	74.8	5 309	25.2	21 038	100.0
D	19 404	69.6	8 464	30.4	27 868	100.0
E	23 573	73.8	8 373	26.2	31 946	100.0
F	<u>19 051</u>	<u>63.2</u>	<u>11 098</u>	<u>36.8</u>	<u>30 149</u>	<u>100.0</u>
Total	104 752	70.2	44 409	29.8	149 161	100.0

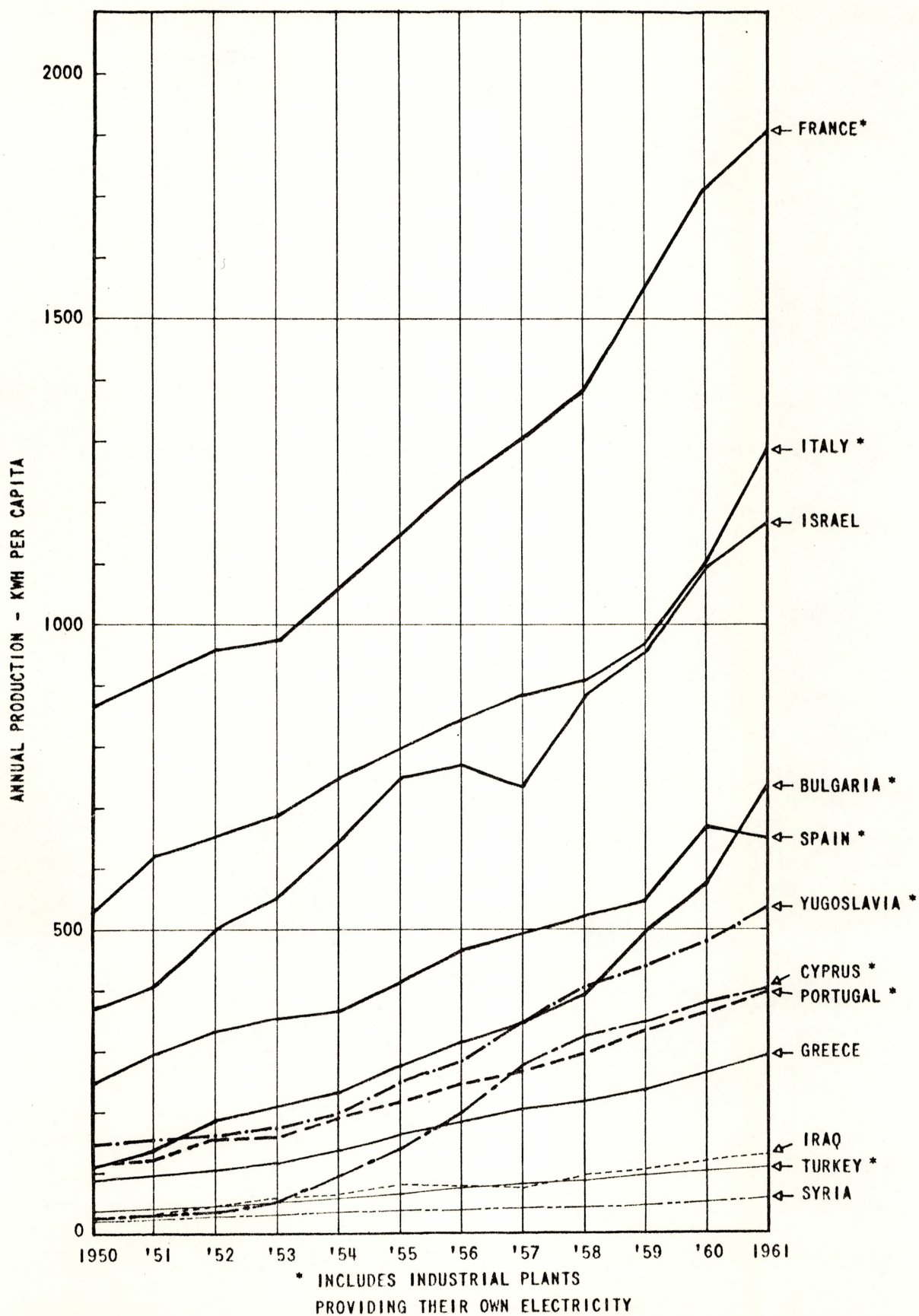
SERVED AT RETAIL BY EXISTING SYSTEMS

A	188 531	35.8	338 685	64.2	527 216	100.0
B	122 887	15.6	665 272	84.4	788 159	100.0
C	125 585	49.3	128 981	50.7	254 566	100.0
D	-	-	-	-	-	-
E	66 445	23.6	215 345	76.4	281 790	100.0
F	<u>45 836</u>	<u>24.5</u>	<u>141 541</u>	<u>75.5</u>	<u>187 377</u>	<u>100.0</u>
Total	549 284	26.9	1 489 824	73.1	2 039 108	100.0

The preceding tables show that in the locations not connected to one of the existing systems 70.2% of the energy is used for lighting and 29.8% is used for industrial purposes. The reverse is true where service is from any of the existing electric systems (which other than the Northwest and West Anatolia Interconnected Systems get most of their electricity from hydroelectric electric-generating plants), 73.1% being used for industrial purposes and 26.9% for lighting.

