CHAPTER 2 GENERAL SITUATION IN THE REPUBLIC OF TURKEY

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2.1 Geography

The Republic of Turkey is geographically located between north latitudes 42°06' and 35°51', and east longitudes 44°48' and 25°40', and is situated at the connecting point between the European and Asian continents.

The country is in the shape of a rectangle, 650 km wide and 1,565 km long having a total area of 779,452 km^2. 97% of this area belongs to the Anatolian Peninsula at the westernmost tip of Asia called Asia Minor, with the remaining 3% being the Thrace Region in the southeastern part of the Balkan Peninsula located at the eastern tip of the European continent.

The land is bounded on the south by the Mediterranean Sea, on the west by the Aegean Sea and Bulgaria and Greece, on the north by the Black Sea, and on the east by the Georgia, Armenia, Iran, Iraq and Syria.

Broadly dividing the land geographically, it consists of the Aegean-Mediterranean Region, Black Sea Coast Region, Eastern and Central Anatolia Region, and the Southern Anatolia Region. 96% of the land belongs to a steppe type climate zone called the Anatolian Plateau, and only 30% of the land is cultivated.

The mean elevation of the land is 1,132 m with no more than 20% of the land being below elevation 500 m. The mean elevation of Ankara, the capital city, is 902 m.

Representative rivers are the Kizilirmak River (1,355 km), the longest in Turkey, the Sakarya River (825 km), the Seyhan River (560 km) and the Yesilirmak River (520 km), besides these, there are the famous Dicle (523 km) and Firat (1,263 km) which are international rivers that rise within the boundaries of Turkey.

Lake Van (3,700 km^2) in Eastern Anatolia, and Lake Tuz (1,500 km^2) in Central Anatolia are representative lakes, and both are salt water lakes. Artificial lakes are Lake Keban (675 km^2) on the Firat River and Lake Hirfanli (263 km^2) on the Kizilirmak River which are well-known, and both are playing important roles as reservoirs for hydroelectric power generation, namely, as water power energy resources.

Almost all of the seashores of Turkey are of topographies where mountains fall abruptly into the sea with plains only existing in small scale at the mouths of rivers. In such a situation, there are plains such as the Adana Plain at the mouths of the Seyhan River and the Ceyhan River, the Bafra Plain at the mouth of the Kizilirmak River, the Çarşamba Plain at the mouth of the Yeşilirmak River, the plains at the mouths of medium-scale rivers emptying into the Aegean Sea, and the plain along the Ergene River at the European Continent side.

Much of the mountain lands are in the Eastern Anatolian Region bordering on Georgia, Armenia, Iran, and Iraq, with Mt. Ağrı (5,165 m) the most famous, besides which there are Mt. Süphan (4,434 m), Mt. Kaçkar (3,932 m), and Mt. Erciyes (3,916 m) making up the greatest hydroelectric potential area of the country.

Vegetation groups differ according to climatic and topographical conditions, and broadly divided, they are the following:

Black Sea Region: Forest areas are distributed at the mountain slope facing the shoreline, and because of comparatively high temperatures, there are large numbers of oak, elm, and beech.

Aegean-Mediterranean: Olive, citrus, and pine are the predominant species along the Coast Region mountain areas.

Anatolian Plateau Area: The vegetation consists of natural forage and scattered forests.

2.2 Climate

Climates in the Republic of Turkey are greatly influenced by the geographical conditions of its being faced on three sides by the Black Sea at the north, the Aegean Sea at the west, and the Mediterranean Sea at the south, and being connected with the Eurasian Continent at half of its south side and at its east side, and differ considerably depending on the locations. The climate may be broadly divided into the following according to region.

The central part which is a dry region: this Central Region consists of Central Anatolia excluding the eastern part and the area in the southern part contiguous with the Eurasian Continent. The Mediterranean Region which is of Mediterranean climate: temperate but with little rain and hot in midsummer. The eastern part of continental climate, high in

elevation and with extreme differences between hot and cold during the year. Further, the Black Sea Region with relatively much rain and fog.

Isolation during the year is 1,800 hours in the north to 3,200 hours in the south, there being more sunshine the further to the south.

2.2.1 Temperature

The outline of temperatures by region is as follows:

The Black Sea Region is mild with mean temperature around 14^{0} to 15^{0}C. Even in midsummer, in July and August, the temperature is about 22^{0} to 24^{0}C and comparatively easy to bear, while in the winter, in January and February, it is 5^{0} to 7^{0}C, and the cold is not very severe.

Mean annual temperatures in the Aegean Sea-Mediterranean Sea Region are 18 to 20^{0}C. However, higher than 27^{0}C is reached in summer and is fairly hot, but winters are mild with temperatures 8 to 12^{0}C. This is a so-called Mediterranean Sea climate.

On the other hand, the inland Central Region has mean annual temperature from 11^{0}C to 20^{0} C. However, in midsummer, combined with dryness, it becomes scorching hot.

The eastern part of the inland area has large differences in mean annual temperature from 4 to 18^{0}C due to differences in elevations, and is featured by a continental climate of extreme differences between hot and cold. There are many districts which are hit by a cold wave of lower than 20^{0} C below zero in the coldest period.

2.2.2 Precipitation

The outline of precipitation by region is as described below.

The annual rainfall in the Black Sea Region is the most plentiful in Turkey, the pattern being for slightly more rain in the wintertime, although it does rain throughout the year. Therefore, vegetation in this region shows a very good condition of growth. There is a fair amount of annual rainfall in the Mediterranean Sea Region, but the rainfall in summer is extremely small.

The annual rainfall of the Central Region is less than 400 mm so that it is dry and there are places which are of semi-desert conditions. The annual precipitation in the Eastern Region is around 400 mm, and because it is mountainous, there is snowfall in the winter. The climates in the principal cities are given in Table 2-1.

Table 2-1 Climate in the Main Cities

Selected Cities	Regions	Altitude Above Sea (m)	Temperature (^{0}C)			Average Humidity (%)	Average Precipitation (mm)
			Average	Lowest	Highest		
Istanbul	Mar.	39	14.0	-16.1	40.5	75	677.2
Ankara	Cent. A	885	11.7	-24.9	40.0	60	377.7
Izmir	Aegean	25	17.6	-8.2	42.7	64	691.1
Adana	Medit.	20	18.8	-8.4	45.6	66	647.1
Edirne	Thrace	48	13.4	-22.2	41.5	70	585.9
Bursa	Mar.	100	14.6	-25.7	42.6	69	696.5
Antalya	Medit.	42	18.5	-4.6	44.7	64	1052.3
Urfa	S. East A.	547	18.1	-12.4	46.5	49	463.1
Zonguldak	W. Black	136	13.5	-8.0	40.5	72	1220.2
Rize	N.Black	4	14.1	-7.0	38.2	77	2300.4
Van	East A	1,725	8.7	-28.7	37.5	59	380.6
Agri	East A.	1,632	6.1	-43.2	38.0	67	528.5
Mugla	Aegean	646	14.9	-12.6	41.2	61	1196.3
Erzurum	N. East A.	1869	5.9	-37.0	35.0	64	447.2

Source: General directorate Of Meteorology
STATISTICAL YEAR Book of Turkey 1995

The growth in per capita GNP has been eye-catching in recent years due to industrialization, and on a U.S. dollar base, it was US$ 2795/capita in 1995. The per capita GNP figures for recent years are given in Table 2-3.

2.3 Population

The total population as of the end of 1995 was 62,526,000 and in recent years, concentration of population in urban areas has been increasing. Incidentally, the ratio of population between urban and rural areas in 1990 was 59.41.

2.4 Economy

The economy in the Republic of Turkey is a mixed system (established in the early 1930's) where private enterprises coexist with public enterprises set up with state capital. Today, approximately 55% of industrial production is by the public sector.

In 1960 the State Planning Organization was established and a Long-Range Five-Year Economic Development Plan was formulated to start from 1963. Since 1963, a planned economy has been implemented, the objective being to attain an annual average economic growth rate of a 7% level.

This target is to be realized through promoting industrialization and absorbing surplus labor of agriculture into the industrial sector.

At present, the Sixth Five-Year Development Plan (1990-1994) is being implemented. In the Fourth Five-Year Development Plan (1979-1983), it was planned to attain an economic growth of 8% annually by investing 10,595 x 109 TL (1983 prices), but the actual performance was as shown in Table 2-2, and the growth rate was approximately 2.0%, considerably below the planned level.

With the Fifth Five-Year Plan (1984-1989), there was a recovery from the oil crisis, and the economic growth rate according to GNP reached 6.1% as shown in Table 2-2.

Table 2-2 Growth Rates during Planned Development Period by Sectors

	1st Plan Average (1963-1967)	2nd Plan Average (1968-1972)	3rd Plan Average (1973-1977)	1978 Average	4th Plan Average (1979-1983)	5th Plan Average
1. Agriculture						
a. Target	4.2	4.1	4.6	4.1	5.3	
b. Realisation	3.1	3.5	3.5	2.7	2.2	4.8
2. Industry						
a. Target	12.3	12.0	11.2	8.0	9.9	
b. Realisation	10.8	7.8	9.8	6.6	1.7	7.6
3. Services						
b. Realisation	7.3	7.9	7.9	4.1	2.6	5.3
4. Gross Domestic Product						
b. Realisation	6.4	6.8	7.3	4.3	2.3	5.7
5. Gross National Product						
a. Target	7.0	7.0	7.9	6.1	8.0	6.3
b. Realisation	6.6	7.1	6.5	2.9	2.1	6.1

Source : Economic Report (Turkey) 1991

Publication No. 1991/13

Table 2-3 Per Capital GNP

Year	1991	1992	1993	1994	1995
Per Capital GNP*	2655	2708	3056	2184	2795

In the Fifth Five-Year Development Plan, it is planned to invest a total of 14,413 x 10^9 TL (1983 prices), the breakdown of which is 57% for the public sector, and 43% for the private sector. By category, the investment is to be 27.04% for manufacturing industries. 18.57% for transportation and communications, 15.20% for housing, 11.37% for agriculture, 14.89% for energy and 12.93% for others, with which it is planned to achieve and annual average growth of 6.3%. The major economic activities during the 4-year period of 1993-1996 (with estimates partially included) are indicated in Table 2-4.

Industrial activity in Turkey in recent years has been shifting its weight from agriculture and mining to manufacturing, but the weight of agriculture indicated in Table 2-6 is still great. In the mining and manufacturing sector, as may be seen in Table 2-5, growths are prominent in vehicles such as passenger cars and trucks, chemical products such as polyethylene and polyvinyl chloride, and steel. It may be considered that sure steps are being taken by industrialization.

The recent state of foreign trade of Turkey is as shown in Table 2-7.

The principal items of export in 1995 were textiles, agricultural products such as processed foodstuffs, grains, leaf tobacco, and nuts, leather goods, and metal products. On the other hand, the principal items of import were crude oil, machinery, chemical products, steel, wheat, electrical appliances, automobiles, etc.

Table 2-4 Macroeconomics Balance (TL billion, at current prices)

Macroeconomics Balance (TL billion, at current prices)

						% Share		
		1993	1994	1995*	1996**	1994	1995*	1996**
I	1. GNP	1,997,323	3,887,903	7,644,206	13,500,050	100.0	100.0	100.0
	2. Foreign Deficit	96,906	-57,323	266,181	526,500	-1.5	3.5	3.9
	3. Total Resources	2,094,229	3,830,580	7,910,387	14,026,550	98.5	103.5	103.9
	4. Total Investment	531,497	834,284	1,884,904	3,395,644	21.5	24.7	25.2
	5. Fixed Capital Investment	505,867	946,186	1,766,277	3,301,012	24.3	23.4	24.5
	5.1 Public	144,133	192,242	320,433	661,551	4.9	4.2	4.9
	5.2 Private	361,733	753,944	1,465,844	2,639,462	19.4	19.2	19.6
	6. Change In Stock	25,630	-111,902	98,627	94,632	-2.9	1.3	0.7
	6.1 Public	1,561	-50,632	-35,131	641	-1.3	-0.5	0.0
	6.2 Private	24,070	-61,270	133,758	93,990	-1.6	1.7	0.7
	7. Total Consumption	1,562,732	2,996,296	6,025,483	10,630,906	77.1	78.8	78.7
II	8. Public Disposable Income	189,091	370,686	655,739	1,138,145	9.5	8.6	8.4
	9. Public Consumption	245,710	418,750	751,195	1,430,328	10.8	9.8	10.6
	10. Public Savings	-56,620	-47,864	-95,456	-292,184	-1.2	-1.2	-2.2
	11. Public Investments	145,694	141,610	285,302	662,192	3.6	3.7	4.9
	12. Public (Saving-Investment)	-202,314	-189,474	-380,758	-954,375	-4.9	-5.0	-7.1
III.	13. Private Disposable Income	1,808,232	3,517,016	6,988,467	12,361,905	90.5	91.4	91.6
	14. Private Consumption	1,317,022	2,577,546	5,274,289	9,200,578	66.3	69.0	68.2
	15. Private Savings	491,210	939,470	1,714,179	3,161,327	24.2	22.4	23.4
	16. Private Investment	385,803	692,674	1,599,602	2,733,452	17.8	20.9	20.2
	17. Private (Saving-Investment)	105,406	246,796	114,577	427,875	6.3	1.5	3.2
	18. Private Savings Ratio	24.6	26.7	24.5	25.6			
	19. Total Domestic Saving	434,591	891,606	1,618,723	2,869,144	22.9	21.2	21.3
	20. F.Capital Invest /GNP	25.3	24.3	23.4	24.5			
	21. Domestic Saving/GNP	21.8	22.9	21.2	21.3			

Source : SPO

GNP by Origin (Annual Percentage Change in 1987 Prices)

	1993		1994		1995	
	Growth	Share	Growth	Share	Growth	Share
Agriculture	-1.3	14.8	-0.3	15.7	2.6	14.9
Industry	8.2	26.9	-5.7	27.0	12.1	28.0
Mining	-6.4	1.6	8.0	1.8	-6.9	1.5
Manufacturing	9.3	22.7	-7.6	22.3	13.9	23.5
Energy	8.9	2.6	3.4	2.9	9.6	2.9
Services	9.5	47.0	-4.0	48.0	6.4	47.2
Construction	7.9	6.4	-2.0	6.7	-4.7	5.9
Trade	11.6	20.5	-7.5	20.1	11.6	20.8
Transport&Comm.	10.8	12.4	-2.0	12.9	5.9	12.6
Financial Institutions	-0.4	2.5	-1.5	2.6	0.4	2.4
Imp.inc.on Residences	2.8	5.1	-2.8	5.6	2.1	5.3
Business&Pers.Serv.	6.9	2.2	-4.2	2.3	7.5	2.3
Gross Domestic Product	8.0	98.9	-5.5	99.6	7.3	98.9
Gross National Product	8.1	100.0	-6.0	100.0	8.1	100.0

Source : State Institute of Statistics

Table 2-5 Production of Mayor Industrial Commodities

	Unit	1990	1991	1992	1993	1994	1995	January-June 1995	January-June 1996
Mining									
Hard coal	(1000 tons)	5,604	5,210	2,829	2,722	2,839	2,248	1,266	1,207
Lignite	(1000 tons)	45,826	44,511	49,847	45,957	48,838	51,943	23,744	22,526
Crude oil	(1000 tons)	3,720	4,520	4,296	3,892	3,,686	3,514	1,738	1,759
Manufacturing									
Cotton yarn	(Tons)	44,859	47,366	47,177	43,744	35,066	32,305	16,449	12,319
Wool yarn	(Tons)	4,378	4,001	3,739	5,425	4,784	3,360	1,433	1,676
Filtered cigarette	(Tons)	56,480	67,740	63,773	69,803	77,938	75,382	34,658	34,587
Raki & Beer	(Mill.Lts)	432	480	543	620	666	740	335	312
Newsprint	(1000 tons)	166	96	119	94	110	138	73	42
Craft paper	(1000 tons)	103	88	88	72	78	74	39	30
Sulfuric acid	(1000 tons)	716	532	642	757	730	630	386	296
Polyethylene	(Tons)	235,599	256,001	260,571	270,772	282,964	301,087	145,717	147,538
PVC	(Tons)	136,655	131,638	150,453	159,294	156,942	161,036	87,964	98,636
LPG	(1000 tons)	692	709	709	707	733	792	387	415
Naphtha	(1000 tons)	1,525	1,140	1,242	1,249	1,266	1,473	751	892
Gasoline	(1000 tons)	2,855	2,772	2,946	3,215	3,339	3,554	1,686	1,575
Gas oil	(1000 tons)	6,548	6,332	6,565	7,252	7,399	7,983	3,800	3,742
Fuel-Oil (5,6)	(1000 tons)	8,243	8,444	8,441	8,701	7,583	7,786	3,760	4,014
Bottles&Glass artic	(1000 tons)	377	358	422	437	440	506	490	574
Crude Iron	(1000 tons)	4,827	4,594	4,508	4,355	4,604	4,363	2,357	2,563
Steel ingot	(1000 tons)	9,413	9,398	10,343	11,519	12,179	12,798	6,535	6,467
Blistered copper	(Tons)	18,840	28,380	26,092	33,453	30,437	24,416	16,859	18,515
Alumina	(Tons)	177,915	159,091	156,474	141,550	155,299	171,978	95,905	84,629
Cement	(1000 tons)	24,416	26,037	28,607	31,311	29,493	33,153	14,950	15,422
Tractor	(No.)	30,739	21,964	23,012	33,294	24,249	38,295	16,930	22,556
Automobile	(No.)	166,222	195,599	265,090	343,481	208,531	222,145	99,281	100,374
Truck	(No.)	16,679	16,906	20,743	29,739	11,235	19,172	7,418	12,232
Bus and Minibus	(No.)	14,331	15,584	19,302	21,585	8,791	12,424	4,832	7,905
Production of Mayor									
....Consumer Goods									
Refrigerator	(No.)	986,574	1,019,627	1,093,773	1,253,791	1,258,353	1,662,835	817,789	851,360
Washing machine	(No.)	743,957	836,986	870,890	979,717	780,015	665,747	382,654	532,109
Cooker (LPG)	(No.)	594,318	731,568	761,290	629,778	448,613	511,229	261,305	271,361
Vacuum cleaner, electric	(No.)	516,041	533,444	596,466	715,351	436,750	878,923	429,401	449,054
Sewing machine	(No.)	255,667	237,631	197,104	170,349	119,145	150,980	65,155	56,395
Television set (color)	(No.)	1,994,621	2,567,773	2,320,460	1,921,704	1,528,255	1,859,333	739,337	1,063,568
Video	(No.)	118,857	80,484	46,153	17,141	8,148	2,769	1,869	900
Hi-Fi Music system	(No.)	141,989	192,201	123,575	87,416	90,450	95,996	56,067	60,465
Energy									
Electric power	(Mil. kWh)	57,542	60,220	66,983	73,734	78,261	85,983	40,955	45522

Source : SIS

Table 2-6 Agricultural Production-Major Crops

(In thousands of tons)

	1991	1992	1993	1994	1995
CEREALS					
Wheat	20400	19300	21000	17500	18000
Barley	7800	6900	7500	7000	7500
Maize	2180	2225	2500	1850	1700
PULSES					
Lentils	640	600	735	610	675
Chick Peas	855	770	740	650	750
Dry Beans	214	200	200	180	210
INDUSTRIAL CROPS					
Sugar Beet	15474	14840	15620	12730	11680
Cotton	559	574	602	628	770
Tobacco	241	322	339	242	220
OIL SEEDS					
Cotton Seed	895	905	900	930	1230
Sunflower	800	950	815	740	850
Groundnut	60	67	70	70	65
FRUITS & NUTS					
Grape & Fig	3600	3450	3700	3450	3770
Citrus Fruits	1696	1674	1737	1878	1814
Hazelnut	315	520	305	490	450
Apple	1900	2100	2080	2095	2095
ADDED VALUE IN AGRICULTURE (AT 1987 PRICES, BILLIONS OF TL.)	14049	14651	14463	14358	14279

Source : SIS

Table 2-7 Foreign Trade

Million $

(%)

	1990	1991	1992	1993	1994	1995
.Exports : Total (FOB)	12959	13,594	14,719	15,348	18,105	21,636
Agriculture and livestock	2347 (18.11)	2683 (19.74)	2204 (14.97)	2365 (15.41)	2457 (13.57)	2307 (10.66)
Industrial Products	10285 (79.37)	10625 (78.16)	12251 (83.23)	12,744 (83.03)	15,376 (84.93)	18,924 (87.47)
Mining and Quarrying Products	327 (2.52)	286 (2.1)	264 (1.80)	239 (1.56)	272 (1.50)	405 (1.87)
Imports : Total (CIF)	22,302	21,047	22,870	29,429	23,270	35,708
Agriculture and Livestock	1,318 (591)	808 (3.84)	1,178 (5.15)	1,664 (5.65)	1,209 (5.20)	2,444 (6.84)
Mining and Quarrying Products	3,989 (17.89)	2,991 (14.21)	3,054 (13.35)	3.041 (10.33)	2,969 (12.76)	3,477 (9.74)
Industrial Products	16,995 (76.20)	17,248 (81.95)	18,638 (81.50)	24,724 (84.01)	19,092 (82.05)	29,787 (83.42)

Source : Undersecretariat of Foreign Trade (Prime Ministry)

The main trading partners in 1995 were as follows:

Foreign Trade by Destination (Million USD)

	Exports			Imports		
	1994	1995	Ch.(%)	1994	1995	Chg (%)
OECD Countries	10,758	13,223	22.9	15,334	23,595	53.9
EU	8,635	11,078	28.3	10,915	16,860	54.5
EFTA	277	294	6.1	563	892	58.4
Other OECD	1,846	1,851	0.3	3,856	5,843	51.5
Non-OECD Co.	7,348	8,413	14.5	7,936	12,114	52.6
European	2,437	3,567	46.4	2,590	4,555	75.9
Mid-East	2,050	2,050	0.0	2,529	2,688	6.3
Other	2,861	2,796	-2.3	2,817	4,871	72.9
Total	18,106	21,636	19.5	23,720	35,709	53.5

Source : State Institute of Statistics

Germany has been once again the largest trade partner of Turkey with 23.3% (21.7% in 1994) and 15.5% (15.7% in 1994) respective share in exports and imports, followed by USA with 7.0% and 10.4%. Italy ranked third with 6.7% share in exports and 8.9% in imports. In terms of countries' share in Turkey's trade deficit, USA ranked first with $2.2bn followed by Italy and Japan with $ 1.7 bn and $1.2bn respectively.