The per capita production of electricity in Turkey is very low but is on about the same level as its Asian neighbors. However, it is lower than that of the Balkan countries of Europe and considerably lower than other European countries. The chart on the next page shows the production per capita for a selected group of nations to illustrate the level of use of electricity in these countries.

PRODUCTION OF ELECTRICITY
KILOWATT-HOURS PER CAPITA



SOURCE: UNITED NATIONS BULLETIN OF STATISTICS

3 - Factors Limiting Present Use of Electricity

The most important factors that limit the present use of electricity in the area under study are outlined below. There are many other factors, and careful consideration of them all is necessary for a clear understanding of the problem and for the planning and operation of the future power system in the study area. The major factors that now limit electrical use are:

- a) In many localities the generating equipment is so limited that it is impossible to meet the demand. Restrictions have been placed upon present users, particularly small industrial customers, and many desiring new or additional service cannot obtain it.
- b) Distribution systems of most utilities are overloaded and in many instances do not cover all of the area in the Municipality. The DLF loan to 15 cities and Illerbank's plan for assistance under the Five-Year Plan will help in eliminating these problems, in some instances, but there will still be many cases where distribution systems will be inadequate for some time in the future.
- c) Hundreds of towns and villages have never had electric service.
- d) Limited financing available to Municipalities has retarded the improvement of existing utility systems and delayed building of new systems.
- e) In many towns service is available only because a factory located near or in the town supplies some electricity as a by-product of its principal function. Often the amount they can supply is insufficient to meet the demand.
- f) In many instances service is not available 24 hours a day.
- g) Many Municipalities are not interested in supplying service outside of the city limits. (Turkish laws favor the operation of electric utilities by Municipalities and practically all distribution of energy to the ultimate customer, except large industrials, is supplied by Municipalities.)
- h) Earning power of the great majority of the people is so low that only minimum amounts of electricity can be purchased.
- i) The price of electricity is high in most places not connected to one of the electric systems. Also many Municipalities increase the rates for energy to finance additions to the distribution system, further limiting the amount of electricity consumers can purchase.

- j) The number of electrical appliances and equipment available is limited and the cost of what is available places them beyond the capacity of many people to purchase them.
- k) In many instances power systems are poorly maintained and spare parts are difficult to obtain, so that service interruptions are frequent and use is curtailed.

Until the conditions outlined above are improved or eliminated the use of electricity will continue to be low.

4 - Methods Used in Making Load Forecasts

The methods used in preparing this forecast are basically the methods used in preparing all load forecasts. The total area under study was divided into smaller geographical areas. The areas used in the previous forecast of Northwest Anatolia, approximately three years ago, are the same and designated as Areas A, B, C and D. Two additional areas, "E" and "F," were added to this forecast.

Visits were made to all major load centers in all areas, the Market Analyst being accompanied by members of the staff of EIE. Interviews were held with the operators of utility systems (both local and regional), industrialists, civil officials and chambers of commerce, to obtain first-hand information of the business conditions in the area, the availability of service, any curtailments in effect and the condition of the distribution system, etc.

After the completion of the visits to the various areas, contacts were made in Ankara with organizations such as:

- Mineral Research and Exploration Institute of Turkey (MTA)
- American Mining Assistance Commission
- Sumerbank (textiles, plastics, cement, dyes, ceramics, etc.)
- The Turkish Cement Industry Corporation
- Etibank
- The Turkey State Railways (DDY)
- U. S. Corps of Engineers
- U. S. Air Force Engineering Office
- Devlet Su Isleri (DSI)
- Illerbank

These gave information on their plans for establishing new industries and expanding existing industries and distribution systems during the forecast period.

Forecasting of the loads followed the classifications of electric service used in Turkey, namely: Domestic and Commercial; Governmental; Street Lighting and Industrial.

Population estimates for each city, town and village were made by Elektrik Isleri Etut Idaresi (EIE), based on the trends indicated by the Census of 1945, 1950, 1955 and 1960. Historical data on the use of electricity by each city, town and village in relation to its population were examined by the above classifications as each was estimated. Each province was forecast separately and upon completion of an area it was summarized.