Foreign Trade by Individual Countries (Million USD)

	Exports			Imports		
	1994	1995	Ch.(%)	1994	1995	Chg (%)
Germany	3,934	5,036	28.0	3,646	5,547	52.1
USA	1,520	1,513	-0.5	2,429	3,723	53.3
Italy	1,034	1,457	40.9	2,009	3,193	58.9
UK	889	1,136	27.8	1,170	1,830	56.4
France	851	1,033	21.4	1,458	1,996	36.9
Russian Fed.	820	1,238	51.0	1,045	2,082	99.2
The Netherlands	621	737	18.7	740	1,084	46.5
Saudi Arabia	609	470	-22.8	1,229	1,384	12.6
Japan	186	180	-3.2	967	1,400	44.8

(1) Ranked according to 1995 exports, Source : State Institute of Statistics

Imports by Main Commodity Groups

	1994		1995		Change
	M. USD	Shr (%)	M.USD	Shr. (%)	(%)
Investment Goods	6894	29.6	10,488	29.4	52.1
Construction	745	3.2	946	2.6	26.9
Machinery	6129	26.3	9,245	25.9	50.8
Consumer Goods	2780	11.9	4,414	12.4	58.8
Raw materials	13596	58.4	20,807	58.3	53.0
Total	23270	100.0	35,709	100.0	53.5

Source : State Institute of Statistics

Exports by Main Commodity Groups

	1994		1995		Change
	M. USD	Shr (%)	M.USD	Shr. (%)	(%)
Investment Goods	3,141	17.3	3,518	16.3	12.0
Construction	1,739	9.6	1,918	8.9	10.3
Machinery	1,263	7.0	1,520	7.0	20.4
Consumer Goods	9,756	53.9	12,574	58.1	28.9
Raw materials	5,208	28.8	5,543	25.6	6.4
Total	18,106	100.0	21,636	100.0	19.5

Source : State Institute of Statistics

Approximately 61% of exports and 66% of imports are with OECD countries, and almost all of the remainder being barter with the former Russian Fed., West European countries and Middle East countries based on bilateral trade agreements.

The balance of trade is constantly that of a deficit, and in 1995 exports amounted to $\$21,636 \times 10^6$ and imports to $\$35,709 \times 10^6$ recording a deficit of approximately $\$14,073 \times 10^6$.

2.5 Energy Resources

In Turkey, hydroelectric power resources to be developed economically are estimated to be 35,241 MW, of which twenty eight (28) percent had already been developed by 1995.

Indigenous energy resources in Turkey are petroleum (estimated to be 57 million tons), coal (12,900 million tons), and uranium as well as hydroelectric power resources above mentioned.

As for petroleum, it covers only 10 to 20 percent of domestic demand.

The lignite, the major portion of coal produced in Turkey and with low calorific value is not suitable for industrial use and is mainly used for residential and fuel for coal fired thermal power stations.

The production of primary energy and the situation of its use in Turkey are given in Table 2-8. According to this, the principal energy sources of lignite, water power, wood, fuel, and energy from animals and plant life are made up of what are produced indigenously, but for hard coal, natural gas, and petroleum, imports are almost entirely

relied on, while although a slight amount, electric power is also being imported. The increase in importation of natural gas has been especially prominent, this being imported for fuel and heating for urban populations, and for gas-fired thermal power generation. An as described in Chapter 5, since gas-fired thermal power stations will increase rapidly in Turkey, it is thought that importation of natural gas will increase. The sources of these imports will probably be Russia and Iran in view of their reserve situations.

The amount of imported coal will increase for use as raw materials and fuel. However, it is thought there will be almost no petroleum imported for the purpose of electric power.

Table 2-8 Primary Energy Production and Consumption

Unit : Thousand tons of oil equivalent

	1987	1988	1989	1990	1991	1992	1993	1994
Production	**24 795**	**24 364**	**25 490**	**25 824**	**26 847**	**27 132**	**26 818**	**26 845**
Coal	2 111	2 212	2 027	2 080	1 827	1 727	1 722	1 636
Lignite	9 827	8 603	10 564	9 524	9 117	10 299	9 790	10 409
Asphalt	271	268	179	119	60	92	37	-
Natural Gas	270	90	158	193	185	180	182	182
Petroleum	2 762	2 692	3 020	3 902	4 674	4 495	4 087	3 871
Hydraulic	1 600	2 490	1 542	1991	1 950	2 285	2 921	2 629
Wood	5 308	5 313	5 345	5 361	5 391	5 421	5 451	5 482
Animal and vegetable waste	2 586	2 614	2 580	2 548	2 530	2 512	2 494	2 475
Geothermal	50	59	54	69	70	60	67	68
Other	10	13	21	37	43	61	67	92
Consumption	**46 601**	**47 657**	**50 440**	**53 334**	**54 624**	**57 022**	**60 641**	**59 610**
Coal	4 404	5 204	4 722	6 150	6 501	6 243	5 834	5 512
Lignite	9 189	7 932	10 207	9 765	10 572	10 743	9 918	10 334
Asphalt	271	268	176	123	60	65	44	-
Natural Gas	669	1 115	2 878	3 110	3 827	4 197	4 630	4 928
Petroleum	22 301	22 590	22 865	23 901	23 315	24 865	28 412	27 198
Hydraulic	1 600	2 490	1 542	1991	1 950	2 285	2 921	2 629
Wood	5 308	5 313	5 345	5 361	5 391	5 421	5 451	5 482
Animal and vegetable waste	2 586	2 614	2 580	2 548	2 530	2 512	2 494	2 475
Geothermal	50	59	54	69	70	60	67	68
Other	10	13	21	37	43	61	67	92
Imports	49	33	48	15	65	16	18	29
Exports	-	-	-	78	44	27	51	49

Source : Ministry of Energy and Natural resources.

Note: Total energy consumption covers changes in secondary coal.

Taking all these into consideration, we can easily understand that the electric power industry supported by two major resources of hydroelectric power and lignite coal plays a significant role in promoting the industrialization of Turkey.

The tendency of each resource used for power generation is shown in Table 2-9.

The outstanding figure in this table is that of other fuels, that is that the use of natural gas has increased sharply in recent years and overcame oil fired thermal power in 1989.

Table 2-9 Distribution of Electrical Energy Generation of Turkey over Primary Power Resources

Unit : %

YEARS	HARD COAL	LIGNITE	FUEL-OIL	DIESEL OIL	OTHER	NATURAL GAS	GEO-THERMAL	TOTAL THERMAL	TOTAL HYDRO	TOTAL
1970	16.0	16.7	27.1	3.1	1.9			64.8	35.2	100.0
1971	14.8	15.6	39.8	1.4	1.7			73.3	26.7	100.0
1972	12.7	13.3	43.1	0.8	1.6			71.5	28.5	100.0
1973	12.1	14.0	47.0	4.3	1.6			79.0	21.0	100.0
1974	11.3	17.5	39.9	4.9	1.5			75.1	24.9	100.0
1975	9.1	17.2	30.1	4.4	1.4			62.2	37.8	100.0
1976	7.4	16.3	25.5	4.1	0.9			54.2	45.8	100.0
1977	6.2	17.6	26.9	6.5	1.1			58.3	41.7	100.0
1978	5.6	20.1	26.1	4.6	0.6			57.0	43.0	100.0
1979	4.7	23.9	22.7	2.4	0.6			54.3	45.7	100.0
1980	3.9	21.7	22.4	2.6	0.6			51.2	48.8	100.0
1981	3.6	21.3	21.1	2.5	0.4			48.9	51.1	100.0
1982	3.4	20.8	20.0	2.4				46.6	53.4	100.0
1983	2.9	28.5	23.2	3.9				58.5	41.5	100.0
1984	2.3	30.7	21.9	1.1			0.1	56.1	43.9	100.0
1985	2.1	41.8	20.5	0.2		0.2	0.0	64.8	35.2	100.0
1986	2.0	47.0	17.5	0.1		3.4	0.1	70.1	29.9	100.0
1987	1.4	38.4	12.2	0.2		5.7	0.1	58.0	42.0	100.0
1988	0.7	25.3	6.8	0.1		6.7	0.1	39.7	60.3	100.0
1989	0.6	38.3	8.1	0.1		18.3	0.1	65.5	34.5	100.0
1990	1.1	34.0	6.8	0.0		17.7	0.2	59.8	40.2	100.0
1991	1.7	34.1	5.6	0.0	0.1	20.8	0.1	62.4	37.6	100.0
1992	2.7	33.8	7.8	0.0	0.1	16.0	0.1	60.5	39.5	100.0
1993	2.4	29.7	7.0	0.0	0.1	14.6	0.1	53.9	46.1	100.0
1994	2.5	33.5	7.1	0.0	0.1	17.6	0.1	60.9	39.1	100.0
1995	2.6	29.9	6.4	0.3	0.3	19.2	0.1	58.8	41.2	100.0

Source : TEAŞ

Further, according to the long-range plans for electric power generation prepared by TEK in April 1994, the installed capacities and composition by type of resource used 1995-2010 will be as shown in Table 2-10. As shown in this table, the ratio between thermal and hydro in composition of installed capacity in 2000 will be 57:43. However, this composition ratio will be 56:44 in 2005 and 62:39 in 2010 the proportion of thermal becoming higher as the years go by.

According to the above mentioned long-range electric power plan, lignite-burning thermal will continue to be developed in the thermal power generation program, but there are large increases planned for power generation by natural gas and imported coal. Hydroelectric power generation is also planned to be aggressively developed.

Table 2-10 Composition of Generating Facility Between 1995-2010

(Reference Solution)

Years	Lignite + Hard Coal MW (%)	Natural Gas MW (%)	Fuel Oil Diesel MW (%)	Imported Coal MW (%)	Nuclear MW (%)	Total Thermal MW (%)	Total Hydro-electric (MW) (%)	General Total MW	Percentage of Imported fuel (%)
1995	5803 (28.04)	2671 (12.91)	1925 (9.3)	0	0	10399 (50.25)	10297 (49.75)	20696	Domestic: 77.79 Import : 22.21
1996	6304 (27.96)	3351 (14.86)	1925 (8.54)	0	0	11580 (51.36)	10969 (48.64)	22549	Domestic : 76.60 Import : 23.40
1997	6304 (26.53)	4031 (16.97)	1925 (8.10)	0	0	12260 (51.60)	11498 (48.40)	23758	Domestic : 74.93 Import :25.07
1998	7434 (29.08)	4711 (18.43)	1925 (7.53)	0	0	14070 (55.03)	11498 (44.97)	25568	Domestic : 74.05 Import : 25.95
1999	7434 (29.79)	6071 (22.30)	1925 (7.07)	0	0	15730 (57.77)	11498 (42.23)	27228	Domestic : 70.63 Import : 29.37
2000	8714 (29.79)	6071 (20.76)	1925 (6.58)	0	0	16710 (57.13)	12537 (42.87)	29247	Domestic : 72.66 Import : 27.43
2001	9394 (29.44)	6751 (21.16)	1925 (6.04)	0	0	18070 (56.64)	13836 (43.36)	31906	Domestic : 72.81 Import : 27.91
2002	9734 (28.21)	7431 (21.54)	1925 (5.58)	0	0	19090 (55.32)	15416 (44.68)	34506	Domestic : 72.89 Import : 27.11
2003	10414 (28.18)	8111 (21.95)	1925 (5.21)	0	0	20450 (55.34)	16503 (44.66)	36953	Domestic : 72.84 Import : 27.16
2004	10904 (27.46)	8791 (22.13)	1925 (4.85)	0	0	21620 (54.44)	18097 (45.56)	39717	Domestic : 73.02 Import : 26.98
2005	11054 (26.08)	8791 (20.74)	1925 (4.54)	1000 (2.36)	1000 (2.36)	23770 (56.08)	18617 (43.92)	42387	Domestic : 70.00 Import : 30.00
2006	11734 (25.96)	9471 (20.95)	1925 (4.26)	2000 (4.43)	1000 (2.21)	26130 (57.81)	19067 (42.19)	45197	Domestic : 68.15 Import : 31.85
2007	12564 (26.09)	10151 (21.08)	1925 (4.0)	3000 (6.23)	1000 (2.08)	28640 (59.47)	19519 (40.53)	48159	Domestic : 66.62 Import : 33.38
2008	13014 (25.28)	10831 (21.04)	1925 (3.74)	4000 (7.77)	2000 (3.88)	31770 (61.71)	19713 (38.29)	51483	Domestic : 63.57 Import : 36.43
2009	13654 (24.51)	11511 (20.67)	1925 (3.46)	5000 (8.98)	2000 (3.59)	34090 (61.21)	21607 (38.79)	55697	Domestic : 63.31 Import : 36.69
2010	14854 (24.74)	12191 (20.31)	1925 (3.21)	6000 (9.99)	2000 (3.33)	36970 (61.58)	23064 (38.42)	60034	Domestic : 63.16 Import : 36.84

Source : Ministry of Energy and Natural Resources

Prepared by TEK in April 1994.

* Tunçbilek A Thermal Plant (129 MW, 840 GWh) will be stopped at the beginning of 1996

* Geothermal Power Plant (15 MW, 90 GWh) is including in hydroelectric total

2.6 Transportation and Telecommunication

Transportation of goods by road, railroad, ship and air are available in Turkey.

The total length of roads including national and provincial roads amounted for approximately 59,832 km in 1994 ninety-six (96) percent of which is paved.

The most useful measure among various transportation facilities is road, which conveyed 88 percent of passengers and 72 percent of goods transported in Turkey in 1987.

The number of vehicles registered in 1994 amounted for 5,489,000 units, of which 52 percent were passengers cars.

The total length of railroad amounts for 10199 km, of which 8 452 km are trunk lines (of which 939 km are electrified) and 1,747 km are local lines (of which 72 km are electrified).

Turkey is a peninsula, three directions of which are surrounded by the Black Sea, the Aegean Sea and the Mediterranean Sea, and navigation by the sea made remarkable progress in the old days.

There are 10 international trade ports and another 65 major ports, among which Istanbul ports is the most important owing to it's blessed location.

Air liners connecting 10 major cities as well as 3 international air ports of Istanbul, Ankara and Izmir are operated frequently.

Telecommunication systems available in Turkey are mail, telegram and telephone.

The number of telephone exchange offices are, the centrals of 1137, the local offices of 2872 and agencies of 30683.

TV and radio broadcasting is popularized, a broadcasting network covers all areas in Turkey.

CHAPTER 3 GENERAL DESCRIPTION OF PROJECT AREA AND SURROUNDINGS

CONTENTS

Chapter 3 GENERAL DESCRIPTION OF PROJECT AREA AND SURROUNDINGS

3.1 General Description of Project Area and Surroundings

3.1.1 General Description

This project is planned on the Berta River, a tributary of the Çoruh River. The Berta River is located in the northeast corner of Turkey between 40^0 59' - 41^0 30' north latitude and 41^0 54' - 42^0 32' east longitude.

The Berta river which is the second largest tributary of the Çoruh river next to the Oltu river, is located at the northeast part of the Çoruh river basin. It is surrounded by the Karçal mountain range in the northwest, the Savsetskij mountain range in the northeast, and the Yalnızçam mountain range in the southeast and connects to the Çoruh river mainstream in the southwest for a catchment of rectangular shape in the northeast-southwest direction with a catchment area of 2,315 km^2. The Berta river runs from northeast to southwest through the middle of this catchment.

The Berta river consists of the Meydancık river of catchment area 577 km^2 which rises from the Karçal Mountain range at the northwest parts of the basin and flows south, and the Şavşat river of catchment area 580 km^2 which rises from the Yalnızçam mountain range at the southeast part of the basin, which merge at EL. 665 m to become the Berta river to flow southwest. After being joined by middle and small-size tributaries, the Sungu river from the left-bank side at El. 470, and the Karçal river and the Ortaköy river at El. 515 m and EL. 340 m, respectively, the Berta is joined from the right-bank side at El.276 m by the Ardanuç river which springs from the Yalnızçam mountain range at the southern part of the basin, flows down in the northwest direction with a catchment area of 572 km^2, and at EL.212 m the Berta river merges with the Çoruh river from the right-bank side.

The Berta Basin also shows some characteristics of the Continental Climate, but in predominantly subject to the East Black Sea Climate. Annual mean precipitation over the basin was estimated at 624 mm.

The air temperature of Şavşat, a town in the basin, in terms of annual mean, annual maximum, and annual minimum are 9.9^0C, 38.8^0C and -19.9^0C, respectively. There is considerable difference between hot and cold.

The Çoruh River Basin drains the following three provinces with areas and population of 1990 listed below.

	Area (km^2)	Population	Capital/km^2
Erzurum	25,066	848,840	34
Kars	18,557	666,167	36
Artvin	7,436	212,833	29

There are the two counties of Şavşat and Ardanuç in the Berta River Basin, the total population as of 1990 having been 212,833 for a population density per square kilometer of approximately 3.1 persons.

The residents of the river basin are mainly engaged in agriculture and livestock farming. Cultivated fields of Bağlık and Bayram sites amount to approximately 4000 da which is around 2.4% of Artvin Province. Several varieties of fruits, maize, orchard, vineyard are being grown, and main products are wheat, corn, tomato and bean.

No industrial facilities exists in project area. Only some timber processing plants exists near by the river. There are no mine and underground resources under work.

National Highways No. 950 and No. 010 which are asphalt-paved go through the basin.

National Highway No. 950 is a road which leads from Hopa and goes through Artvin and Yusufeli, heads north along the Tortum River, and passes through Tortum to reach Erzurum. National Highway No. 010 is a road which branches from Route No. 950 at the confluence of the Berta River and the Çoruh River, heads up the Berta River, and forks at the confluence of the Berta River and Ardanuç River, into a route heading for Şavşat and Kars and another heading for Ardanuç.

There are port facilities at Hopa, while air transportation are available to Trabzon.

3.1.2 Water Resources Development Plan and its Present Status.

(1) Hydroelectric Power Development Plan

A Master Plan for hydroelectric power development plan for the Çoruh River was prepared by EİE in 1982, while subsequently, up to the present, final design and feasibility studies of various sites have been carried out and these projects are shown in the following table.

DAM AND HPP'S PROJECTS LOCATED ON THE ÇORUH RIVER BASIN

Location	Condition	Name of Project	Type	Height from Thalveg (m)	Installed Capacity (MW)	Annual Mean Energy (GWh)
Main River Feasibility and Final Design Projects	Feasibility	Laleli	Rockfill	122	99	245
		İspir	Rockfill	85	54	327
		Güllübağ	Thin arch	61	84	285
		Aksu (Çamlıkaya)	Rockfill	114 (162)	120 (231)	344 (554)
		Arkun (Arkun I)	Rockfill	129 (137)	222 (207)	788 (645)
	Final Design Project	Yusufeli	Rockfill	223	540	1705
		Artvin	Arch gravity	135	332	1026
		Deriner	Thin arch	207	670	2118
		Borçka	Rockfill	86	300	1039
		Muratlı	Rockfill	44	115	444
			Total		2536	8321
Tributaries Feasibility Master Plan and Reconnaissance	Feasibility	Olur	Rockfill	85	65	242
		Ayvalı	Rockfill	125	125	409
		Erenler	Run of River	-	19	89
		Bağlık	Concrete Arch	115	55	215
		Bayram	Rockfill	90	40	148
	Master Plan	Altıparmak	Concrete Arch	63	50	152
		İkizkavak	Run of River	-	20	73
	Reconnaissance	Öğdem	Run of River	-	18	69
		Çayaşan	Run of River	-	17	84
		Ardıçlı	Run of River	-	13	35
		Çayırözü	Run of River	-	6	16
		Özlüce	Run of River	-	27	71
		Yedigöl	Run of River	-	23	61
		Aksu	Run of River	-	47	123
		Sırakonaklar	Run of River	-	22	57
		Engücek	Run of River	-	7	18
		Konacık	Run of River	-	17	45
		Taşlıca	Run of River	-	30	80
		Aralık	Run of River	-	20	53
			Total		621	2040
			General Total		3157	10361

Note : 1- Values in parenthesis are alternative characteristics of project.

2- Feasibility study of Bayram and Bağlık Projects has been prepared by JICA

3- Project characteristics of run of river project on tributaries are taken from "Master Plan Report of Çoruh River Basin".

Regarding the Berta River, which is one of the major tributaries, there were the two development sites of Bayram and Bağlık planned in cascade from in the stretch from the midstream vicinity of EL. 392 m which is the end of the backwater of Deriner Reservoir.

In 1992, EIE newly set up a Master Plan for the Berta River Basin. In this Master Plan, the two-stepped development plan consisting of the Bayram and Bağlık projects was selected as the hydroelectric power development plan for the Berta River.

As for Berta River tributaries, Meydancık and Şavşat project sites have been selected on the Meydancık and Şavşat Rivers for a run-of-river projects.

Outline of the four projects in the master plan is as follows.

Dam and Power Plant	Installed Capacity (MW)	Annual Energy Production (GWh)
1. Bayram	40	148.22
2. Bağlık	55	215.30
3. Meydancık	17	66
4. Şavşat	11	41
Total	123	470

Other than the above mentioned plans, there is the Tortum No.1 Hydroelectric Power plant with an installed capacity 26 MW which has been constructed on the Tortum River, a right-bank tributary of the Çoruh River, and this is presently in operation. The power from this plant is connected to Hopa Substation by a transmission line.

(2) Irrigation Plan

There is no irrigation development plan of the Berta River.

3.2 General Description of Project Area

3.2.1 Landform and National Environment

(1) Landform

The local catchment area of the Berta River is 2,315 km^2, the total length is approximately 73.5 km, with the annual inflow at the Bağlık site 24.9 m^3/sec, the Project being situated on the midstream stretch of the Berta River. The Berta Basin is surrounded by lofty mountain ranges rising over 2000 m above sea level and the average basin elevations is 1800 m.

The principal mountains in the basin are Karçal Dağı (El. 3,415 m), Ziyaret Tepesi (El. 3,200 m), Göze Dağı (El. 3,167 m) and Eğripınar Tepesi (El. 3,054 m). The Berta River is composed mainly of three tributaries, the Meydancık, the Şavşat and Ardanuç.

(2) General Description of Natural Conditions

(a) Geology

Quaternary deposits, Berta Formation, İkizdere igneous rocks (mainly granite) and Yusufeli formation are distributed in the Berta River Basin where this project site is located. Quaternary deposits consists of talus deposits, river deposits and terrace deposits. Berta formation composed of volcanic rocks such as tuff, basic lava (basalt) or acidic lava. Yusufeli formation consists of sandstone, slate, basic lava and other basic rocks.

At the Bayram reservoir in the project area, Quaternary deposits and Berta formation are distributed. The foundation of the Bayram dam site consists of Berta formation. At the Bağlık reservoir, Berta formation and Yusufeli formation distributed. The foundation of the Bağlık dam site consists of Yusufeli formation.

(b) Earthquake

Turkey is located at roughly the middle of the Alpine-Himalayan Orogenic Belt, and is a region where crustal movements have been severe from ancient times. Large fault zones existing in Turkey are the North Anatolian Fault which runs east-west through the northern part of the country and the South-east Anatolian Fault which runs northeast-southwest through the Eastern Region. Although earthquake faults do not necessarily coincide with active faults, active faults often exist in the surroundings. Most of earthquakes of M7 or greater have occurred along the above mentioned two faults. This project area is located at 200 to 250 km north of the point where the two faults intersect. The area of the Project does not belong to a zone of high seismicity. According to the "Map of Earthquake Regions by the Ministry of Civil Works" published in 1996, this project site belongs to a third degree zone.

(c) Meteorology

The Çoruh River Basin may be divided into a downstream part of Black Sea climate having the greatest amount of rainfall and an upstream part of Eastern Region climate which is of continental nature. The Berta River of the project area is situated at the northeast part of the Çoruh River midstream stretch and the area shows some characteristics of the continental climate, but in predominantly subject to the East Black Sea climate. There is considerable difference between hot an cold air temperatures, and according to the records of the nearby Şavşat Meteorological Observation Station, the annual mean temperature 9.9^{0}C, but the average annual maximum temperature in the summer is 38.8^{0}C, while the average annual minimum temperature in the winter is -19.9^{0}C. Precipitation is an average annual of 624 mm, the greater part of which falls during the rainy season from April to June. Snowfall occurs from November to April, the maximum snow cover depths seen in the past records 125 cm at Şavşat, 125 cm at Veliköy and 214 cm at Meydancık.

3.2.2 Natural and Social Environment

The natural and social environment will be discussed in detail in Chapter 13. "Environment Impact and Compensation", and only an outline will be given here.

(1) Natural Environment

(a) Scenery

The Project area on the large scale is located between the inner mountainous and dry part of Northeast Anatolia and Outer, green mountainous part as well as sea shore. Upstream part of Berta River passes through forest zones and valleys surrounded by small mountain villages. Downstream part and the junction of Berta River to Çoruh River is surrounded by steep mountains usually dry and not covered by plant species upto a certain elevation.

(b) Vegetation

Reservoir area consists of mainly irrigated agricultural fields, dry fields and limited mixed orchard. Forest zone is higher than the elevation of maximum water level of reservoirs. However some of material borrow areas are near by to forest zone.

(c) Animals

Forest zone above the 1500 m is an important habitat for wild animals such as migrating birds deer, roe deer, wild pig, chamois, fox, bear etc. Salmo trutta labrax is present in upper creeks of Berta river such as Karçal river.

(d) Water Quality

According to the results of water quality investigation, three sampling points were chosen in Berta River (Şavşat river, Bayram dam site and Bağlık dam site). Temperature is between 8.2-9.7^{0}C, pH is between 8.35-8.46, DO is around 10.4 mg/l, COD is in the range of 1-4 mg/l in dam sites but it is 16 mg/l in Şavşat river due to dumping area. NH_3-N is 0.08 mg/l, NO_2 is around 0.002 mg/l, NO_3-N ranges between 0.3-0.7 mg/l. PO_4-P is in the range of 0.01-0.09 mg/l, T-P is between 0.04-0.2 mg/l and organic phosphate is in the range between 0.01-0.12 mg/l.

(2) Social Environment

(a) Population

According to the census in 1990, total population is 212,833. Population is mainly concentrated in the villages. Reservoir of Bayram will inundate Okçular Mahallesi and Bayram Mahallesi (Partly), also Savail Mahallesi will be subjected to civil works due to material borrow implementation.

Population of villages affected and near by the project are is listed below:

Population of Bayram Mah. (On.avg.)	:	200
Population of Çiftehanlar Mah.	:	120
Population of Köprübaşı Mah.	:	60
Population of Savail Mah.	:	80
Population of Okçular Mah.	:	45
Population of Bağlık Mah.	:	35

(b) Public Facilities:

Public facilities like primary school, mosque, police station, road maintenance building, store are inundated in Bayram reservoir. Fortunately no health services will be inundated. In general, Şavşat town provides health services for the settlements in project area. Moreover, no public facilities will be inundated in Bağlık reservoir except the road, power transmission line and telephone line.

(c) Transportation:

Şavşat district is at the cross road from Artvin to Ardahan Road No "010" connects Şavşat district to project area .

(d) Industries

No industrial facility exists in project area. Only some lumber plants exist near by the river.

(e) Cultural Assets and Recreation

Within the project site, there is no cultural assets. In the Bayram site, there is a castle on the cliff with its slope climbed from Okçular Village. No recreational facility at the site of Bayram project. Similarly, there is no recreational facility or historical relics in the immersed area of Bağlık reservoir.

Artvin province is rich about landscape and recreational areas. There are seven protected areas, two national parks (Şavşat district), one hunting protection area (Şavşat district) and seven camping and picnic areas. In terms of historical assets, there are three castles and church's in Şavşat district, one castle in Meydancık village and several mosques.

CHAPTER 4 PRESENT SITUATION OF ELECTRICITY

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CHAPTER 4 PRESENT SITUATION OF ELECTRICITY

4.1 Present Situation of Electricity

(1) Installed capacity

Installed capacity of generating facilities in Turkey has shown a great increase in this ten-year period. The total capacity at the end of 1985 was 9,119.1 MW and the capacity at the end of 1995 became 20,951.8 MW which is 2.3 times (See Table 4-1 and Figure 4-1).

At the end of 1995 installed capacity of thermal power was 11,089.0 MW and hydroelectric power was 9,862.8 MW. The ratio of thermal and hydroelectric is 53 : 47.

In the view of electric utilities, TEAŞ who is the biggest electricity producer had 18,855.7 MW (90.0%). And on the other utilities, private companies (ÇEAŞ and KEPEZ) had 716.3 MW (3.4%), autoproducers had 1,379.8 MW (6.6%).

Table 4-2 indicates trend of primary energy resources and 1995 data is shown as Figure 4-2. The total installed capacity of Turkey in 1995 had been composed of 2.3% - Hard coal, 28.9% - Lignite, 6.7% - Liquid Fuels, 13.8% - Natural Gas and Geothermal and Hydroelectric was 48.3%.

(2) Energy generation

For annual energy generation, as shown in Table 4-3 and Figure 4-3, they are 2.5 times in this ten-year period. In 1995 energy generation reached 86,247.4 GWh and 58.8% of energy generation corresponding to 50,706.5 GWh had been obtained from thermal power, while 41.2 % corresponding to 35,540.9 GWh from hydroelectric power.

TEAŞ had realized 78,194.9 GWh generation in 1995 which corresponded to 90.7% of total. The contribution of private sector entities (ÇEAŞ and KEPEZ) to total production had been by 2.8%, whereas the autoproducers had the remaining 6.5%.

Table 4-4 indicates trend of primary energy resources and 1995 data is shown as Figure 4-4. The total energy generation of Turkey in 1995 has been composed of 2.6% - Hard

coal, 29.9% - Lignite, 6.7% - Liquid Fuels, 19.3% - Natural Gas and Geothermal and Hydroelectric was 41.5%.

4.2 Electric Power Utilities

In Turkey, the organizations which are concerned with electric power, consist of EİE, DSİ, TEAŞ and TEDAŞ.

On the other hand some region is supplied by private companies.

(1) EİE (Directorate of Electrical Power Resources Survey and Development Administration)

EİE performs investigations, survey and engineering services on hydrology, mapping, foundation surveys, grouting, drilling for coal and other mines, design of dams and hydropower plants.

Furthermore, EİE is in charge of naturall utilization of energy resources, planning and development of new and renewable energy sources and energy conservation studies.

(2) DSİ (General Directorate of State Hydraulic Works)

DSİ was established by Law No.6200 on Dec. 18, 1953 which was authorized for the development of surface and groundwater resources of Turkey to achieve the highest benefit from them.

Presently DSİ is attached to the Ministry of Energy and Natural Resources and has 13 departments in headquarters and 25 regional departments all over the Turkey.

Its tasks and responsibilities can be outlined as the following:

* Studying master plans of all river basins.
* Preparation of feasibility studies and contract design of each development project.
* To take protective measures against floods and torrents.

* Construction and operation of irrigation and drainage networks.
* Preservation and development of groundwater resources.
* To supply domestic and industrial water to cities with populations over 100,000 provided that the government has authorized.
* To build all types of hydroelectric power plants.

(3) TEAŞ (Turkish Electricity Generation and Transmission Company) and TEDAŞ (Turkish Electricity Distribution Company)

TEK which changed to TEAŞ and TEDAŞ was established in 1970 as a public enterprise for the consolidation of the services of generation, transmission and distribution by bringing together all functions for electric power under one authority.

In 1994 TEK was divided to TEAŞ and TEDAŞ due to government policy.

TEAŞ is responsible for operation and maintenance of hydroelectric power plants, construction, operation and maintenance of thermal and nuclear power plants, construction and maintenance of transmission and distribution lines more than 36 kVA.

In 1994 TEAŞ operated 89 % generating facilities in Turkey and rest 11% was operated by public power plants and private companies.

After the construction is completed the operation of a hydroelectric power plant and its switchyard, including headache structures, is turnover to TEAŞ but where the powerhouse is connected with a large dam, the operation surveillance and maintenance services of the dam and its reservoir are retained by DSİ.

The inflow forecast and operation rule curve for each storage reservoir is predicted annually by DSİ and the operation of all types of power plants is arranged and done by TEAŞ. However, the power plant of an irrigation oriented multipurpose reservoir should be operated according to the irrigation diversion requirements as set by DSİ.

Distribution system consists of following three regions. First region is distributed directly by TEDAŞ, second region is distributed electricity which TEAŞ and TEDAŞ supplied by regional public utilities, third region is distributed by electric and gas utilities of cities.

Distribution areas of these three regions is partially overlapped and in the view of effective distribution system combination of regions is studied.

4.3 Electric Power Facilities

(1) Thermal Power Plants

For the year 1995, the total national electric energy generation amounted to 86,247.4 GWh, and about 59% of them was thermal generation. The installed capacity of thermal power plants in Turkey was 11,089.0 MW at the end of 1995. Outline of thermal power plants in TEAŞ is as shown in Table 4-5.

(2) Hydroelectric Power Plants

Installed capacity of hydroelectric power plants in Turkey was 9,862.8MW at the end of 1995. The outline of hydroelectric power plants in TEAŞ is as shown in Table 4-6.

(3) Transmission and Distribution Facilities

Table 4-7 shows the outline of Transmission and distribution facilities in Turkey.

4.4 Electric Power Supply and Demand

(1) Demand trend

Table 4-8 and Figure 4-5 shows the trend of energy consumption from 1980 to 1995.

It is known from the power demand situation that in 1995 the hourly peak power demand was 13,876 MW and energy consumption was 67,393.9 GWh. The annual average increase rate from 1980 to 1995 was 8.6% for the hourly peak power demand and 8.0% for the energy demand.

The consumption of energy per capita in 1995 increased to 1,078 kWh/capita from 1980's 459 kWh/capita.

As for the power interchange with the adjacent countries, it should be noted that in 1990, the energy was first exported to the adjacent foreign countries though until that time it had only been imported inversely.

However, from 1990 export exceeds import except 1991. In 1995 only export was 695.9 GWh.

(2) Demand structure

Table 4-9 shows the trend of power demand structure from 1980 to 1995.

The main component ratio in 1995 cane to 56.0% for the industrial use, 21.5% for the household use, and 6.2% for the commercial use.

The household use decreased from 1980 (17.2%) to 1984 (15.6%), but it increased up to 21.5% in 1995. On the other hand, the industry use increased from 1980 (63.8%) to 1985 (65.9%) , from 1985 it decreased and in 1995, 10% dropped compared to 1985.

(3) Load Curve

The annual load factor in 1995 was 71.0%. For last four years, load factor decreased slightly. Figure 4-6 shows the annual load duration curve. It is assumed that the maximum power demand occurs in each month on the third Wednesday of 1984, 1990, 1993 and 1994, which are illustrated in Figure 4-7. The maximum demand was 12,495 MW in December and the minimum demand was 10,361.2 MW in June. The maximum demand increased 5.4% compared with previous year.

The daily load curve of maximum and minimum consumption days in 1994 is shown as Figure 4-8.

Daily consumption had risen to maximum by 244.3 GWh on 21st December, Wednesday. In comparison to the previous year, the increase ratio was 6.7%. The minimum daily consumption was recorded as 146.3 GWh on 14th March, Monday.

The charts of daily demand and supply of the maximum load day is illustrated as Figure 4-9.

(4) Loss factor

Auxiliary loss in 1995 was 4,388.8 GWh. It was approximately 3 times to 1980 and annual average increase ratio was 5.9%. On the other hand, network loss in 1995 was 13,768.8 GWh. It was 4.9 times to 1980 and annual average increase ratio was 13.4%.

The power loss mainly consists of the consumption in the power station which accounted for 5.1% or so of the generated power and the network loss which amounted to 16.8% or so of the sending-end output in 1995. Hence, the total loss factor became approximately 21% in terms of the generated power.

(5) Artvin area

In Artvin province total supplied energy was 187.923 GWh and network loss was 30.572 GWh in 1995.

Energy consumption in 1995 was 157.171 GWh which decreased 13.2% compared to previous year.

In the view of category-wise, industry use was 102.303 GWh (65.1%), household use was 34.705 GWh (22.1%), commercial use was 5.187GWh (3.3%), official use was 3.704GWh (2.4%) and others use was 11.273 GWh (7.1%),

Table 4-10 shows trend of power demand and supply from 1986 to 1995 in Artvin province.