The forecast is based on these assumptions:

- a) That the distribution systems in the present cities, towns and villages connected to the systems will be rebuilt and extended to provide adequate capacity to supply the needs of these communities.
- b) That adequate distribution facilities will be built in other cities, towns, villages, and rural areas when they are connected to the system.
- c) That provision will be made for Municipalities or some other organization to provide electric service to villages near the Municipality when electric service is supplied from the interconnected system.
- d) That electric rates to the ultimate consumer will be reasonable and low enough to encourage large industrial customers to purchase rather than generate their requirements and that they will be encouraged to do so when power from the interconnected system becomes available.
- e) That service from the system will be reliable so that critical industries will be willing to take utility service.
- f) That a sufficient supply of reasonably priced appliances, motors and other electrical utilization equipment will be available.
- g) That the extension of electric service to all areas will be in accordance with the Development Plan, First Five Years, of the Republic of Turkey State Planning Organization and with the plan prepared by Elektrik Isleri Etut Idaresi for later years.

5 - Load Forecasts by Customers Classification

a - Industrial

Large existing and prospective industrial loads were forecast individually from information obtained from utilities and industrialists during the field visits and in the contacts with the headquarters offices in Ankara and other centers.

The list of prospective large loads and the years they are expected to be connected to the system are shown in Appendix E-1. The lists of the largest industrial customers now connected to the largest Municipalities and existing systems also are shown in Appendixes E-2 through E-6.

b - Domestic and Commercial

Statistics for the domestic and commercial classifications were not separately available for these classes of service, therefore these classifications were forecast together.

Historical data for at least 10 years are maintained by Elektrik Isleri Etut Idaresi and recorded separately for each city, town and village that has electric service. These data, together with the census and population forecast, were used to establish the number of people per customer and the kwh used per customer for past years and to establish the trend for the years of the forecast. Consideration was also given to the price paid for electricity at the present time and the price that would be paid when connected to the system.

For cities, towns and villages that had never had electric service, that are included in the plan to be connected to the system during the forecast period, statistics on cities, towns and villages similar in size and economic conditions were analyzed and yardsticks developed for forecasting the domestic and commercial usage.

c - Governmental

The governmental classification includes the lighting of Government and Municipal buildings and offices, military installations, highway department buildings, state farms, and other governmental installations.

The use of electricity varies considerably depending upon local conditions. Historical data for each category are kept for all cities, towns and villages by Elektrik Isleri Etut Idaresi for at least 10 years. These data, together with population forecasts, information obtained on field trips and from governmental and military organizations, were used to establish trends for forecasting the energy to be used during the forecast period. Cities of similar size with electric service were studied to forecast loads for those locations that have not previously had electric service and were scheduled to be connected to the system during the forecast period.

For the larger installations information was obtained from the organization operating the facility on their future requirements and each of these installations was estimated individually.

d - Street Lighting

The street lighting category includes all lighting of streets and parks and harbor lighting.

As in other countries, it was found that in Turkey the size of the community largely governs the amount of energy used for street lighting. The historical data maintained by Elektrik Isleri Etut Idaresi were used together with the population forecast and observations made during the field trips to forecast this classification.

For locations that have never had electric service and are planned to be connected to the system during the forecast period, yardsticks were established on the basis of population estimates and electric consumption of similar places that now have electric service.

6 - Comparison of Forecast Growth Rate With Historical Trends

During the period 1950 to 1961 the sales of all utilities in the study area increased from 530 million kwh to 2220 million kwh or approximately 4 times. This is the normal growth pattern in Turkey.