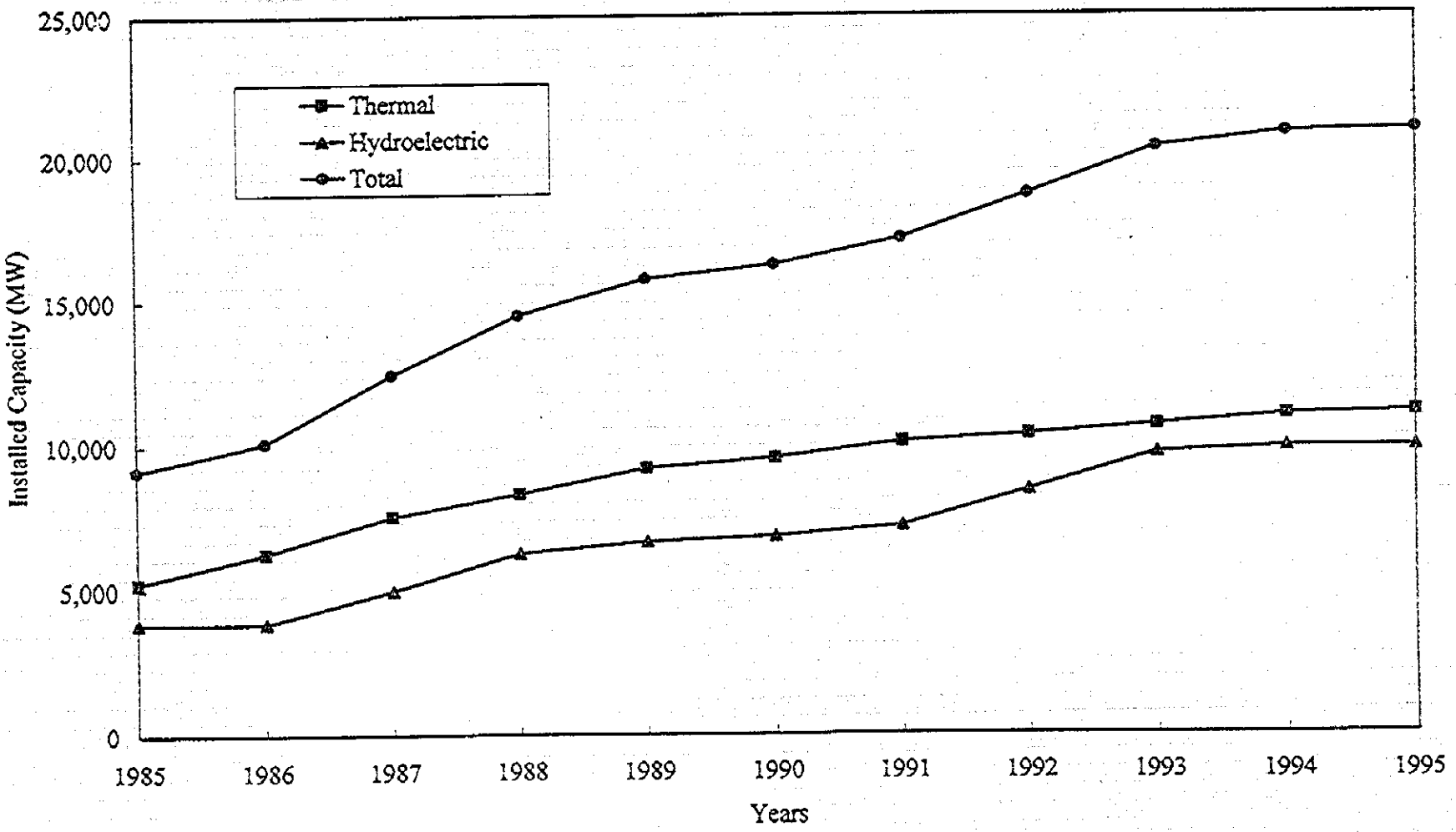

Figure 4-1 Trend of Installed Capacity of Turkey

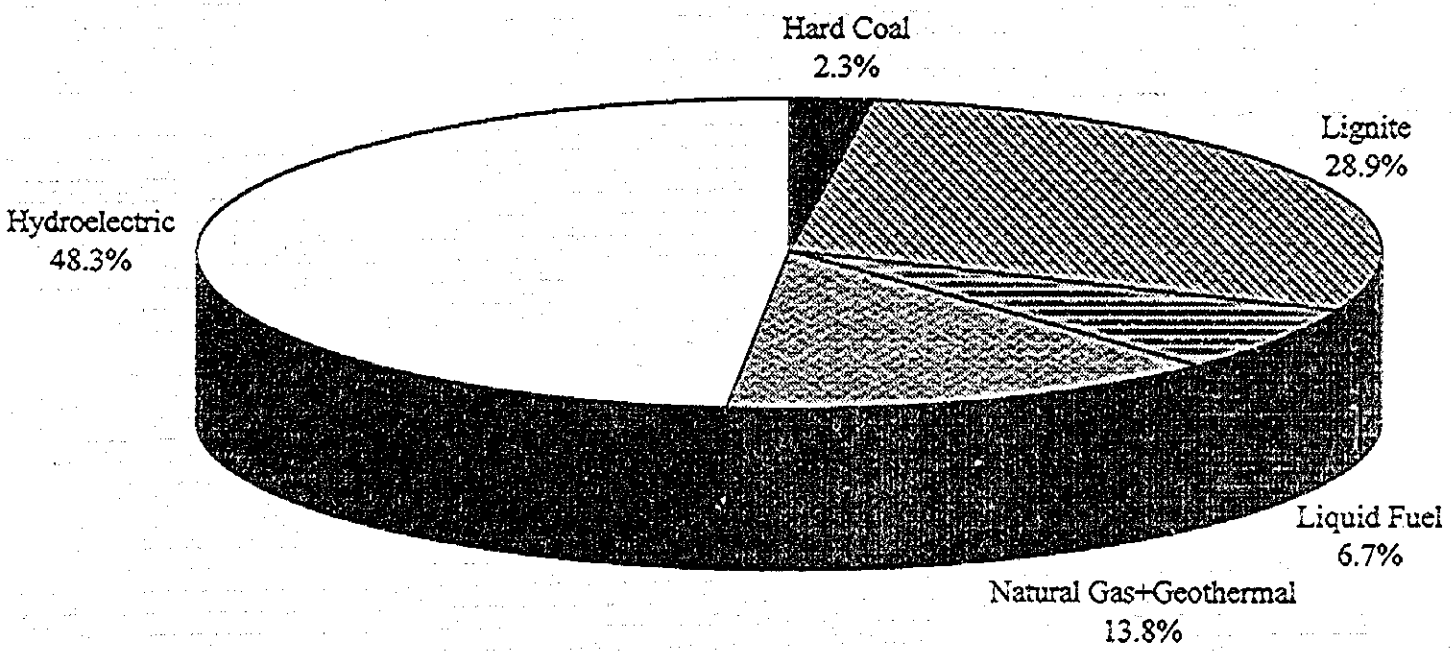

Figure 4-2 Distribution of Installed Capacity of Turkey by Fuel Type

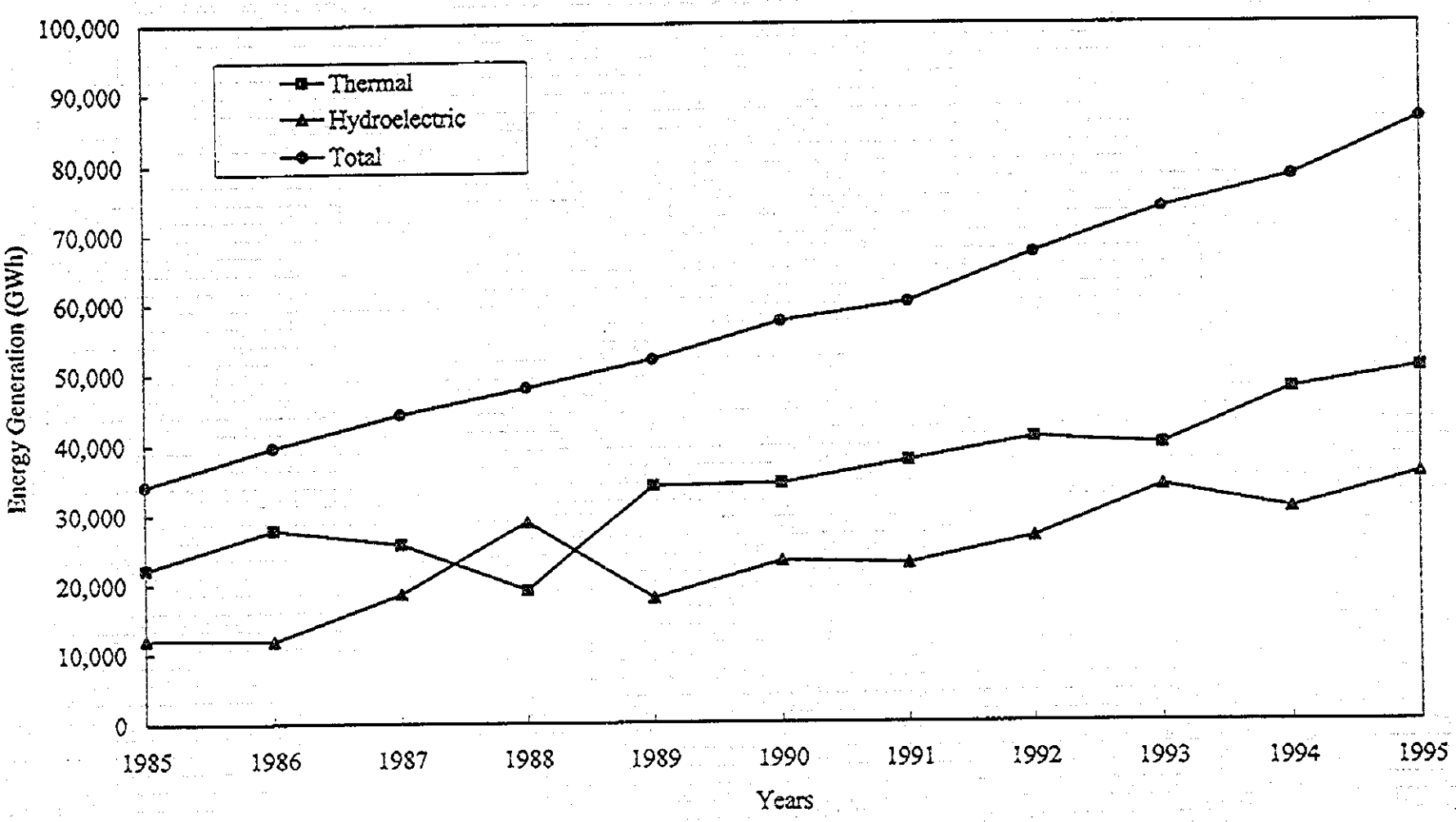

Figure 4-3 Trend of Energy Generation of Turkey

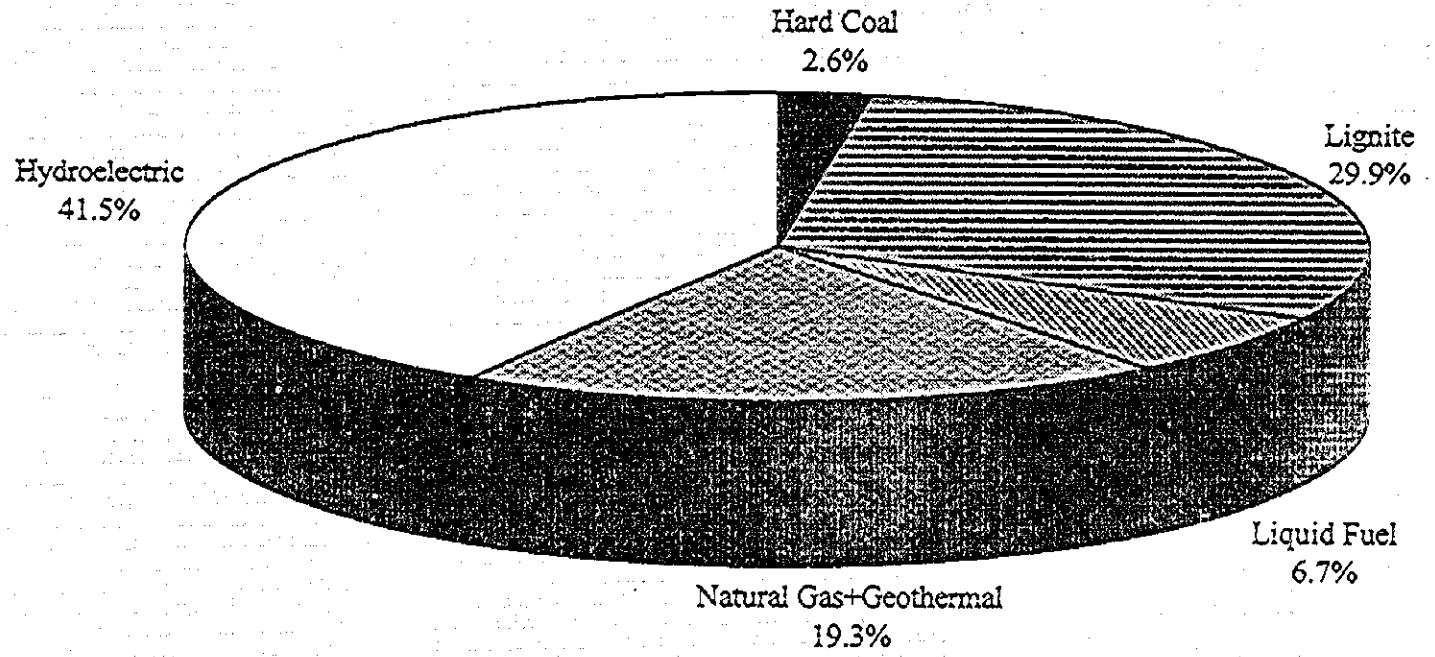

Figure 4-4 Distribution of Energy Generation of Turkey by Fuel Type

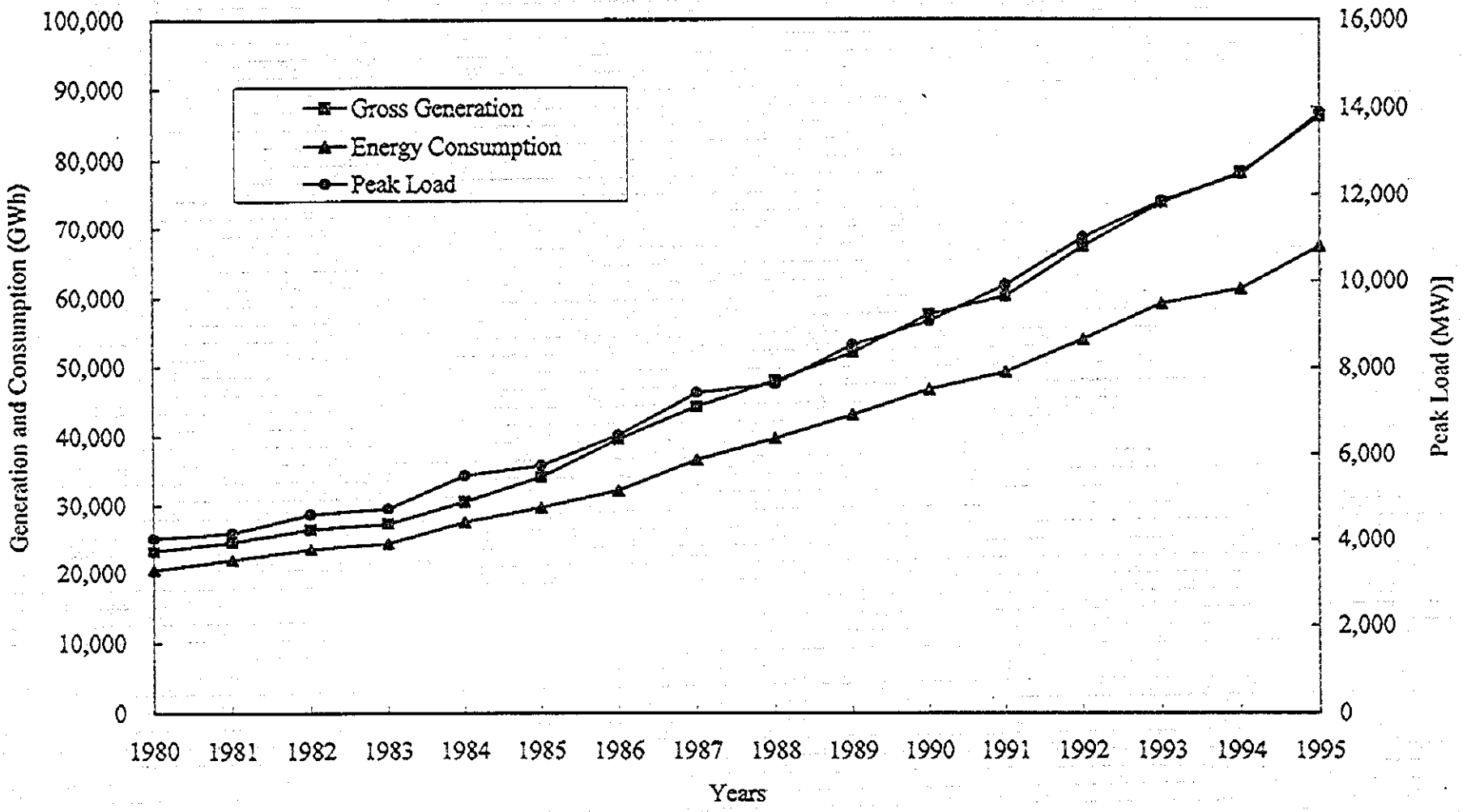

Figure 4-5 Trend of Energy Consumption and Peak Load of Turkey

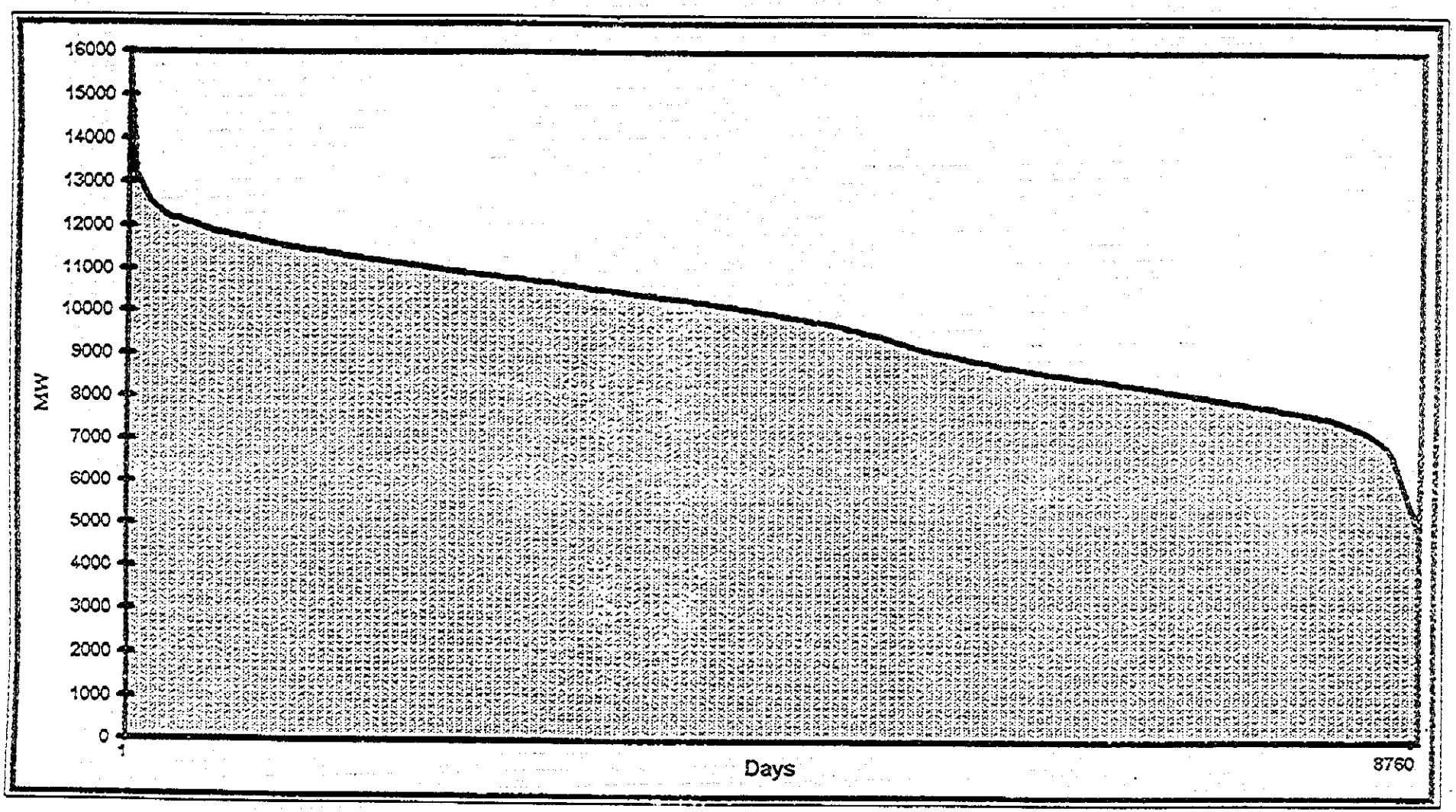

Figure 4-6 Annual Load Duration Curve in 1995

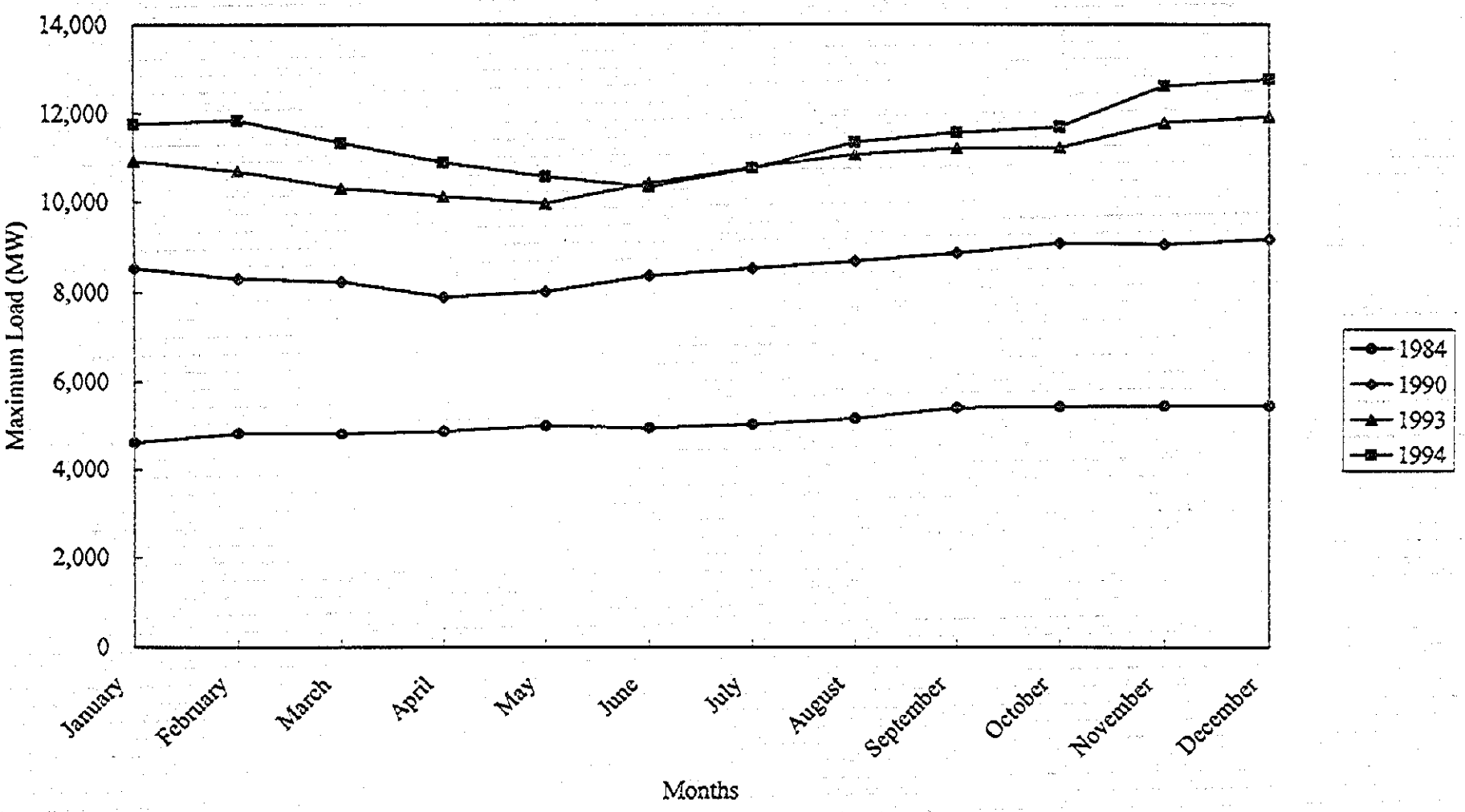

Figure 4-7 Monthly Maximum Load Curve of Turkey

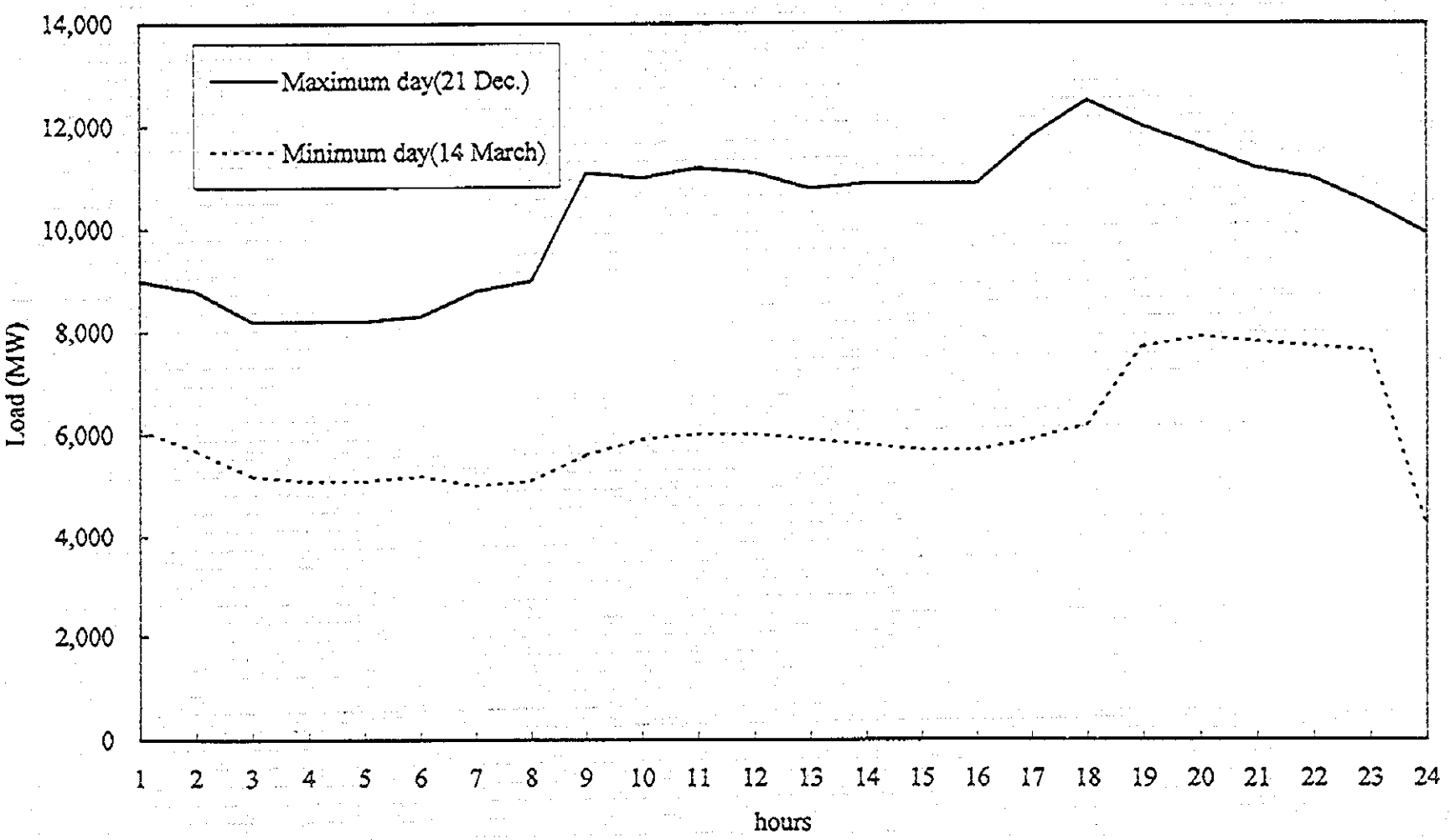

Figure 4-8 Daily Load Curve of Maximum and Minimum Consumption Days in 1994

Figure 4-9 Daily Load Curve on Maximum Consumption Day in 1994

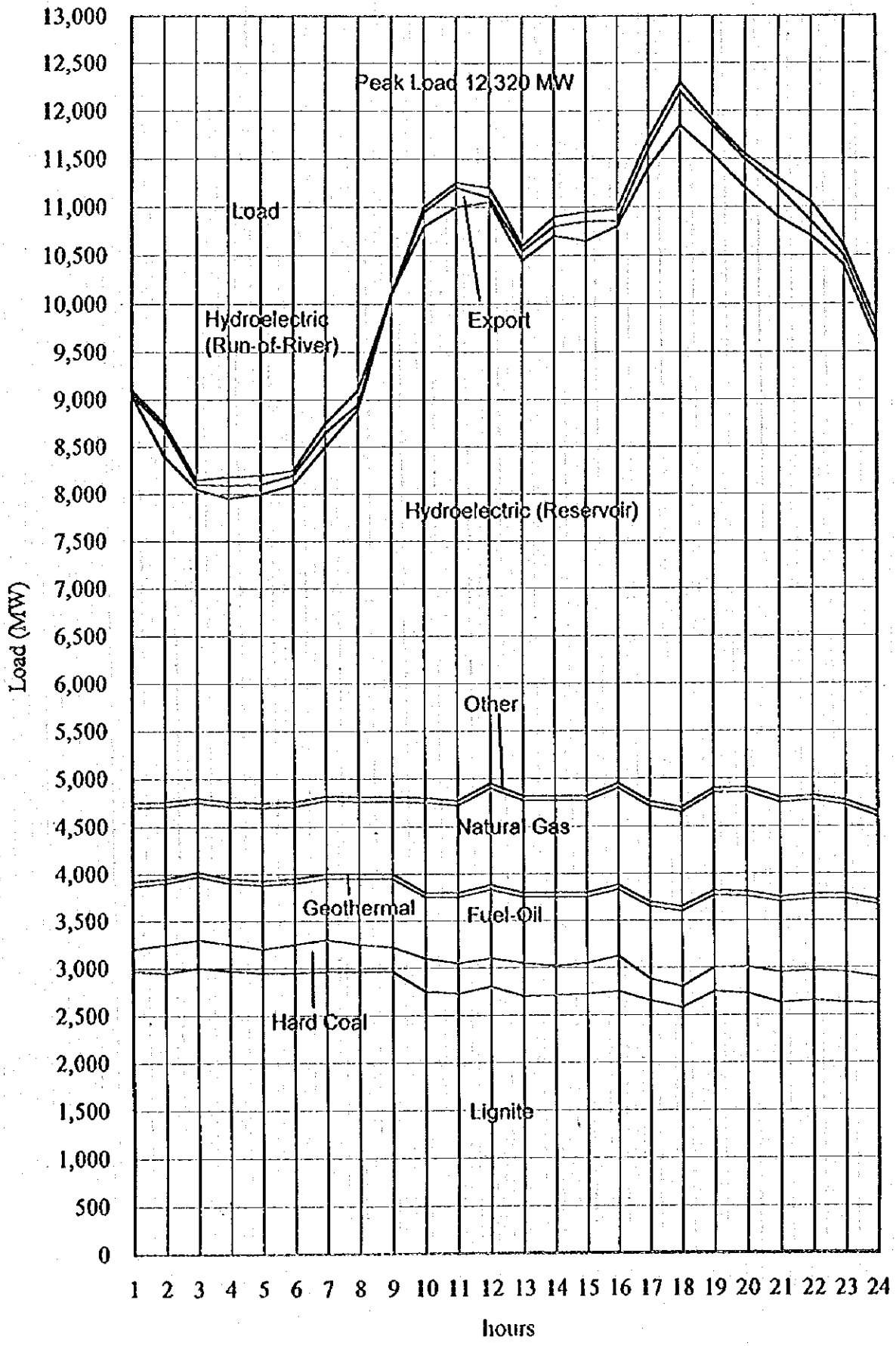

Table 4-1 Development of Installed Capacity of Turkey

Unit : MW

Years	Turkey				TEAS			
	Thermal	Hydroelectric	Total	Increase (%)	Thermal	Hydroelectric	Total	Increase (%)
1985	5,244.3	3,874.8	9,119.1	7.8	4,147.9	3,644.2	7,792.1	8.4
1986	6,235.2	3,877.5	10,112.7	10.9	5,141.8	3,644.2	8,786.0	12.8
1987	7,489.3	5,003.3	12,492.6	23.5	6,290.9	4,720.1	11,011.0	25.3
1988	8,299.8	6,218.3	14,518.1	16.2	7,046.4	5,935.1	12,981.5	17.9
1989	9,208.4	6,597.3	15,805.7	8.9	7,939.0	6,298.1	14,237.1	9.7
1990	9,550.8	6,764.3	16,315.1	3.2	8,261.7	6,465.1	14,726.8	3.4
1991	10,092.8	7,113.8	17,206.6	5.5	8,793.1	6,521.5	15,314.6	4.0
1992	10,334.9	8,378.7	18,713.6	8.8	9,018.1	7,779.2	16,797.3	9.7
1993	10,653.4	9,681.7	20,335.1	8.7	9,228.1	9,049.1	18,277.2	8.8
1994	10,992.7	9,864.6	20,857.3	2.6	9,438.1	9,208.3	18,646.4	2.0
1995	11,089.0	9,862.8	20,951.8	0.5	9,648.1	9,207.6	18,855.7	1.1

Table 4-2 Annual Development of Installed Capacity of Turkey by Primary Energy Resources

Unit : MW

Years	Thermal								Hydroelectric	Grand Total
	Hard Coal	Lignite	Fuel-Oil	Diesel Oil	Geothermal	Natural Gas	Other	Total		
1985	219.9	2,886.4	1,395.7	627.3	15.0	100.0		5,244.3	3,874.8	9,119.1
1986	197.7	3,601.4	1,395.7	625.4	15.0	400.0		6,235.2	3,877.5	10,112.7
1987	181.6	4,456.4	1,492.6	543.7	15.0	800.0		7,489.3	5,003.3	12,492.6
1988	181.6	4,456.4	1,547.6	544.0	15.0	1,555.2		8,299.8	6,218.3	14,518.1
1989	331.6	4,735.8	1,544.6	545.6	15.0	2,035.8		9,208.4	6,597.3	15,805.7
1990	331.6	4,896.2	1,552.4	545.6	15.0	2,210.0		9,550.8	6,764.3	16,315.1
1991	352.6	5,072.6	1,541.6	545.6	15.0	2,555.4	10.0	10,092.8	7,113.8	17,206.6
1992	352.6	5,447.5	1,520.5	393.8	15.0	2,591.7	13.8	10,334.9	8,378.7	18,713.6
1993	352.6	5,651.2	1,526.8	393.5	15.0	2,700.5	13.8	10,653.4	9,681.7	20,335.1
1994	352.6	5,861.2	1,532.7	393.5	15.0	2,823.9	13.8	10,992.7	9,864.6	20,857.3
1995	486.4	6,047.9	1,203.9	204.2	15.0	2,883.9	13.8	11,089.0	9,862.8	20,951.8

Table 4-3 Development of Energy Generation of Turkey

Unit : GWh

Years	Turkey				TEAS			
	Thermal	Hydroelectric	Total	Increase (%)	Thermal	Hydroelectric	Total	Increase (%)
1985	22,174.0	12,044.9	34,218.9	11.8	19,256.7	10,992.2	30,248.9	13.4
1986	27,822.2	11,872.6	39,694.8	16.0	24,511.4	10,958.7	35,470.1	17.3
1987	25,735.1	18,617.8	44,352.9	11.7	22,122.2	17,537.1	39,659.3	11.8
1988	19,099.2	28,949.6	48,048.8	8.3	15,563.4	27,450.2	43,013.6	8.5
1989	34,103.6	17,939.6	52,043.2	8.3	30,407.9	17,046.2	47,454.1	10.3
1990	34,395.0	23,148.0	57,543.0	10.6	30,698.1	22,156.1	52,854.2	11.4
1991	37,563.0	22,683.3	60,246.3	4.7	34,067.8	21,392.9	55,460.7	4.9
1992	40,774.2	26,568.0	67,342.2	11.8	36,936.3	24,597.0	61,533.3	10.9
1993	39,856.6	33,950.9	73,807.5	9.6	35,371.7	31,728.1	67,099.8	9.0
1994	47,735.8	30,585.9	78,321.7	6.1	42,998.0	28,944.5	71,942.5	7.2
1995	50,706.5	35,540.9	86,247.4	10.1	45,089.6	33,105.3	78,194.9	8.7

Table 4-4 Annual Development of Energy Generation of Turkey by Primary Energy Resources

Unit : GWh

Years	Thermal								Hydroelectric	Grand Total
	Hard Coal	Lignite	Fuel-Oil	Diesel Oil	Geothermal	Natural Gas	Others	Total		
1985	710.3	14,317.5	7,028.6	53.4	6.0	58.2		22,174.0	12,044.9	34,218.9
1986	772.8	18,664.5	6,941.3	59.3	43.6	1,340.7		27,822.2	11,872.6	39,694.8
1987	627.8	17,025.7	5,418.1	77.5	57.9	2,528.1		25,735.1	18,617.8	44,352.9
1988	345.3	12,141.3	3,248.7	56.0	68.4	3,239.5		19,099.2	28,949.6	48,048.8
1989	317.0	19,952.5	4,209.2	38.3	62.6	9,524.0		34,103.6	17,939.6	52,043.2
1990	620.8	19,560.5	3,920.9	20.8	80.1	10,192.3		34,395.4	23,147.6	57,543.0
1991	998.4	20,563.1	3,291.0	2.2	81.3	12,588.6	38.4	37,563.0	22,683.3	60,246.3
1992	1,814.6	22,756.2	5,271.3	1.7	69.6	10,813.7	47.1	40,774.2	26,568.0	67,342.2
1993	1,796.1	21,963.8	5,171.4	3.1	77.6	10,788.2	56.4	39,856.6	33,950.9	73,807.5
1994	1,977.6	26,257.1	5,546.8	2.0	79.1	13,822.3	50.9	47,735.8	30,585.9	78,321.7
1995	2,232.1	25,814.8	5,498.2	273.8	86.0	16,579.3	222.3	50,706.5	35,540.9	86,247.4

Table 4-5 Thermal Power Plants of TEAS (1995)

Power Plant	Fuel Types	Commissioning Year	Number and Unit Capacity	Installed Capacity (MW)	Annual Mean Energy Generation (GWh)
Catalagzi	Hard Coal	1989,91	2×150	300.0	1,950.0
Afsin-Elbistan A	Lignite	1984,86,87	4×340	1,360.0	8,840.0
Cayirhan 1,2	Lignite	1987	2×150	300.0	1,950.0
Kangal	Lignite	1989,90	2×150	300.0	1,950.0
Orhaneli	Lignite	1992	1×210	210.0	1,365.0
Seyitomer	Lignite	1973,77,89	4×150	600.0	3,900.0
Tuncbilek A	Lignite	1956	2×32+1×65	129.0	840.0
Tuncbilek B	Lignite	1977,78	2×150	300.0	1,950.0
Yatagan	Lignite	1982,83,84	3×210	630.0	4,100.0
Ambarli	Fuel Oil	1967,70,71	3×110+2×150	630.0	4,100.0
Hopa	Fuel Oil	1973	2×25	50.0	200.0
Aliaga GT +KC(CC)	Diesel Oil	1975,76,84	4×30+2×30	180.0	
Avsa Adasi	Diesel Oil	1983,84	2×0.2+3×0.1+1×0.4	1.1	
Bozcaada	Diesel Oil	1980,81	1×0.2+1×0.2+1×0.3	0.7	
Cukurca	Diesel Oil	1967	1×0.08+1×0.07	0.15	
Ercis	Diesel Oil	1974	1×1.2	1.2	
Gokceada	Diesel Oil	1978	3×0.5	1.5	
Gokceada GT	Diesel Oil	1978	1×0.9	0.9	
Kemaliye	Diesel Oil	1965	1×0.1	0.1	
Llic	Diesel Oil		1×0.06+1×0.06	0.1	
Marmatra Ada	Diesel Oil	1977	2×0.3+1×0.5	1.1	
Seyyar GT	Diesel Oil		3×0.5+1×0.9	2.4	
Aliaga GT +KC(CC)	Natural Gas	1988-1991	6×138.8+3×172.7	1,350.9	8,780.0
Ambarli KC(CC)	Natural Gas	1985-89	12×100	1,200.0	7,800.0
Denizli	Geothermal	1984	1×15	15.00	90.0
Total		24 plants	70 units	6,364.1	40,015.0

Table 4-6 Hydroelectric Power Plants of TEAS (1995)(1/2)

Power Plant	Types	Commissioning Year	Number and Unit Capacity	Installed Capacity (MW)	Annual Mean Energy Generation (GWh)
Almus	Dam	1966	3×9.0	27.0	100.0
Altinkaya	Dam	1987,88	4×175.0	700.0	1,632.0