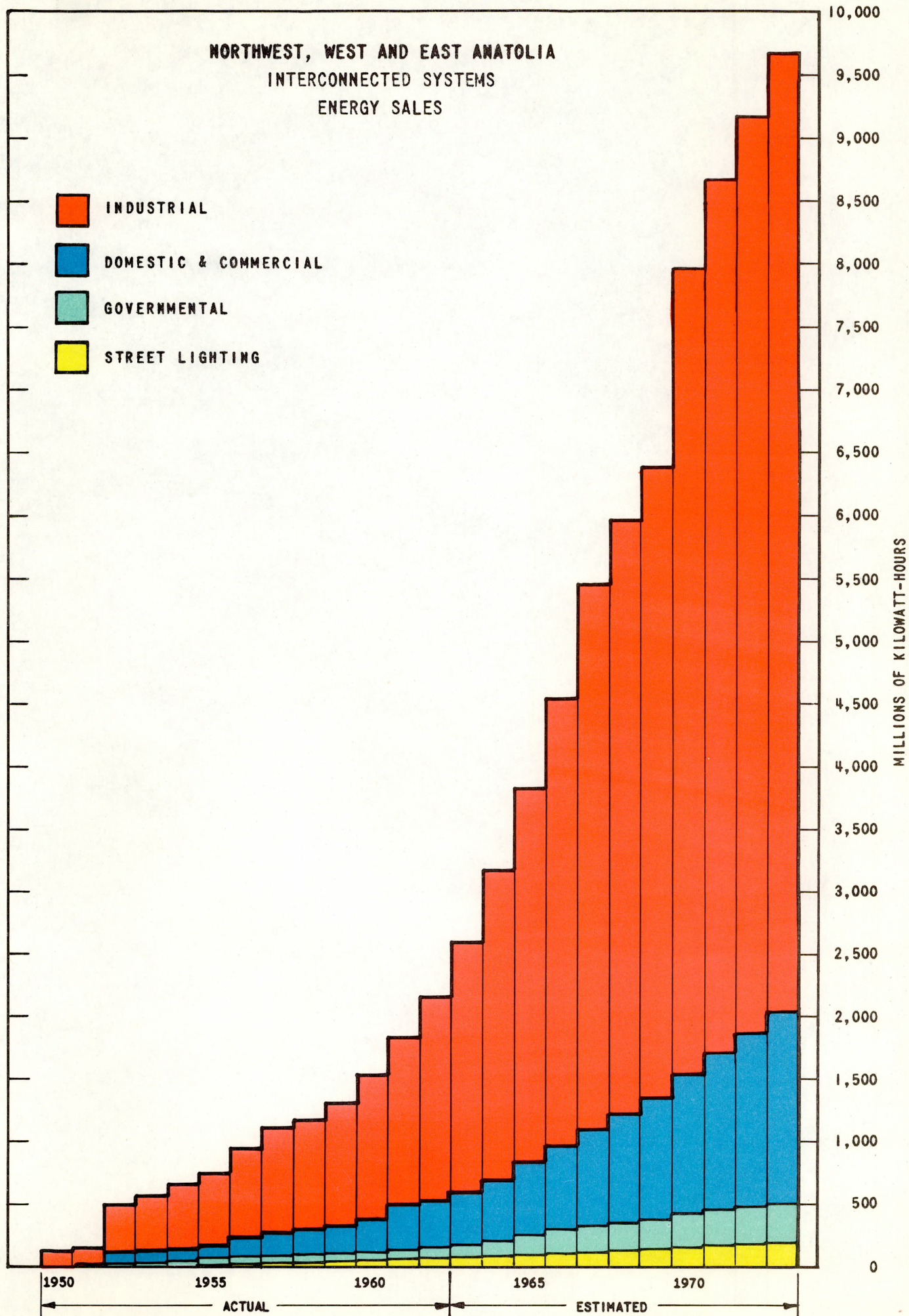
On interconnected systems the growth has been much greater because much new territory was added which included large existing utilities that were already in operation. The consumption on the Northwest and West Anatolia Interconnected Systems, as shown in the Table, Appendix E-7,

increased from 129 million kwh to 2169 million kwh, or about 17 times, in the period from 1950-1962.