Aslantas	Dam	1984	3×46.0	138.0	569.0
Atakoy	Dam	1989	1×5.5	5.5	8.0
Ataturk	Dam	1992,93	8×300.0	2,400.0	8,900.0
DemirKopru	Dam	1960	3×23.0	69.0	190.0
Derbent	Dam	1991	1×6.0+2×25.2	56.4	257.0
Gokcekaya	Dam	1973,74,76	3×92.8	278.4	562.0
Gezende	Dam	1994	3×53.1	159.3	528.0
H. Ugurlu	Dam	1979,82,83	4×125.0	500.0	1,217.0
Hirfanli	Dam	1960,83	1×32.0	128.0	400.0
Karacaoren	Dam	1990	2×16.0	32.0	142.0
Karakaya	Dam	1987,88,89	6×300.0	1,800.0	7,354.0
Keban	Dam	1974,81,82	4×158+1×175	1,330.0	6,000.0
Kemer	Dam	1958	3×16.0	48.0	135.0
Kesikkopru	Dam	1967	2×38.0	76.0	250.0
Kilickaya	Dam	1990	2×60.0	120.0	332.0
Kockopru	Dam	1993	4×2.2	8.8	44.0
Menzelet	Dam	1992,93	4×31.0	124.0	515.0
Oymapinar	Dam	1984	4×135.0	540.0	1,620.0
H. Polatkan	Dam	1956	4×40.0	160.0	400.0
S. Ugurlu	Dam	1980,82	2×23.0	46.0	273.0
Kokluce	Dam	1988	2×45.0	90.0	588.0
Kapulukaya	Dam	1989	3×18.0	54.0	190.0
Tercan	Dam	1990	3×5.0	15.0	51.0
Zernek	Dam	1989	2×1.8	3.5	13.0
Sub Total		26 plants	90 units	8,908.9	32,270.0
Cildir	Natural Lake	1975	3×5.12	15.4	30.0
Hazar 1	Natural Lake	1957	4×3.3+1×7	20.1	128.0
Hazar 2	Natural Lake	1957	2×5.0	10.0	64.0
Kovada 1	Natural Lake	1960	3×2.75	8.3	35.0
Kovada 2	Natural Lake	1971	2×25.6	51.2	220.0
Tortum	Natural Lake	1960,62	2×5.6+2×7.5	26.2	85.0
Sub Total		6 plants	19 units	131.2	562.0
Adilcevaz	Run-of-River	1967,74	2×0.2	0.4	2.0
Aksehir	Run-of-River	1936	2×0.15	0.3	1.5
Akyazi	Run-of-River	1953	1×0.1	0.1	0.5
Anamur	Run-of-River	1966	3×0.2	0.6	3.0
Arpacay	Run-of-River		1×0.1	0.1	0.5
Besni	Run-of-River	1961	1×0.3	0.3	1.5
Beytussebap	Run-of-River	1972	1×0.28	0.3	1.5
Bozkir	Run-of-River	1952	2×0.05	0.1	0.5
Botan	Run-of-River	1957,64	2×0.5+1×0.6	1.6	7.0
Bozuyuk	Run-of-River	1938	2×0.15	0.3	1.0
Bozyazi	Run-of-River	1974	2×0.2	0.4	1.0
Bunyan	Run-of-River	1928,36,45	1×0.7+2×0.32	1.4	4.0
Ceyhan	Run-of-River	1958	3×1.2	3.6	12.0
Cumacay	Run-of-River	1984	2×0.2	0.4	2.0
Cag-Cag	Run-of-River	1968	3×4.8	14.4	42.0
Cay	Run-of-River	1936	1×0.1	0.1	0.5

Table 4-6 Hydroelectric Power Plants of TEAS (1995)(2/2)

Power Plant	Types	Commissioning Year	Number and Unit Capacity	Installed Capacity (MW)	Annual Mean Energy Generation (GWh)
Cukurca	Run-of-River		1×0.1	0.1	0.5
Defne	Run-of-River	1953	3×1.25	3.8	19.0
Dere	Run-of-River		2×0.2	0.4	2.0
Dinar	Run-of-River	1951	2×0.5+1×0.1	1.1	5.0
Dogankent A	Run-of-River	1971,78	4×8.2	32.8	314.0
Dogankent B	Run-of-River	1981	1×38.0	38.0	
Dortyol	Run-of-River	1954	2×0.15	0.3	1.5
Durucasu	Run-of-River	1955	2×0.4	0.8	4.0
Engil	Run-of-River	1968	3×1.53	4.6	14.0
Ercis	Run-of-River	1968	2×0.4	0.8	2.0
Ermenek	Run-of-River	1973	2×0.56	1.1	2.0
Girlevik	Run-of-River	1963	3×1.0	3.0	15.0
Goksu	Run-of-River	1959,63	3×3.52	10.6	65.0
Gulnar(Zeyne)	Run-of-River	1971	1×0.32	0.3	1.5
Hakkari	Run-of-River	1981	2×0.65	1.3	6.0
Harakli	Run-of-River	1953	2×0.15	0.3	1.0
Ikizdere	Run-of-River	1961,69	3×5.04	15.1	100.0
Inegol	Run-of-River	1950	2×0.17	0.3	1.5
Iznik	Run-of-River	1953	2×0.15	0.3	1.0
Kayadibi	Run-of-River		1×0.5	0.5	2.5
Kayakoy	Run-of-River	1956	3×1.28	3.8	12.0
Kars	Run-of-River	1972	2×0.15	0.3	1.5
Kernek	Run-of-River	1964	1×0.83	0.8	2.5
Kiti	Run-of-River	1966	2×1.38	2.8	6.0
Ladik	Run-of-River	1954	1×0.14	0.1	0.5
Malazgirt	Run-of-River	1967,79	2×0.6	1.2	5.0
M.Kemal Pasa	Run-of-River	1952	1×0.4+1×0.23	0.6	2.5
Mut	Run-of-River	1967	2×0.45	0.9	4.0
Osmaniye	Run-of-River	1954	2×0.2	0.4	2.0
Sizir	Run-of-River	1961	3×2.26	6.8	35.0
Silifke	Run-of-River	1966	1×0.4	0.4	2.0
Turuncova	Run-of-River	1961	3×0.2	0.6	3.0
Uludere	Run-of-River	1976	2×0.4	0.8	2.0
Varto	Run-of-River	1968,74	2×0.132	0.3	1.5
Others	Run-of-River			7.4	
Sub Total		51 plants	105 units	167.5	720.0
Grand Total		83 plants	214 units	9,207.6	26,985.0

Table 4-7 Outline of Transmission and Distribution System of Turkey (1995)

Voltage (kV)	Transformers		Transmissions Lines
	Number of Substations	Capacity (MVA)	Length (km)
380	92	13,980	10,904.5
220			84.6
154	712	27,026	24,863.0
66 kV and below	85	849	1,189.7
Total	889	41,855	37,041.8

Table 4-8 Trend of Energy Consumption of Turkey

Years	Gross Generation		Auxiliary Loss		Net Generation	Import	Supplied Energy	Network Loss		Export	Energy Consumption		Hourly Peak Load		Population	Consumption per capita	Load Factor	Utility Factor
	(GWh)	Incr. (%)	(GWh)	Incr. (%)	(GWh)	(GWh)	(GWh)	(GWh)	Incr. (%)	(GWh)	(GWh)	Incr. (%)	(MW)	Incr. (%)	(1,000)	(kWh/capita)	(%)	(%)
1980	23,275.4	3.3	1,393.9	6.0	21,881.5	1,341.2	23,222.7	2,824.5	12.2	-	20,398.2	3.7	4,023.0	6.8	44,438.0	459.0	66.0	78.6
1981	24,672.8	6.0	1,327.8	5.4	23,345.0	1,616.1	24,961.1	2,931.1	11.7	-	22,030.0	8.0	4,158.1	3.4	45,540.0	484.0	67.7	75.1
1982	26,551.5	7.6	1,420.5	5.3	25,131.0	1,773.4	26,904.4	3,317.6	12.3	-	23,586.8	7.1	4,600.3	10.6	46,688.0	505.0	65.9	69.3
1983	27,346.8	3.0	1,680.2	6.1	25,666.6	2,220.8	27,887.4	3,422.3	12.3	-	24,465.1	3.7	4,734.0	2.9	47,864.0	511.0	65.9	68.3
1984	30,613.5	11.9	1,890.7	6.2	28,722.8	2,653.0	31,375.8	3,740.6	11.9	-	27,635.2	13.0	5,509.2	16.4	49,070.0	563.0	63.4	65.1
1985	34,218.9	11.8	2,306.8	6.7	31,912.1	2,142.4	34,054.5	4,345.9	12.8	-	29,708.6	7.5	5,739.0	4.2	50,306.0	591.0	68.1	62.9
1986	39,694.8	16.0	2,815.0	7.1	36,879.8	776.6	37,656.4	5,446.7	14.5	-	32,209.7	8.4	6,439.5	12.2	51,433.0	626.0	70.0	63.7
1987	44,352.9	11.7	2,607.7	5.9	41,745.2	572.1	42,317.3	5,620.0	13.3	-	36,697.3	13.9	7,412.0	15.1	52,561.0	698.0	68.3	59.3
1988	48,048.8	8.3	2,400.0	5.0	45,648.8	381.2	46,030.0	6,308.5	13.7	-	39,721.5	8.2	7,613.0	2.7	53,715.0	739.0	72.0	52.4
1989	52,043.2	8.3	3,234.5	6.2	48,808.7	558.5	49,367.2	6,247.2	12.7	-	43,120.0	8.6	8,499.0	11.6	54,893.0	786.0	69.9	53.8
1990	57,543.0	10.6	3,311.4	5.8	54,231.6	175.5	54,407.1	6,680.3	12.3	906.8	46,820.0	8.6	9,056.0	6.6	56,098.0	835.0	72.5	55.5
1991	60,246.3	4.7	3,655.2	6.1	56,591.1	759.4	57,350.5	7,561.2	13.2	506.4	49,282.9	5.3	9,903.0	9.4	57,326.0	860.0	69.4	57.6
1992	67,342.2	11.8	4,237.3	6.3	63,104.9	188.8	63,293.7	8,994.8	14.2	314.2	53,984.7	9.5	10,986.0	10.9	58,584.0	921.0	70.0	68.7
1993	73,807.5	9.6	3,943.1	5.3	69,864.4	212.9	70,077.3	10,251.6	14.6	588.7	59,237.0	9.7	11,852.0	7.9	59,869.0	989.0	71.1	58.3
1994	78,321.7	6.1	4,539.1	5.8	73,782.6	31.4	73,814.0	11,843.0	16.0	570.1	61,400.9	3.7	12,495.0	5.4	61,183.0	1,004.0	71.6	59.9
1995	86,247.4	10.1	4,388.8	5.1	81,858.6	0.0	81,858.6	13,768.8	16.8	695.9	67,393.9	9.8	13,876.0	11.1	62,526.0	1,078.0	71.0	66.2
Average	48,395.4	8.8	2,822.0	5.9	45,573.4	962.7	46,536.1	6,456.5	13.4	223.9	39,855.7	8.0	7,930.9	8.6	53,255.9	728.1	68.9	67.8