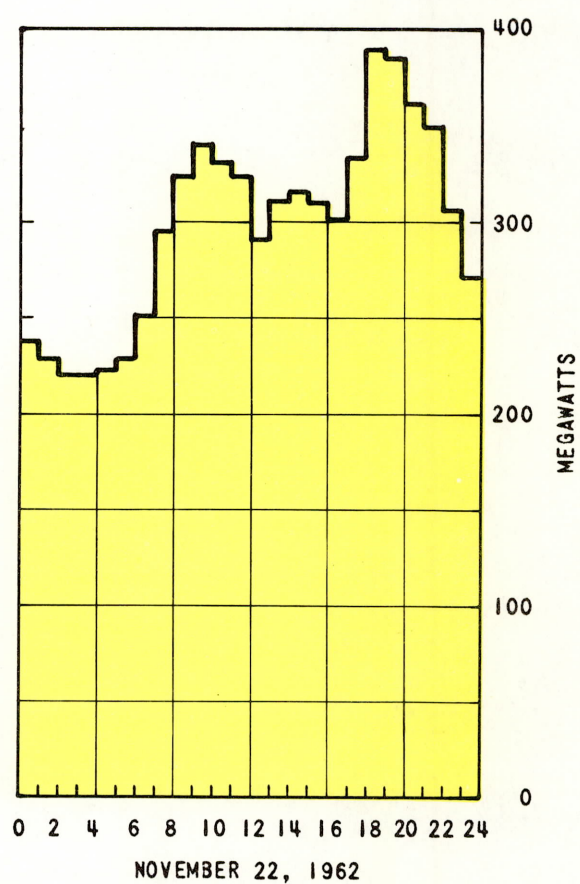
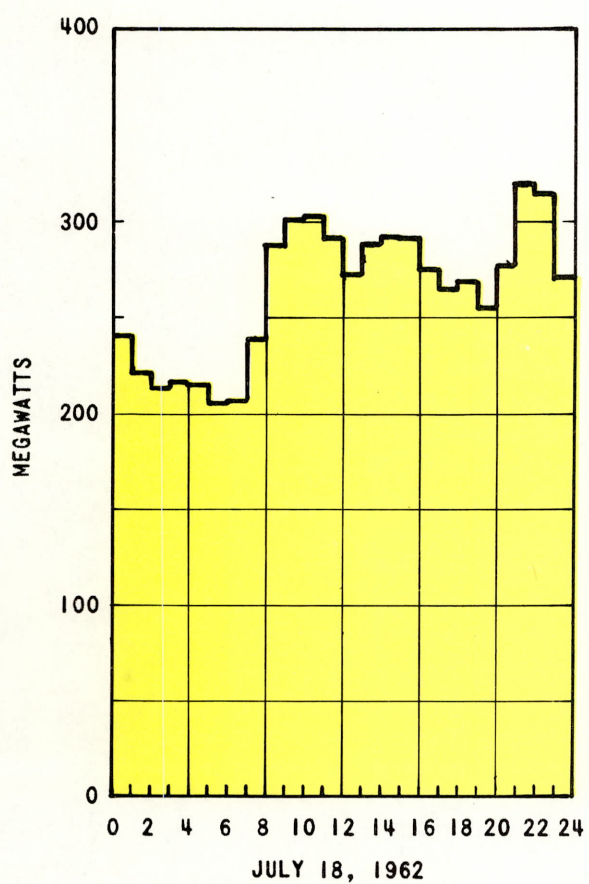
The consumption of all of the electric systems in the study areas is estimated to increase from 2220 million kwh in 1961 to 10 777 million ~~kmwh~~ in 1973, or about 4.9 times. With the exclusion of the Cukurova territory and Hatay province, the comparable figures are 2063 and 9681 kmwh for 1961 and 1973, respectively, an increase of 4.7 times. This growth is approximately equal to the growth of all utilities in the study area for the period 1950-1961, and represents an annual growth rate of 14 percent.

The chart on the following page shows the actual load 1950-1962 and the estimated load growth 1963-1973, by classes of service.

On page III-15 is a chart showing typical daily load curves for a summer and a winter day.



NORTHWEST ANATOLIA INTERCONNECTED SYSTEM
TYPICAL DAILY LOAD CURVES
FOR SUMMER AND WINTER SEASONS
1962



C - PRESENT POWER AND ENERGY RESOURCES

The existing resources serving the six load areas considered in this report fall into two classifications; those which are presently connected to the Northwest Anatolia Interconnected System and those which serve isolated loads within the load areas. The expansion program proposed in this report provides for some of these latter resources to be connected to the system during the study period; others will remain isolated. The existing resources have a total dependable generating capability of 698 mw. Those resources which are presently serving the interconnected system have a dependable capability of 656 mw.

1 - Hydroelectric Stations

Existing hydroelectric stations have a total dependable capability of 324 mw of which 285 mw are in stations presently connected to the system.

The following table gives the capacity and energy available at each of the existing hydroelectric plants.

<u>Load Area</u>	<u>Plant</u>	<u>Dependable Capacity Mw</u>	<u>Average Annual Energy Kmwh</u>
<u>Plants Now Connected to System</u>			
C	Sariyar	75	402
C	Hirfanli	93	315
E	Demirkopru	69	187
E	Kemer	48	165
	Total	285	1069
<u>Plants To Be Connected to System Within Study Period</u>			
B	Kayakoy	4	15
C	Yerkopru	8	70
C	Bunyan	2	5
C	Sizir	7	38
D	Durucasu	1	5
F	Derme	4	15
F	Hazar	13	80
	Total	39	228
	Total All Hydro	324	1297

A table giving pertinent statistics and generation during the last five years for the stations listed above will be found in Appendix F-3.