Table 4-9 Evolution of Category-Wise Energy Consumption of Turkey

Years	Household		Commercials		Officials		Industry		Lighting		Others		Total	
	(GWh)	%	(GWh)	%	(GWh)	%	(GWh)	%	(GWh)	%	(GWh)	%	(GWh)	%
1980	3,499.3	17.2	1,146.7	5.6	609.2	3.0	13,007.9	63.8	289.5	1.4	1,845.6	9.0	20,398.2	100.0
1981	3,665.1	16.6	1,256.9	5.7	638.1	2.9	14,206.1	64.5	298.4	1.4	1,965.4	9.0	22,030.0	100.0
1982	3,846.0	16.3	1,375.8	5.8	596.1	2.5	15,197.7	64.4	309.0	1.3	2,262.2	9.3	23,586.8	100.0
1983	4,024.4	16.4	1,399.5	5.7	687.0	2.8	15,575.7	63.7	296.3	1.2	2,482.2	10.2	24,465.1	100.0
1984	4,304.9	15.6	1,569.9	5.7	766.7	2.8	18,027.0	65.2	330.8	1.2	2,635.9	9.5	27,635.2	100.0
1985	4,978.9	16.7	1,620.5	5.4	891.5	3.0	19,607.7	65.9	450.3	1.5	2,202.7	7.5	29,751.6	100.0
1986	5,661.5	17.6	1,680.0	5.2	1,036.3	3.2	20,885.9	64.8	666.0	2.1	2,280.0	7.1	32,209.7	100.0
1987	6,506.3	17.7	1,747.8	4.8	1,168.7	3.2	23,872.9	65.1	786.3	2.1	2,615.3	7.1	36,697.3	100.0
1988	7,612.3	19.2	1,981.4	5.0	1,269.4	3.2	25,257.5	63.6	815.4	2.1	2,785.5	7.0	39,721.5	100.0
1989	8,264.5	19.3	2,300.2	5.4	1,278.3	3.0	27,602.7	64.3	715.7	1.7	2,758.6	6.4	42,920.0	100.0
1990	9,059.8	19.4	2,557.8	5.5	1,463.3	3.1	29,211.8	62.4	1,231.4	2.6	3,295.9	7.0	46,820.0	100.0
1991	10,993.3	22.3	3,054.1	6.2	1,864.3	3.8	28,351.8	57.5	1,417.9	2.9	3,601.5	7.3	49,282.9	100.0
1992	11,481.7	21.3	3,270.3	6.1	2,008.6	3.7	31,535.6	58.4	1,859.7	3.4	3,828.8	7.1	53,984.7	100.0
1993	12,559.0	21.2	3,605.4	6.0	2,266.4	3.8	34,247.1	57.8	2,307.1	3.9	4,252.0	7.1	59,237.0	100.0
1994	13,449.7	21.9	3,704.7	6.0	3,315.1	5.4	34,138.1	55.6	2,502.1	4.1	4,291.1	7.0	61,400.9	100.0

Table 4-10 Energy Consumption of Artvin Province

Years	Supplied Energy (GWh)	Network Loss (GWh)	Energy Consumption					
			Industry (GWh)	Household (GWh)	Commercial (GWh)	Official (GWh)	Others (GWh)	Total (GWh)
1986	105.649	9.341	75.710	9.389	1.440	1.458	8.311	96.308
1987	129.126	10.109	93.448	9.458	1.595	1.555	12.961	119.017
1988	139.519	9.784	99.236	12.805	1.611	1.904	14.179	129.735
1989	152.803	9.125	109.415	14.437	1.753	1.983	16.090	143.678
1990	170.680	12.992	121.748	16.548	2.009	2.138	15.245	157.688
1991	187.711	15.424	130.491	29.100	2.883	2.661	7.152	172.287
1992	197.072	23.396	129.863	28.897	3.579	2.909	8.428	173.676
1993	202.525	26.343	132.198	30.616	4.424	3.038	5.906	176.182
1994	207.018	25.988	125.225	35.341	4.542	1.389	14.533	181.030
1995	187.923	30.752	102.303	34.705	5.187	3.704	11.273	157.171

CHAPTER 5 LOAD FORECAST AND POWER DEVELOPMENT PROGRAM

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CHAPTER 5 LOAD FORECAST AND POWER DEVELOPMENT PROGRAM

5.1 Load Forecast and Power Development Program

5.1.1 Trend in Economic Growth

Table 5-1 shows the trend of Gross Domestic Product (GDP) from 1970 to 1994.

From 1970's to 1980's, economy of Turkey was grown up satisfactory except oil crisis. However, in 1990's the growth rate of GDP was very unstable. In 1994 the growth rate was minus 5.4% compared with previous year. On the other hand, the growth rate of 1995 was plus 8.1% to previous year and actual result of the first quarter of 1996 was increased to 9.9%.

Table 5-1 shows the trend of population. The growth rate of population is almost constant and from 1985 to 1994, annual average growth rate is 2.2%.

5.1.2 Power Demand Forecast in Turkey

In 1994 power demand forecast (from 1995 to 2010) prepared by TEAŞ (former TEK) is shown as Table 5-2. In 2010, maximum power demand is estimated to 43,590 MW. Power generation is estimated to 271,450 GWh and annual average growth rate is approximately 8.0%.

5.1.3 Power Demand Forecast

(1) Method of Forecast

To estimate the power demand, a macroscopic forecast method is used with regard to the comprehensive nationwide power demand. In this method, a certain fixed rule or tendency is derived from the past actual demand trend and then used to estimate the long-term nationwide power demand.

To this effect, the following three approximate equations are used in order to find out the correlation between the power consumption and economic potential in Turkey.

(a) The simple regression equation that is to be used when a linear correlation is found between the power demand and GDP.

(b) The multi-regression equation that is to be used when a linear correlation is found among the power demand, population and GDP.

(c) The parabolic regression equation that is to be used when a quadratic correlation is found between the power demand and GDP.

Out of the above regression equations, the one most suitable for the power demand pattern in the target country is to be selected.

(2) Conditions for Estimation

(a) Period of Power Demand Forecast

The period of power demand forecast is for 15 years from 1995 to 2010.

(b) Long-term increase rates of GDP and population

Above mentioned, increase rates of GDP in 1990's is so unstable that it is very difficult to estimate future GDP. From past trend, the increase rates of GDP and population from 1995 to 2010 are taken as follows:

It is known from the statistics that the annual average increase rate was 3.2% for the past ten years (1980 to 1989), 3.7% for past five years (1990 to 1994). In view of these actual results, the GDP growth rate is taken in the range of 4 to 6%. While the annual average increase rate of population is taken as 2.2% which was annual average increase rate from 1985 to 1994.

(c) Regression Equation

As a result of the above survey, the regression equations are calculated as follows:

(I) Simple Regression Equation

$$Y = -21{,}403 + 0.000906 \times X_1$$
$$(R = 0.986)$$

(II) Multi-regression Equation

$$Y = -77{,}434 + 0.000235 \times X_1 + 1.918129 \times X_2$$
$$(R = 0.983)$$

(III) Parabolic Regression Equation

$$Y = 14{,}545 - 0.00016 \times X_1 + 7.36 \times 10^{-12} \times X_1^2$$
$$(R = 0.982)$$

Where;

Y : Energy consumption (GWh)
X_1 : GDP (M. TL)
X_2 : Population (1,000 persons)
R : Correlation coefficient

(3) Results of Power Demand Forecast

The result of the power demand forecast obtained by the regression equations is shown in Table 5-3 and Figure 5-1. The results are presented in the form of energy consumption and energy generation. The energy generation is calculated based on the energy consumption that is obtained from the regression equations presuming that the power station consumption is 6% and transmission loss 16%, both of which are the estimated values derived from the TEAŞ's records from 1980 to 1994. Table 5-4 and Figure 5-2 show the peak power demand forecast. The peak power demand represents the total output of the

power stations and which is calculated based on the energy generation on the assumption that the load factor is 70%.

When the forecast of JICA Study Team is compared with TEAŞ's. It is known from the table that among the three regression equations, the parabolic regression equation with 4.0% of economic growth rate gives the most closest values to the TEAŞ's forecast. Other regression equations only give values substantially lower than those of TEAŞ's forecast.

As the result of the above study, it is concluded herewith that the demand forecast by TEAŞ should be regarded as appropriate and that the power development plans should be verified by using the TEAŞ's estimated values hereafter.

5.2 Power Development Plan

(1) Scale of Development

The power development plan corresponding with the power demand forecast (1995 to 2010) prepared by TEAŞ is shown in Table 5-5. Accordingly, it is anticipated that the total installed capacity in 2010 will be as much as 60,056 MW, of which the thermal and nuclear power amounts to 36,970 MW (62%) in combination while the hydroelectric power to 23,086 MW (38%).

Figure 5-3 and 5-4 show trend of power development plan and power generation from 1995 to 2010.

(2) Types of Power Resources

Table 5-6 shows by type the trend of power resources planned to be developed during the period from 1995 to 2010.

At present, the ratio of thermal power and hydroelectric power is almost equal. Above mentioned, thermal power will be more important than hydroelectric power. In 2010, thermal power will be estimated twice compared with hydroelectric power.

Until 2005, hydroelectric power source will be almost developed. As for the coal firing thermal power, it is known that from 2005 onward, construction of import coal firing power stations are under plan in addition to the development of lignite firing power stations.

Likewise, from 2005 onward, the development of nuclear power stations are under plan.

Table 5-7 shows the schedule of power development plan from 1995 to 2010.

5.3 Timing of Commissioning of Berta Project

Generally, condition to decide the power generation facilities consists of following:

(1) To secure a lot of time before commissioning of the power plant
(2) To secure the transmission line for sending power
(3) To prepare a lot of investment
(4) To develop the project in accordance with demand and supply balance

(I) In the process of constructing hydroelectric power plant, after feasibility study, term for detailed design, raising funds and tendering is necessary. In Turkey, this term is about 4 years. This means beginning of construction work of Berta project is 2003.

(II) Transmission line for Berta project will be connected with 154 kV switchyard of Deriner power plant. This means commissioning must be after commissioning of Deriner power plant and that is 2002.

(III) From chapter 12, term of construction work needs 5 years.

(IV) In the view of type of power resources of Turkey, ratio of thermal power plant is estimated to increase. Taking consideration variety of power generation into, developing of hydroelectric power plant is important.

Judging from above reason, commissioning year of Berta Project should be 2007.

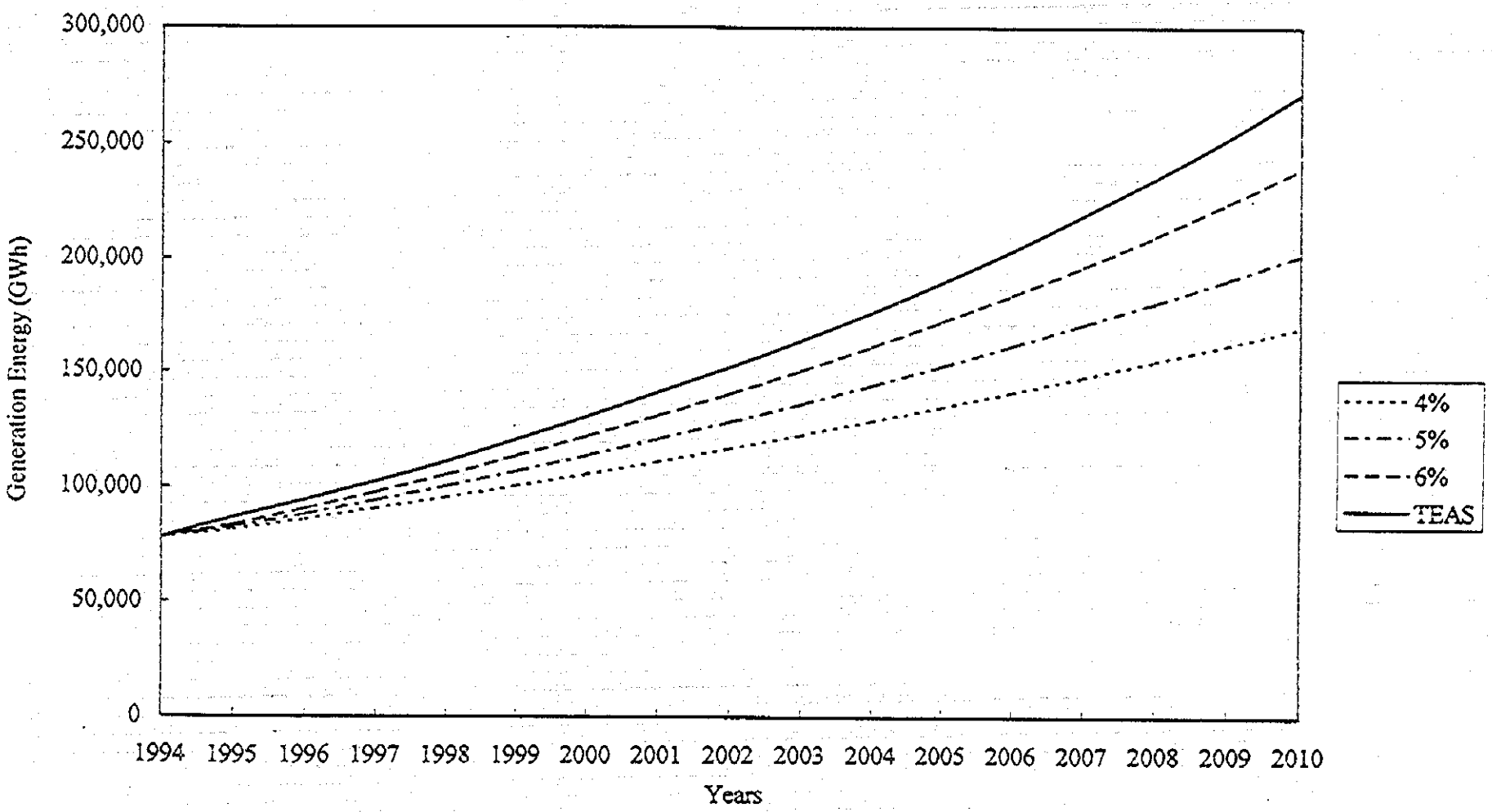

Figure 5-1 Energy Demand Forecast-1 (Simple regression)

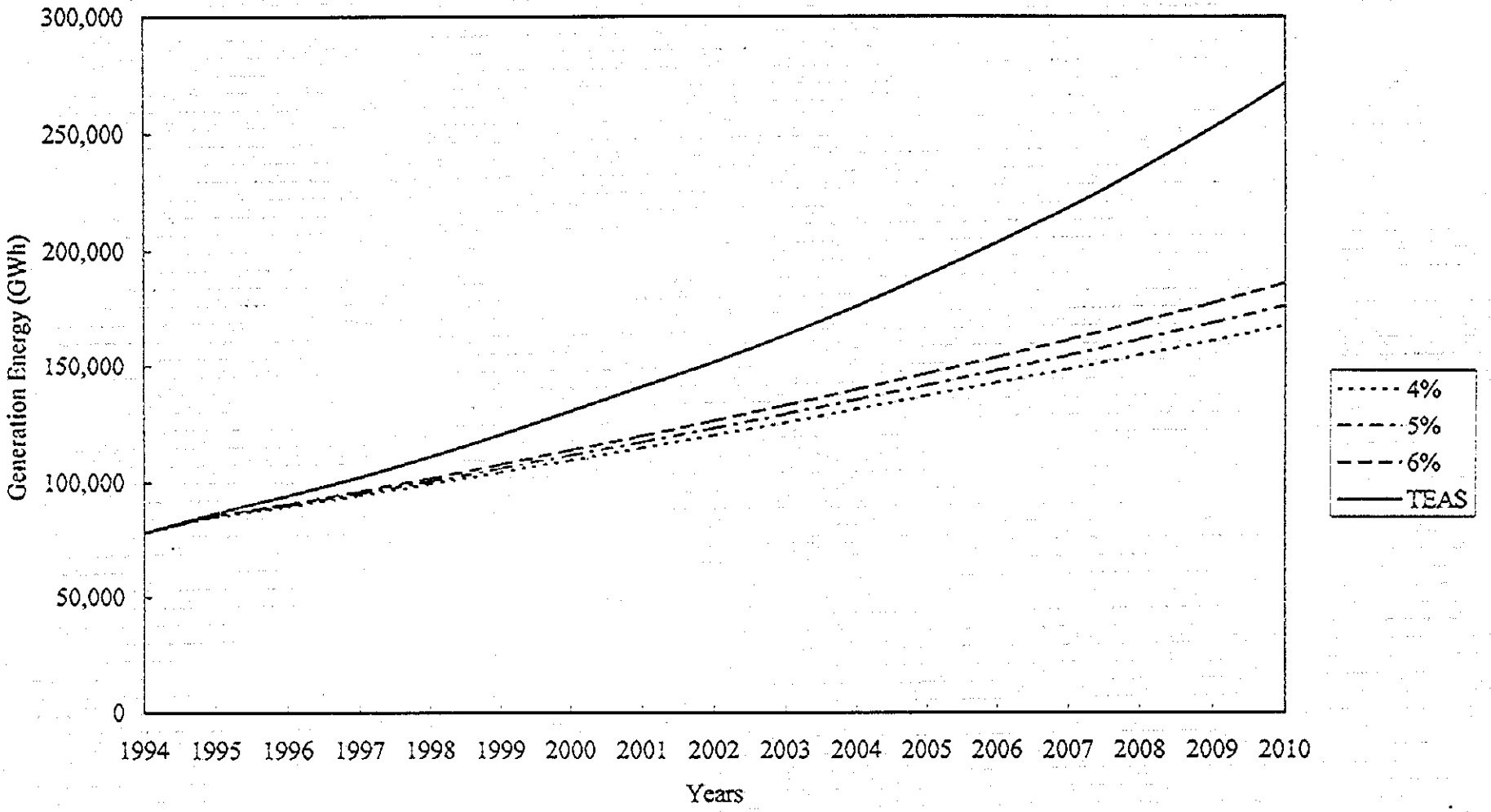

Figure 5-1 Energy Demand Forecast-2 (Multiple regression)

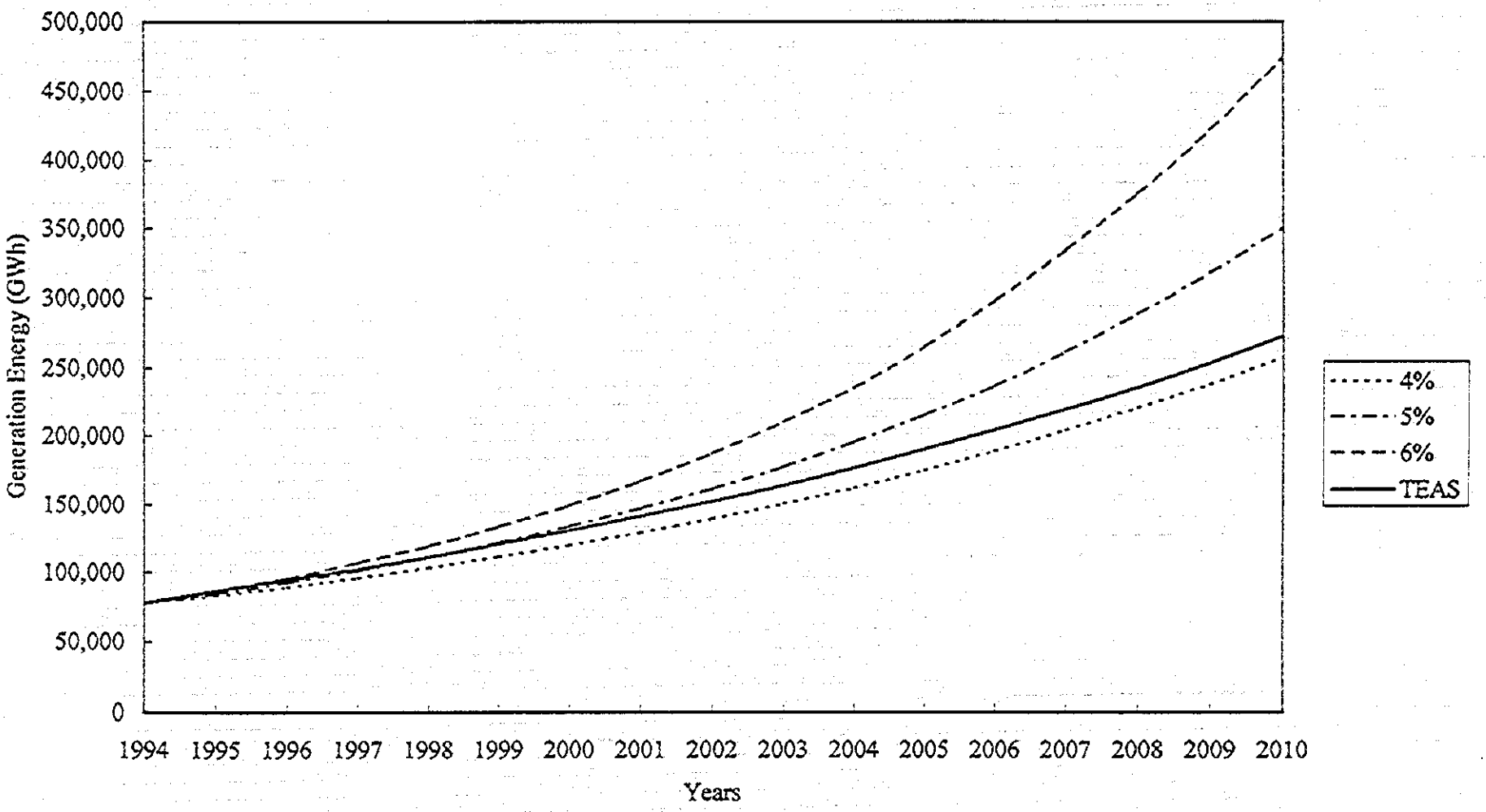

Figure 5-1 Energy Demand Forecast-3 (Parabolic regression)

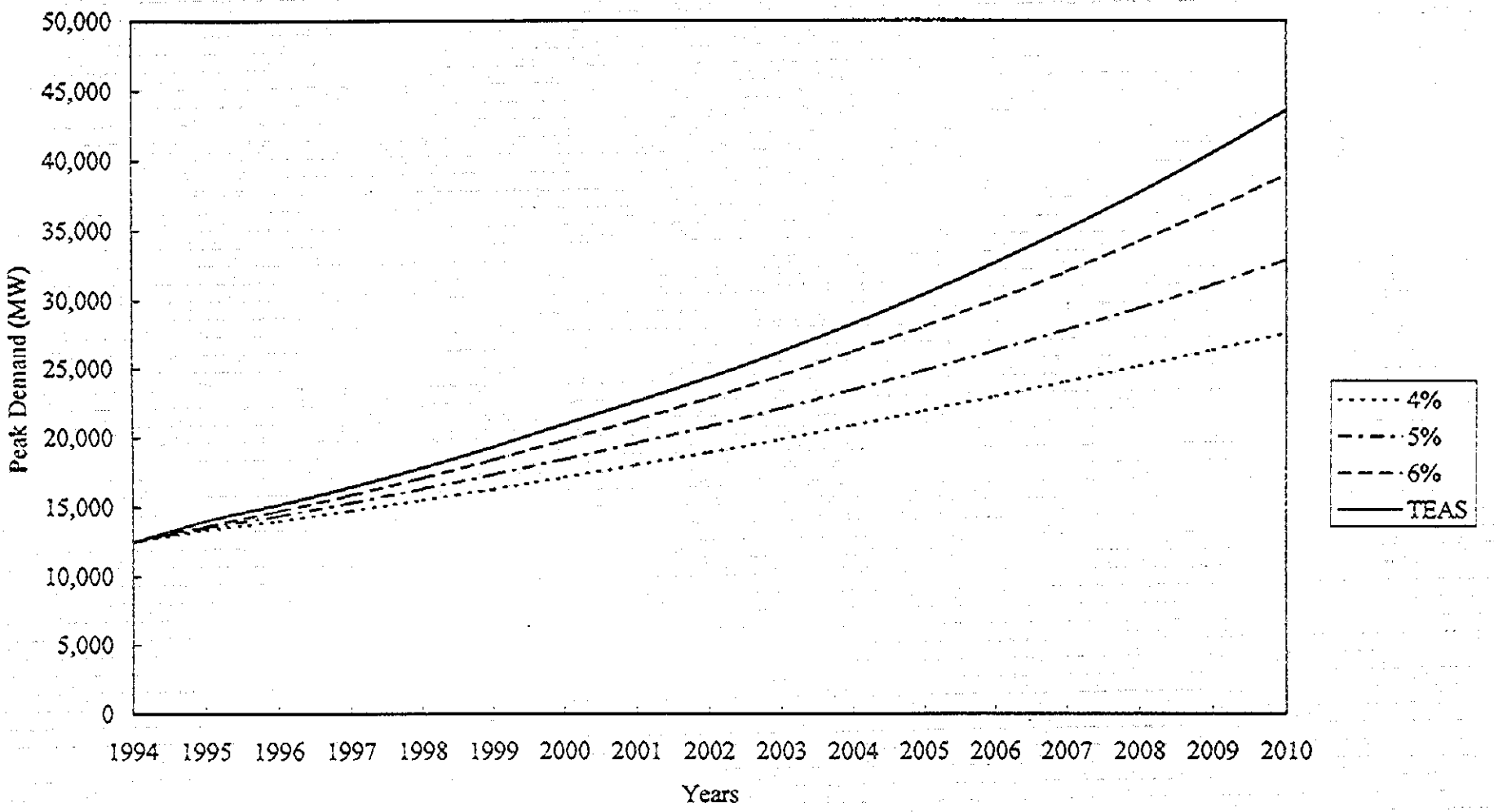

Figure 5-2 Peak Power Demand-1 (Simple regression)

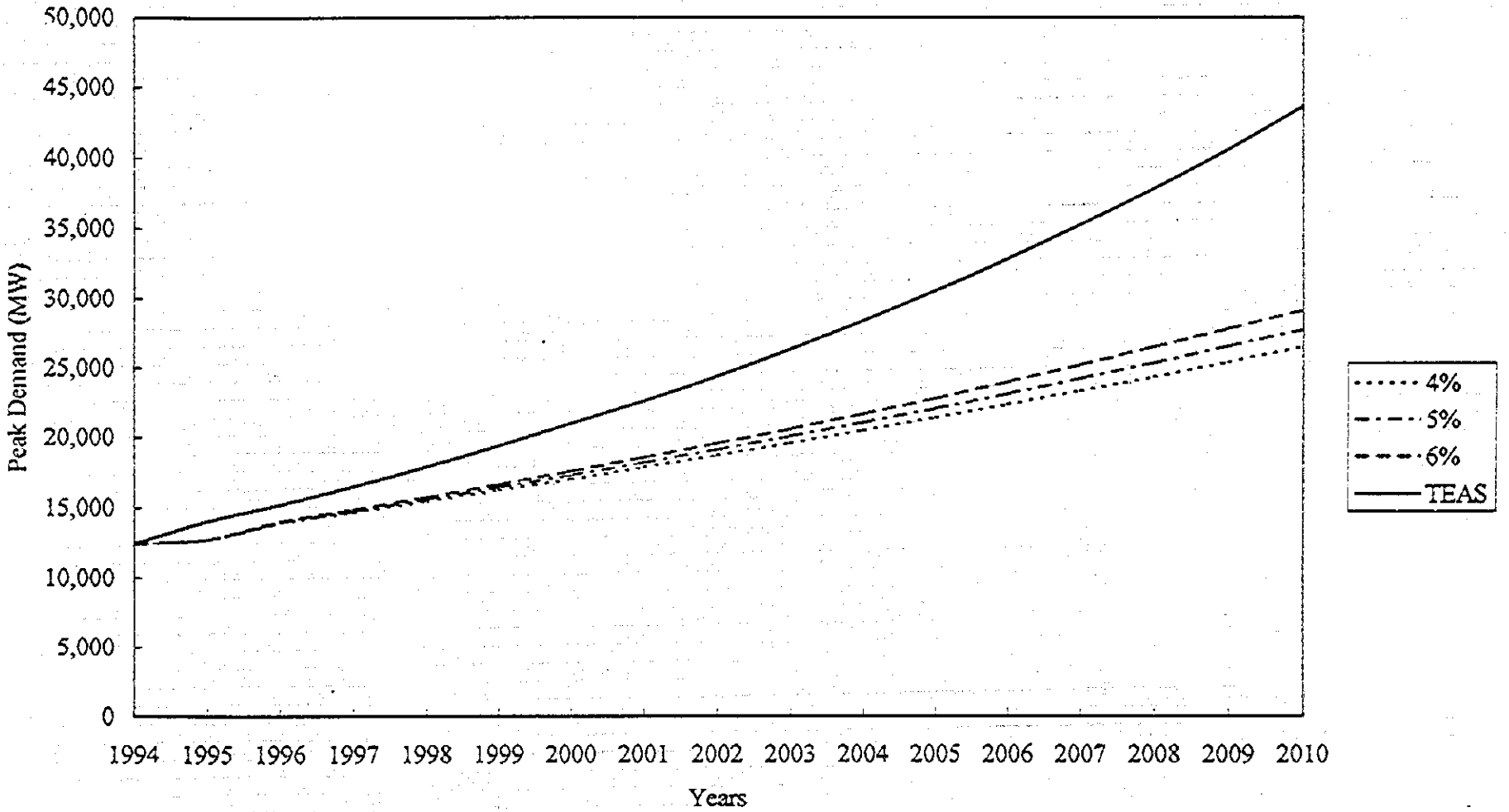

Figure 5-2 Peak Power Demand-2 (Multiple regression)

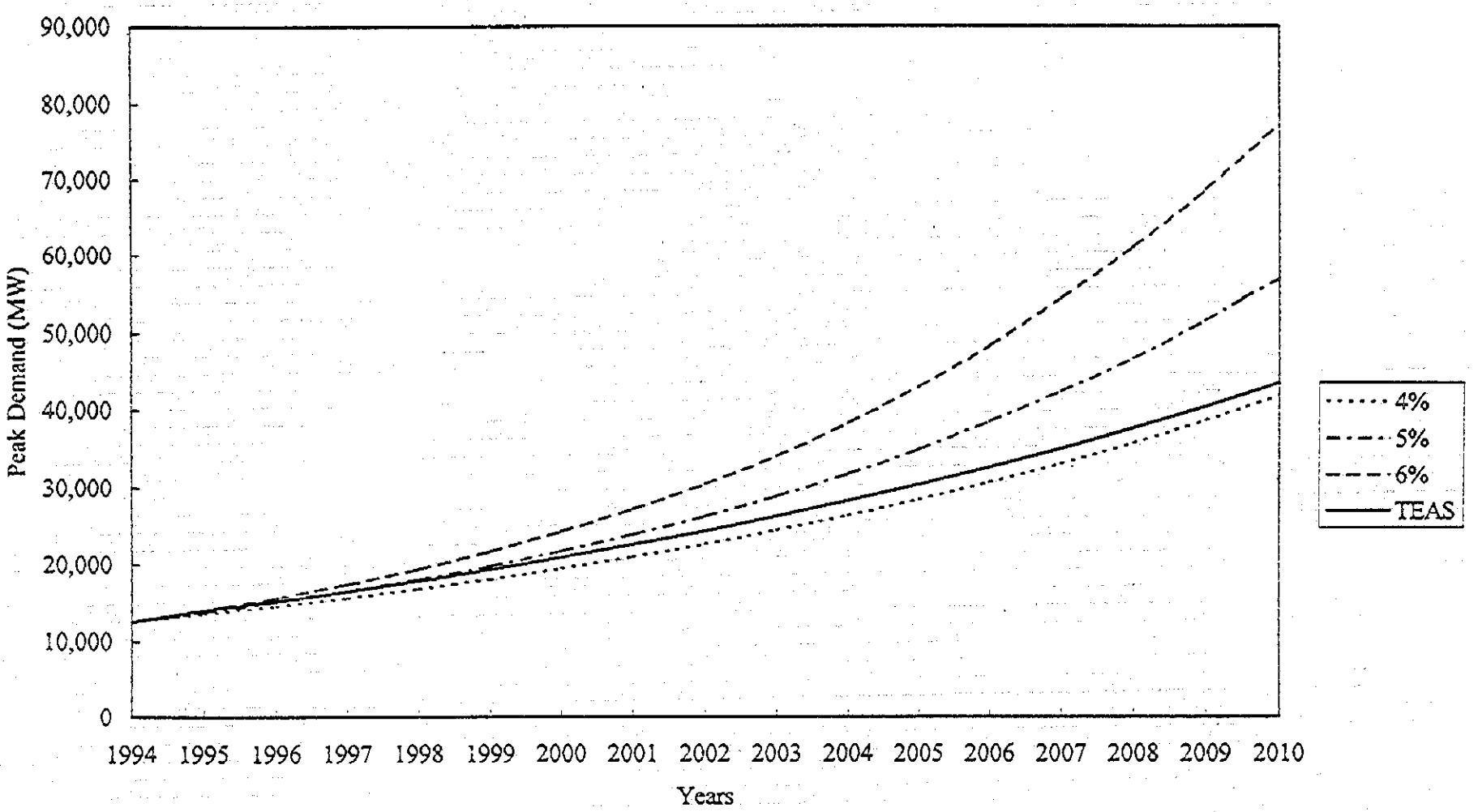

Figure 5-2 Peak Power Demand-3 (Parabolic regression)

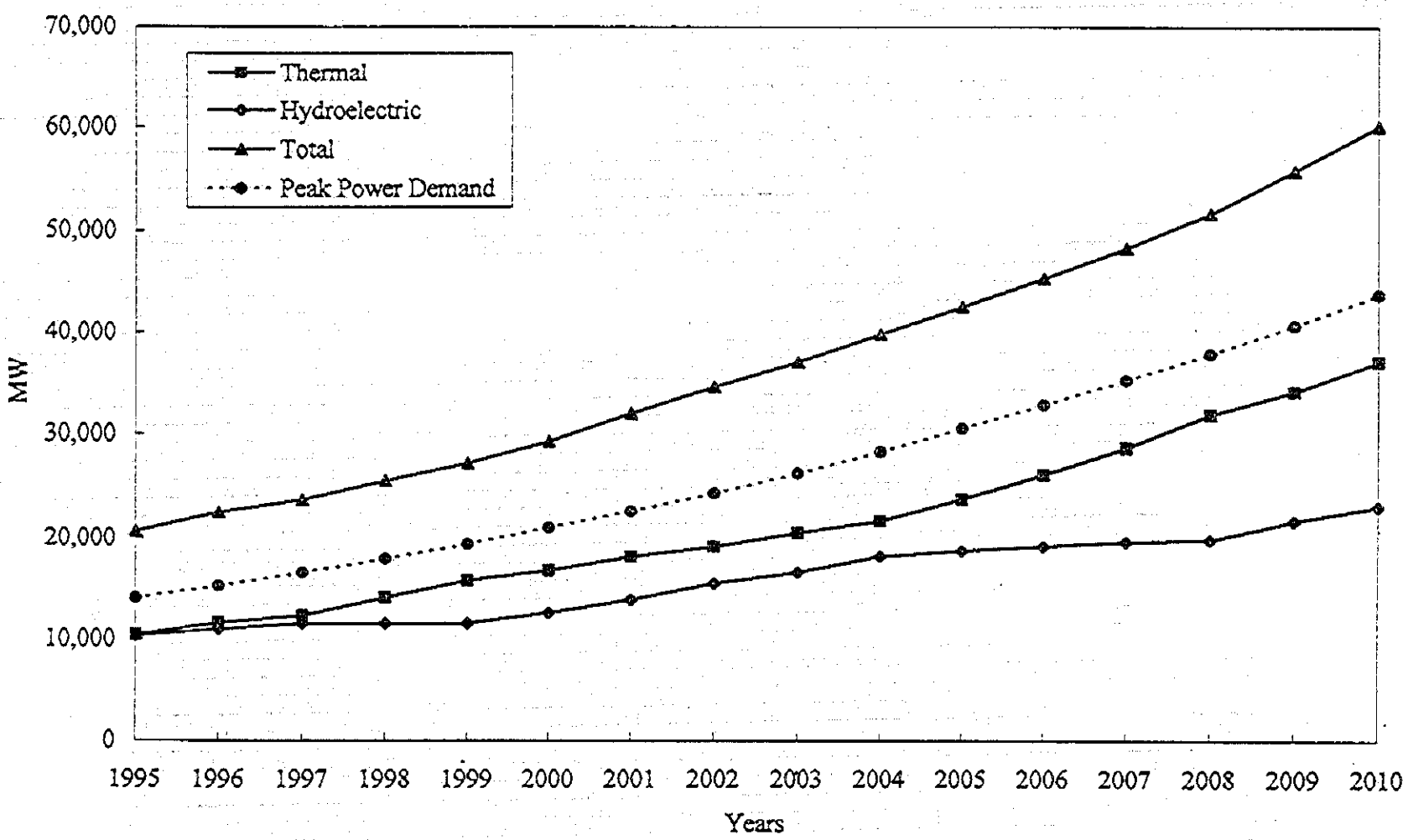

Figure 5-3 Trend of Power Development Plan

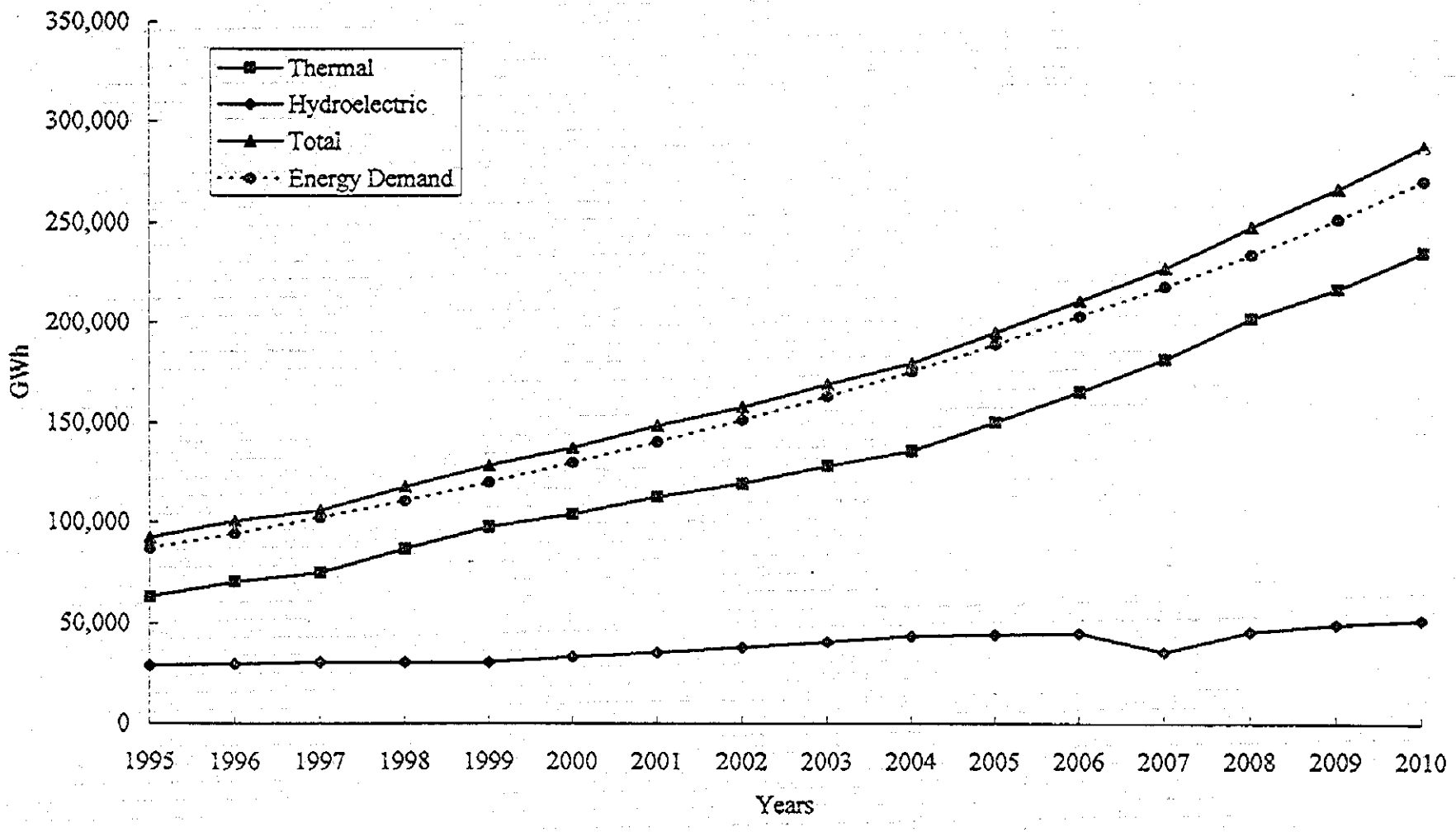

Figure 5-4 Trend of Demand and Supply Forecast

Table 5-1 Data of GDP and Population in Turkey

Years	GDP				Energy Consumption (GWh)	Population	
	(million TL)	(million US$)	At 1987 prices			(1,000)	Growth rate (%)
			(million TL)	Growth rate (%)			
1970	205,567	18,825	33,765,132	3.2		35,605	
1975	674,130	46,300	44,748,268	7.2		40,348	13.3
1980	5,230,618	67,457	50,295,991	-2.4	20,398	44,737	10.9
1981	7,901,027	70,419	52,738,671	4.9	22,030	45,540	1.8
1982	10,492,186	63,485	54,617,937	3.6	23,587	46,688	2.5
1983	13,905,813	60,373	57,332,998	5.0	24,465	47,864	2.5
1984	21,997,146	58,643	61,181,164	6.7	27,635	49,070	2.5
1985	35,095,481	66,408	63,776,134	4.2	29,709	50,664	3.2
1986	51,079,324	75,019	68,248,101	7.0	32,210	51,433	1.5
1987	74,721,925	85,638	74,721,925	9.5	36,697	52,561	2.2
1988	129,224,505	90,495	76,306,292	2.1	39,722	53,715	2.2
1989	227,324,008	106,123	76,498,311	0.3	43,120	54,893	2.2
1990	393,060,171	149,195	83,578,464	9.3	46,820	56,473	2.9
1991	630,116,961	149,156	84,352,830	0.9	49,283	57,326	1.5
1992	1,093,368,045	156,656	89,400,745	6.0	53,985	58,584	2.2
1993	1,913,150,235	171,181	96,089,492	7.5	59,237	59,869	2.2
1994	3,883,827,000	———	91,396,000	-5.4	61,401	61,183	2.2
1995	———	———	———	8.1	———	62,526	2.2

Table 5-2 Power Demand Forecast by TEAS

Years	Peak Load		Power Generation	
	(MW)	Growth Rate(%)	(GWh)	Growth Rate(%)
1995	14,065		87,205	
1996	15,235	8.3	94,605	8.5
1997	16,505	8.3	102,500	8.3
1998	17,880	8.3	111,050	8.3
1999	19,375	8.4	120,310	8.3
2000	20,990	8.3	130,350	8.3
2001	22,610	7.7	140,850	8.1
2002	24,360	7.7	151,720	7.7
2003	26,240	7.7	163,430	7.7
2004	28,260	7.7	176,040	7.7
2005	30,445	7.7	189,630	7.7
2006	32,710	7.4	203,675	7.4
2007	35,145	7.4	218,835	7.4
2008	37,760	7.4	235,130	7.4
2009	40,570	7.4	252,635	7.4
2010	43,590	7.4	271,450	7.4