A brief description of the existing hydro resources follows:

Sariyar Hydroelectric Station with initial capacity of 80 mw (2 units of 40 mw) was placed in service in 1956. It is located on the Sakarya River approximately 130 km west of Ankara. Additional capacity of 80 mw (2 units of 40 mw) is now being installed to raise the plant to its ultimate 160-mw capacity in 1965. Sariyar dam, 108 m high from the river bed, creates enough active storage to regulate the river. Water is diverted to the power plant through a 1-km tunnel of 8-m diameter. Maximum net effective head is 86 m. Average and critical year outputs are 420 kmwh (4-unit installation) and 315 kmwh. Peaking capability at maximum and minimum reservoir levels are 160 mw and 150 mw, respectively.

Hirfanli Hydroelectric Station, present capacity 96 mw (3 units of 32 mw) placed in service in 1959, is located on the Kizilirmak River approximately 110 km southeast of Ankara. Ultimate capacity will be 128 mw with installation of the fourth unit. The river is regulated by the ample active storage created by the 80-m high Hirfanli dam. Maximum net effective head is 65 m. Average and critical year outputs are 315 kmwh and 245 kmwh, respectively. Peaking capability at minimum pond elevation is 93 mw for the existing installation.

Demirkopru Hydroelectric Station, 69-mw capacity (3 units of 23 mw) placed in service in 1960, is part of a multipurpose hydro development on the Gediz River, 110 km east of the City of Izmir on the Aegean Sea. Water is diverted to the power plant by a dam 74 m high and through a 2.6-km tunnel, 4.80-m diameter. Average net effective head is 107.5 m. Average dry and wet year outputs are 187 kmwh, 130 kmwh and 301 kmwh, respectively. Firm output is 56 kmwh. Peaking capability at minimum and maximum water level is 53 mw and 79.5 mw, and at average net effective head is 69 mw.

Kemer Hydroelectric Station, 48-mw capacity (3 units of 16 mw), placed in service in 1958, is located on the Akcay River some 60 km southeast of the City of Aydin in West Anatolia. The dam is 109 m high and average net effective head is 81.5 m. Average dry and wet year outputs are 165 kmwh, 89 kmwh and 220 kmwh, respectively. Firm output is 51.5 kmwh. Peaking

capability under minimum and maximum water levels are 30.5 mw and 55.2 mw, and at average net effective head is 48 mw. Kemer reservoir serves multiple purposes in the Buyukmenderes River Basin.

Kayakoy Hydroelectric Station, 3840-kw capacity, placed in service in 1960, is a run-of-river station located on the Emet stream somewhere between Kutahya and Usak. Small springs of about 1 cumec and high head are utilized. Daily pondage is provided at the forebay where the intakes to the penstocks are located. Firm output is 15 million kwh.

Yerkopru Hydroelectric Station, 10 800-kw capacity, placed in service in 1959, is run-of-river station located on the Goksu River approximately 110 km south of Konya in Central Anatolia. Goksu River originates in the Toros mountains and flows into the Mediterranean Sea. Yerkopru is at the headwaters of this river. There is no storage available for this plant. Water is directed by tunnel and canal system. Firm peaking capability is 8000 kw and average output is 70 million kwh.

Bunyan Hydroelectric Station, 1360-kw capacity consisting of two 320-kw units installed in 1931 and one 720-kw unit in 1951, located on the Sarmisakli stream, branch of Kizilirmak River in Central Anatolia, 38 km northeast of Kayseri. Firm output of this run-of-river plant is 5 million kwh.

Sizir Hydroelectric Station, 6768-kw capacity, placed in service in 1961, is run-of-river station, located on one of the tributaries of the Kizilirmak River, 65 km northeast of Kayseri. Waters from comparatively large springs are utilized through 6-km conveyance system to a pond providing daily regulation. Firm output is 30 million kwh. Average production is 38 million kwh.

Durucasu Hydroelectric Station, 800-kw capacity, placed in service in 1955, is run-of-river station located on a tributary of the Yesilirmak River, 15 km northeast of Amasya. Firm output is 2 million kwh.

Hazar Hydroelectric Station, initially 6560 kw in 1958, ultimately 13 120 kw in 1960 (4 units, each 3280 kw) is located 20 km southeast of Elazig in the Firat River Basin in Eastern Anatolia. Water is directed from Hazar natural lake through a 2-m diameter tunnel approximately 3 km long to a surge tank and penstock, thence to the station. Effective head is 320 m. Peaking and production capability is limited by the tunnel and available storage. Water level in Hazar Lake is gradually being lowered by the rate of use through the power plant. Hazar Lake formerly had an outlet to the Dicle (Tigris) River. Firm production is 80 million kwh.

2 - Thermal Electric Stations

Existing thermal electric stations have a total dependable capability of 374 mw of which 371 mw are in stations presently connected to the system.

The following table gives the maximum net capability of each of the existing thermal electric stations.

<u>Load Area</u>	<u>Plant</u>	<u>Dependable Net Capability Mw</u>
A	Silahtar	100
B	Catalagzi	106
B	Tuncbilek	60
B	Bursa	5
B	Izmit	7
B	Karabuk	8
C	Ankara	15
E	Soma	40
E	Izmir	30
	Subtotal	371
F	Maden*	3
	Total	374

* Not presently tied to the interconnected system.

A table giving pertinent statistics and generation during the last five years for the stations listed above will be found in Appendix F-4.

A brief description of each of these stations follows:

Silahtar (Istanbul) Thermal Station consists of six power generating units ranging in date of installation from 1923 to 1956 and in nameplate capacity from 9.8 mw to 35.6 mw. Generating units are located in three separate machine houses, reflecting gradual evolution of the plant from the date of its original construction in 1914. The plant has 14 boilers ranging in date of installation from 1929 to 1956. Total installation is 127.9 mw. Total net capacity is rated at 120 net mw. With the grade of coal now being received from Zonguldak, firm net peaking capability is limited to 100 mw due to inability of existing chain-grate stokers to handle the coal which has a high proportion in the smaller sizes.

Catalagzi Thermal Station has a total installation of 120 mw consisting of six 20-mw units. Dates of installation range from 1948 to 1956. Installation of each 20-mw unit was accompanied by a 1.5-mw unit for station

service. Catalagzi Station is located near Zonguldak, the coal mining city on the Black Sea. This station uses 2/3 flotation - 1/3 middlings of Zonguldak coal. Net peaking capability is 106 mw.

Tuncbilek Thermal Station, initial capacity of 64 mw (2 units of 32 mw) placed in service in 1956. Ultimate dependable capacity is planned as 120 mw with the addition of a third unit. Tuncbilek Station is located at Tuncbilek and burns lignite mined at the same location. Present net peaking capability is 60 mw.

Bursa Thermal Station installed capacity is 6300 kw with four units, each 1575 kw. Two of them were installed in 1938, the other two in 1953. Burns hard coal and lignite. Net peaking capability is 5 mw.

Izmit Thermal Station is of 11 160-kw capacity and consists of four units: one unit 160-kw diesel; two units lignite burning, one 5000 kw and the other 3500 kw; one unit hard coal burning 2500 kw. Net peaking capability is 7.0 mw.

Karabuk Thermal Station, 20-mw capacity (2 units of 10 mw) placed in service in 1939, is located at the town of Karabuk where the present iron and steel factory is situated. The blast furnace gas and hard coal is used as fuel. Two 210-kw diesel generators for station use were also placed in service in 1939. Peaking capability is 8 mw.

Ankara Thermal Station consists of 5 steam turbine generators ranging from 2.5 mw to 7.5 mw, date of installation ranging from 1936 to 1953, with 22.8-mw total capacity. There are also 5 diesel generators with total capacity 3824 kw, dated from 1927 to 1931. Hard coal and lignite are burned for steam generation. Net peaking capability is 15.0 mw.

Soma Thermal Station, initial capacity 44 mw (2 units at 22 mw) placed in service in 1957, ultimate capacity 66 mw, located in West Anatolia. Lignite is used as fuel. Net peaking capability is 40 mw.

Izmir Thermal Station consists of 6 units ranging from 2.5 mw to 20 mw. Installation dates of the units range from 1928 to 1955. One of the three 5-mw units was placed in service in 1949, the other two in 1953, the 20-mw unit in 1955. Total installation is 40 mw. Fuel is lignite. Peaking capacity is 30 mw.

Maden Thermal Station with capacity of 6.4 mw, consists of two 3.2-mw steam turbines installed in 1939. Plant also contains two diesel generators

which total 1096-kw capacity. Station is located at Maden, 50 km southeast of Elazig, between Elazig and Diyarbakir where the copper smelting plant is located. Hard coal is used as fuel. Net peaking capability is 3.2 mw.

D - SYSTEM EXPANSION PROGRAM THROUGH 1975

1 - Projects Now Under Construction

a - Hydroelectric Stations

Hydroelectric capacity under construction, including additional installations at existing plants as well as new projects, is as follows.

<u>Load Area</u>	<u>Plant</u>	<u>Dependable Capacity Mw</u>	<u>Average Annual Energy Kmwh</u>	<u>Initial Operation</u>
C	Sariyar	75	18	1965
C	Kesikkopru	76	215	1965
D	Almus	15	84	1965
F	Hazar II	10	17	1965

Of these plants, only Sariyar and Kesikkopru will be tied to the interconnected system at the time of initial operation.

The installation at Sariyar will be the installation of two units in the existing powerhouse, which will bring it to its ultimate capacity. A brief description of the other projects follows:

Kesikkopru Hydroelectric Station, 76-mw capacity (2 units of 38 mw) is located 25 km downstream of Hirfanli dam on the Kizilirmak River. Dam will be 51 m high from the river bed. River flow is completely regulated by Hirfanli reservoir. Sufficient active storage will be available at Kesikkopru to provide for coordinated operation with Hirfanli Station. Net effective head is 63 m and average annual energy generation is 215 kmwh.

Almus Dam and Hydroelectric Station on the Yesilirmak River is located 22 km northeast of Tokat and is under construction at present. It consists of an earthfill dam 79.5 m high from the river bed and 27-mw capacity power plant, with three 9-mw units. All units will be installed initially. Annual average production will be 84 million kwh.

Almus dam is a multiple purpose structure. It provides irrigation water to Kazova plain (west of Tokat) and helps to prevent flood damage.

Hazar II Hydroelectric Station is a project in design stage. This station will be located just downstream of existing Hazar Hydroelectric Station which

utilizes water from Hazar Lake 20 km southeast of Elazig. Discharges of Hazar Hydroelectric Station will be diverted just downstream from the tailrace of the power plant and conveyed through approximately 2-km canal system (300 m of which will be pressure tunnel). Pondage will be provided to regulate the flow to permit daily load-factor operation. Pressure tunnel will connect the pond to the surge tank.

Net effective head will be approximately 70 m. Plant capacity will be 10 mw with two 5-mw units. Energy production capability is limited by the capacity of the Hazar Lake tunnel and the existing Hazar plant penstock. In case additional penstock which is being considered at the existing Hazar plant is installed, 7 cms capacity of the Hazar Lake tunnel can be utilized.

With continuous 7 cms flow which can be obtained only if the second penstock is installed at the existing Hazar plant, the maximum annual energy production capability of Hazar II plant will be 34 million kwh. Average production is estimated as 17 million kwh.

b - Thermal Electric Stations

The only thermal electric capacity now under construction is a second 60-mw unit at the existing Tuncbilek Station, in Load Area B, scheduled for operation in 1965.

A 220-mw extension to the existing Silahtar Thermal Electric Station in Istanbul has been authorized and a loan granted by AID for its construction. Studies are being made by Ebasco to determine if this capacity may more advantageously be located outside the city limits. Pending a decision, the station has been called "Istanbul." The first unit is scheduled for operation late in 1966 and the second in early 1967.

2 - Projects Under Consideration

a - Hydroelectric Projects

The following hydroelectric projects are under consideration and have been recommended for construction to provide power and energy resources to meet the increased loads forecast for the period of this study.

<u>Load Area</u>	<u>Plant</u>	<u>Dependable Capacity Mw</u>	<u>Annual Energy</u>	
			<u>Firm</u>	<u>Average</u>
C	Ciceroz	300	473 ✓	562 ✓
F	Keban	1085 (7 units)	4853 ✓	5871

These projects are described in detail in the respective Feasibility Reports concerning them.

b - Thermal Electric Stations

No new thermal electric capacity is being considered for installation on the interconnected system during the study period, 1963-1973.

3 - Proposed Schedule of Capacity Additions

The chart following this section shows the proposed schedule and amount of capacity additions, and also shows the actual and estimated peak loads to be met by the systems. Although the Northwest and West systems have been interconnected since December 1962, by the 154-kv tie through Balikesir, this line is limited, because of its length, to an effective interchange capacity of 45 mw. The chart, therefore, separates the loads and resources of these two areas until late 1970, at which time it is assumed that a high-voltage tie line or other means of reinforcement between the two areas is in operation and the limitation is substantially removed. As shown, the interchange is from West to Northwest in the early years, then from Northwest to West after installation of the first unit at Ciceroz.

It should be noted that the hydro resources of the Ciceroz third unit and the Keban fifth unit have been added at their net effective capability in the year in which they are installed, based upon critical water conditions. These limitations are imposed by the then-existing load and the amount of energy available under critical conditions. As the load grows, the same amount of energy permits greater utilization of the hydro peaking capacity, so that the capability increases until it equals the peak capacity of the respective units. This gradually occurs during the year but for convenience has been shown as an abrupt increase in the middle of the year.

NORTHWEST, WEST AND EAST ANATOLIA INTERCONNECTED SYSTEM PEAK DEMAND AND FIRM CAPABILITY OF SYSTEM RESOURCES