Table 5-3 Power Demand Forecast-1 (Simple Regression)

Unit:GWh

Years	Consumption			Generation			TEAS
	4%	5%	6%	4%	5%	6%	
1994	61,401	61,401	61,401	78,322	78,322	78,322	78,322
1995	64,714	65,542	66,370	81,958	83,007	84,055	87,205
1996	68,159	69,889	71,636	86,320	88,512	90,725	94,605
1997	71,741	74,454	77,219	90,858	94,293	97,795	102,500
1998	75,467	79,247	83,136	95,576	100,363	105,289	111,050
1999	79,342	84,279	89,408	100,483	106,737	113,233	120,310
2000	83,371	89,563	96,057	105,587	113,429	121,653	130,350
2001	87,562	95,112	103,105	110,895	120,455	130,578	140,850
2002	91,921	100,937	110,575	116,415	127,834	140,040	151,720
2003	96,454	107,054	118,494	122,156	135,581	150,068	163,430
2004	101,168	113,477	126,888	128,126	143,715	160,699	176,040
2005	106,071	120,221	135,785	134,335	152,256	171,967	189,630
2006	111,170	127,302	145,216	140,793	161,224	183,911	203,675
2007	116,473	134,738	155,214	147,509	170,641	196,573	218,835
2008	121,988	142,545	165,811	154,494	180,528	209,993	235,130
2009	127,724	150,742	177,043	161,758	190,910	224,219	252,635
2010	133,689	159,349	188,950	169,312	201,810	239,299	271,450

Table 5-3 Power Demand Forecast-2 (Multiple Regression)

Unit:GWh

Years	Consumption			Generation			TEAS
	4%	5%	6%	4%	5%	6%	
1994	61,401	61,401	61,401	78,322	78,322	78,322	78,322
1995	67,475	67,689	67,904	85,454	85,726	85,998	87,205
1996	71,065	71,514	71,967	90,001	90,569	91,143	94,605
1997	74,750	75,453	76,171	94,668	95,559	96,467	102,500
1998	78,533	79,513	80,522	99,459	100,701	101,978	111,050
1999	82,416	83,697	85,027	104,377	105,999	107,684	120,310
2000	86,403	88,009	89,694	109,427	111,461	113,594	130,350
2001	90,497	92,455	94,528	114,611	117,091	119,717	140,850
2002	94,700	97,039	99,539	119,934	122,896	126,062	151,720
2003	99,016	101,766	104,733	125,400	128,883	132,641	163,430
2004	103,448	106,641	110,120	131,014	135,057	139,462	176,040
2005	108,000	111,670	115,707	136,778	141,427	146,539	189,630
2006	112,675	116,859	121,506	142,699	147,998	153,883	203,675
2007	117,476	122,214	127,525	148,779	154,779	161,506	218,835
2008	122,408	127,740	133,775	155,025	161,778	169,421	235,130
2009	127,474	133,444	140,267	161,441	169,003	177,643	252,635
2010	132,678	139,334	147,012	168,032	176,462	186,185	271,450

Table 5-3 Power Demand Forecast-3 (Parabolic Regression)

Unit:GWh

Years	Consumption			Generation			TEAS
	4%	5%	6%	4%	5%	6%	
1994	61,401	61,401	61,401	78,322	78,322	78,322	78,322
1995	65,833	66,972	68,123	83,375	84,818	86,275	87,205
1996	70,651	73,152	75,731	89,477	92,644	95,911	94,605
1997	75,887	80,005	84,339	96,108	101,324	106,812	102,500
1998	81,577	87,604	94,073	103,314	110,947	119,140	111,050
1999	87,759	96,026	105,077	111,143	121,613	133,076	120,310
2000	94,473	105,357	117,511	119,646	133,431	148,823	130,350
2001	101,765	115,694	131,557	128,881	146,523	166,612	140,850
2002	109,682	127,142	147,418	138,909	161,021	186,699	151,720
2003	118,278	139,818	165,323	149,795	177,074	209,376	163,430
2004	127,609	153,849	185,531	161,612	194,844	234,968	176,040
2005	137,735	169,378	208,330	174,436	214,512	263,843	189,630
2006	148,724	186,562	234,047	188,353	236,274	296,413	203,675
2007	160,647	205,572	263,049	203,453	260,350	333,143	218,835
2008	173,582	226,600	295,748	219,835	286,981	374,555	235,130
2009	187,612	249,856	332,608	237,604	316,434	421,236	252,635
2010	202,830	275,572	374,149	256,877	349,001	473,847	271,450

Table 5-4 Peak Power Demand Forecast

Unit:MW

Years	Simple			Multi			Parabo.			TEAS
	4%	5%	6%	4%	5%	6%	4%	5%	6%	
1994	12,495	12,495	12,495	12,495	12,495	12,495	12,495	12,495	12,495	12,495
1995	13,366	13,537	13,708	12,773	12,773	12,773	13,597	13,832	14,070	14,065
1996	14,077	14,434	14,795	13,936	13,980	14,024	14,592	15,108	15,641	15,235
1997	14,817	15,377	15,948	14,677	14,770	14,864	15,673	16,524	17,419	16,505
1998	15,586	16,367	17,170	15,438	15,584	15,732	16,848	18,093	19,429	17,880
1999	16,387	17,406	18,466	16,220	16,422	16,631	18,125	19,832	21,702	19,375
2000	17,219	18,498	19,839	17,022	17,286	17,561	19,512	21,760	24,270	20,990
2001	18,085	19,644	21,295	17,845	18,177	18,525	21,018	23,895	27,171	22,610
2002	18,985	20,847	22,838	18,691	19,095	19,523	22,653	26,259	30,447	24,360
2003	19,921	22,110	24,473	19,559	20,042	20,558	24,428	28,877	34,145	26,240
2004	20,895	23,437	26,207	20,450	21,018	21,631	26,355	31,775	38,318	28,260
2005	21,907	24,830	28,044	21,366	22,025	22,743	28,447	34,982	43,027	30,445
2006	22,960	26,292	29,992	22,306	23,064	23,897	30,716	38,531	48,339	32,710
2007	24,056	27,828	32,057	23,271	24,135	25,095	33,179	42,458	54,329	35,145
2008	25,195	29,440	34,245	24,263	25,241	26,338	35,850	46,801	61,082	37,760
2009	26,379	31,133	36,565	25,281	26,383	27,629	38,748	51,604	68,695	40,570
2010	27,611	32,911	39,025	26,328	27,561	28,970	41,891	56,915	77,274	43,590

Table 5-5 Power Demand Forecast and Demand Supply Balance(1995 to 2005)

Years	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Power Balance (MW)																
Installed Capacity																
Thermal	10,399	11,580	12,260	14,070	15,730	16,710	18,070	19,090	20,450	21,620	23,770	26,130	28,640	31,770	34,000	36,970
Hydroelectric	10,297	10,969	11,498	11,498	11,498	12,537	13,841	15,421	16,508	18,111	18,677	19,127	19,579	19,773	21,631	23,086
Total	20,696	22,549	23,758	25,568	27,228	29,247	31,911	34,511	36,958	39,731	42,447	45,257	48,219	51,543	55,721	60,056
Peak Power Demand	14,065	15,235	16,505	17,890	19,375	20,990	22,610	24,360	26,240	28,260	30,445	32,710	35,145	37,760	40,570	43,590
Reserve capacity	6,631	7,314	7,253	7,688	7,853	8,257	9,301	10,151	10,718	11,471	12,002	12,547	13,074	13,783	15,151	16,466
Reserve ratio (%)	47.0	48.0	44.0	43.0	41.0	39.0	41.0	42.0	41.0	41.0	39.0	38.0	37.0	36.0	37.0	38.0
Energy Balance (GWh)																
Energy Generation																
Thermal	63,348	71,023	75,443	87,208	97,998	104,368	113,208	119,838	128,678	136,283	150,758	166,098	182,413	202,758	217,838	236,558
Hydroelectric	28,958	29,798	30,767	30,767	30,767	33,453	35,619	38,291	40,795	43,745	44,631	45,385	35,994	46,134	49,938	52,219
Total	92,306	100,821	106,210	117,975	128,765	137,821	148,827	158,129	169,473	180,028	195,389	211,483	228,407	248,892	267,776	288,777
Energy Demand	87,205	94,605	102,500	111,050	120,310	130,350	140,850	151,720	163,430	176,040	189,630	203,675	218,835	235,130	252,635	271,450
Reserve capacity	5,101	6,216	3,710	6,925	8,455	7,471	7,977	6,409	6,043	3,988	5,759	7,808	9,572	13,762	15,141	17,327
Reserve ratio (%)	6.0	7.0	4.0	6.0	7.0	6.0	6.0	4.0	4.0	2.0	3.0	4.0	4.0	6.0	6.0	6.0

Table 5-6 Installed Capacity and Trend of Component Ratio of Power Resources

Unit: above MW, below %

Years	Lignite/Coal	Imported coal	Total	Gas	Oil	Thermal Total	Nuclear	Hydroelectric	Grand Total
1995	5,803		5,803	2,671	1,925	10,399		10,297	20,696
	28.0		28.0	12.9	9.3	50.2		49.8	100.0
1996	6,304		6,304	3,351	1,925	11,580		10,969	22,549
	28.0		28.0	14.9	8.5	51.4		48.6	100.0
1997	6,304		6,304	4,031	1,925	12,260		11,498	23,758
	26.5		26.5	17.0	7.5	51.6		48.4	100.0
1998	7,434		7,434	4,711	1,925	14,070		11,498	23,568
	29.1		29.1	18.4	8.1	55.0		45.0	100.0
1999	7,734		7,734	6,071	1,925	15,730		11,498	27,228
	28.4		28.4	22.3	7.1	57.8		42.2	100.0
2000	8,714		8,714	6,071	1,925	16,710		12,537	29,247
	29.8		29.8	20.7	6.6	57.1		42.9	100.0
2001	9,394		9,394	6,751	1,925	18,070		13,836	31,906
	29.4		29.4	21.2	6.0	56.6		43.4	100.0
2002	9,734		9,734	7,431	1,925	190,090		15,416	34,506
	28.2		28.2	21.5	5.6	55.3		44.7	100.0
2003	10,414		10,414	8,111	1,925	20,450		16,503	36,953
	28.2		28.2	21.9	5.2	55.3		44.7	100.0
2004	10,904		10,904	8,791	1,925	21,620		18,097	39,717
	27.5		27.5	22.1	4.8	54.4		45.6	100.0
2005	11,054	1,000	12,054	8,791	1,925	22,770	1,000	18,617	42,387
	26.1	2.4	28.5	20.7	4.5	53.7	2.4	43.9	100.0
2006	11,734	2,000	13,734	9,471	1,925	25,130	1,000	19,067	45,159
	26.0	4.4	30.4	21.0	4.3	55.7	2.2	42.2	100.0
2007	12,564	3,000	15,564	10,151	1,925	27,640	1,000	19,519	48,159
	26.1	6.2	32.3	21.1	4.0	57.4	2.1	40.5	100.0
2008	13,014	4,000	17,014	10,831	1,925	29,770	2,000	19,713	51,483
	25.3	7.8	33.1	21.0	3.7	57.8	3.9	38.3	100.0
2009	13,654	5,000	18,654	11,511	1,925	32,090	2,000	21,607	55,697
	24.5	9.0	33.5	20.7	3.5	57.7	3.6	38.8	100.0
2010	14,854	6,000	20,854	12,191	1,925	34,970	2,000	23,064	60,034
	24.7	10.0	34.7	20.3	3.2	58.2	3.3	38.4	100.0

Table 5-7 Power Development Plan (1/5)

Years	Project Name	Type	Unit	Installed Capacity (MW)	Projected Energy (GWh)	Dependable Energy (GWh)
1995		Lignite	1	5,450	34,484	34,484
		Coal	1	353	2,082	2,082
		Natural Gas	1	2,671	17,281	17,281
		Fuel Oil	1	1,531	8,394	8,394
		Diesel	1	394	1,017	1,017
		GT	1	15	90	90
	Thermal Total			10,414	63,348	63,348
		Hydroelectric	1	5,141	18,765	14,479
		Hydroelectric	1	5,141	18,765	14,479
	Hydroelectric Total			10,282	37,530	28,958
	Total			20,696	100,878	92,306
1996	TUNCBILEK A	Lignite	1	129	840	840
	KEMERKOY	Lignite	3	210	1,365	1,365
	DOGAL GAZ(IST.+K.ELI)	Natural Gas	1	680	4,420	4,420
	Thermal Total			1,181	7,675	7,675
	KRALKIZI	Hydroelectric	1	94	146	111
	CAMLIGOZE	Hydroelectric	1	32	88	77
	SUAT UGURLU 3	Hydroelectric	1	30	78	0
	KURTUN	Hydroelectric	1	85	198	95
	BATMAN	Hydroelectric	1	198	483	251
	OZLUCE-PERI	Hydroelectric	1	170	413	290
	SANLIURFA	Hydroelectric	1	50	124	0
	MANSURLAR	Hydroelectric	1	13	48	16
	Hydroelectric Total			672	1,578	840
	Total			1,853	9,253	8,515
1997	DOGAL GAZ(TEKIRDAG)	Natural Gas	1	680	4,420	4,420
	Thermal Total			680	4,420	4,420
	MERCAN	Hydroelectric	1	19	78	48
	BEREKE	Hydroelectric	1	510	1,668	921
	Hydroelectric Total			529	1,746	969
	Total			1,209	6,166	5,389
1998	ELBISTAN A5,6	Lignite	2	340	2,210	2,210
	KANGAL 3	Lignite	1	150	975	975
	CAYIRHAN 3,4	Lignite	2	150	975	975
	DOGAL GAZ(BURSA)	Natural Gas	1	680	4,420	4,420
	Thermal Total			1,810	11,765	11,765
	Total			1,810	11,765	11,765
1999	TUFANBEYLI 1	Lignite	1	300	1,950	1,950
	DOGAL GAZ(ANK.+BURSA)	Natural Gas	2	680	4,420	4,420
	Thermal Total			1,660	10,790	10,790
	Total			1,660	10,790	10,790

Table 5-7 Power Development Plan (2/5)

Years	Project Name	Type	Unit	Installed Capacity (MW)	Projected Energy (GWh)	Dependable Energy (GWh)
2000	TUFANBEYLI 2	Lignite	1	300	1,950	1,950
	ELBISTAN B1,2	Lignite	2	340	2,210	2,210
	Thermal Total			980	6,370	6,370
	BIRECIK	Hydroelectric	1	672	2,516	1,801
	KARKAMIS	Hydroelectric	1	180	652	462
	CINDERE	Hydroelectric	1	27	88	5
	ALPARSLAN 1	Hydroelectric	1	160	488	418
	Hydroelectric Total			1,039	3,744	2,686
	Total			2,019	10,114	9,056
2001	ELBISTAN B3,4	Lignite	2	340	2,210	2,210
	DOGAL GAZ(IZMIR)	Natural Gas	1	680	4,420	4,420
	Thermal Total			1,360	8,840	8,840
	KAYRAKTEPE	Hydroelectric	1	421	991	639
	BOYABAT0KEPEZ	Hydroelectric	1	513	1,468	925
	YEDIGOZE	Hydroelectric	1	300	969	459
	KILAVUZLU	Hydroelectric	1	54	100	7
	GONEN	Hydroelectric	1	11	47	35
	Hydroelectric Total			1,299	3,575	2,065
	Total			2,659	12,415	10,905
2002	ELBISTAN C1	Lignite	1	340	2,210	2,210
	DOGAL GAZ(KOCAELI)	Natural Gas	1	680	4,420	4,420
	Thermal Total			1,020	6,630	6,630
	UZUNGOL-OF-SOLAKLI	Hydroelectric	1	380	1,000	213
	ILISU	Hydroelectric	1	1,200	3,833	2,459
	Hydroelectric Total			1,580	4,833	2,672
	Total			2,600	11,463	9,302
2003	ELBISTAN C2,3	Lignite	2	340	2,210	2,210
	DOGAL GAZ(ISTANBUL)	Natural Gas	1	680	4,420	4,420
	Thermal Total			1,360	8,840	8,840
	TORUL	Hydroelectric	1	103	322	131
	UZUNCAYIR	Hydroelectric	1	74	317	214
	CIZRE	Hydroelectric	1	240	1,208	947
	DERINER	Hydroelectric	1	670	2,118	1,212
	Hydroelectric Total			1,087	3,965	2,504
	Total			2,447	12,805	11,344

Table 5-7 Power Development Plan (3/5)

Years	Project Name	Type	Unit	Installed Capacity (MW)	Projected Energy (GWh)	Dependable Energy (GWh)
2004	ELBISTAN C4	Lignite	1	340	2,210	2,210
	CAN 1	Lignite	1	150	975	975
	DOGAL GAZ(IZMIR)	Natural Gas	1	680	4,420	4,420
	Thermal Total			1,170	7,605	7,605
	KOPRUBASI	Hydroelectric	1	60	210	153
	YENICEKENT	Hydroelectric	1	21	71	5
	CAMLICA I	Hydroelectric	1	140	227	0
	YUSUFELI	Hydroelectric	1	540	1,705	1,129
	ARTVIN	Hydroelectric	1	332	1,026	662
	BORCKA	Hydroelectric	1	300	1,039	600
	BESKONAK	Hydroelectric	1	201	660	380
	Hydroelectric Total			1,594	4,938	2,929
	Total			2,764	12,543	10,534
2005	CAN 2	Lignite	1	150	975	975
	ITH.KOMUR(C.KALE+ADANA	Coal	2	500	3,250	3,250
	Thermal Total			650	4,225	4,225
	Nuclear	Nuclear	1	1,000	7,000	7,000
	MURATLI	Hydroelectric	1	115	444	253
	SAMI SOYDAM	Hydroelectric	1	175	515	272
	AKSU	Hydroelectric	1	120	344	237
	YAMULA	Hydroelectric	1	80	406	345
	BAYRAMHACILI	Hydroelectric	1	30	160	122
	Hydroelectric Total			520	1,869	1,229
	Total			2,670	16,344	15,704
2006	ELBISTAN D1,2	Lignite	2	340	2,210	2,210
	DOGAL GAZ(KOCAELI)	Natural Gas	1	680	4,420	4,420
	ITH.KOMUR(C.KALE+ADANA	Coal	2	500	3,250	3,250
	Thermal Total			2,360	15,340	15,340
	DILEK-GUROLUK	Hydroelectric	1	180	593	168
	GOKTAS	Hydroelectric	1	270	1,160	586
	Hydroelectric Total			450	1,753	754
	Total			2,810	17,093	16,094
2007	ELBISTAN D3,4	Lignite	2	340	2,210	2,210
	BURSA-KELES	Lignite	1	150	975	975
	DOGAL GAZ(KOCAELI)	Natural Gas	1	680	4,420	4,420
	ITH.KOMUR(C.KALE+TEKIRD	Coal	2	500	3,250	3,250
	Thermal Total			2,510	16,315	16,315
	GURSOGUT	Hydroelectric	1	242	276	159
	KONAKTEPE	Hydroelectric	1	210	730	450
	Hydroelectric Total			452	1,006	609
	Total			2,962	17,321	16,924

Table 5-7 Power Development Plan (4/5)

Years	Project Name	Type	Unit	Installed Capacity (MW)	Projected Energy (GWh)	Dependable Energy (GWh)
2008	CAYIRHAN B	Lignite	1	300	1,950	1,950
	SEYITOMER 5	Lignite	1	150	975	975
	DOGAL GAZ(ISTANBUL)	Natural Gas	1	680	4,420	4,420
	ITH.KOMUR(TEKIRDAG)	Coal	2	500	3,250	3,250
	Thermal Total			3,130	13,845	13,845
	Nuclear	Nuclear	1	1,000	6,500	6,500
	KARGI	Hydroelectric	1	194	245	140
	Hydroelectric Total			194	245	140
	Total			3,324	20,590	20,485
2009	BEYSEHIR	Lignite	1	340	2,210	2,210
	AMASRA 1	Coal	1	300	1,950	1,950
	DOGAL GAZ(KOCAELI)	Natural Gas	1	680	4,420	4,420
	ITH.KOMUR(ISKENDERUN)	Coal	2	500	3,250	3,250
	Thermal Total			2,320	15,080	15,080
	ASLANCIK	Hydroelectric	1	90	349	179
	OBRUK	Hydroelectric	1	180	473	337
	ULUBAT-CINARCIK	Hydroelectric	1	120	548	422
	ALPASLAN 2	Hydroelectric	1	140	430	120
	ERMENEK	Hydroelectric	1	320	1,022	925
	HAKKARI	Hydroelectric	1	322	1,043	582
	ALKUMRU	Hydroelectric	1	222	812	350
	CETIN	Hydroelectric	1	350	1,237	730
	PEMBELIK	Hydroelectric	1	100	313	220
	DALMAN-BEZKESE	Hydroelectric	1	50	205	111
	Hydroelectric Total			1,894	6,432	3,976
	Total			4,214	21,512	19,056

Table 5-7 Power Development Plan (5/5)

Years	Project Name	Type	Unit	Installed Capacity (MW)	Projected Energy (GWh)	Dependable Energy (GWh)
2010	BEYPAZARI	Lignite	1	300	1,950	1,950
	AMASRA 2	Coal	1	300	1,950	1,950
	CATALAGZI C	Coal	2	300	1,950	1,950
	DOGAL GAZ(BURSA)	Natural Gas	1	680	4,420	4,420
	ITH.KOMUR(ADANA+HATAY	Coal	2	500	3,250	3,250
	Thermal Total			2,880	18,720	18,720
	KUPLU	Hydroelectric	1	18	31	25
	ADIGUZEL 2	Hydroelectric	1	22	86	7
	GUZELCE	Hydroelectric	1	27	62	0
	IKISU	Hydroelectric	1	60	127	81
	TIREBOLU	Hydroelectric	1	60	114	59
	LALELI	Hydroelectric	1	99	245	204
	CAMLICA 2	Hydroelectric	1	30	80	23
	CAMLICA 3	Hydroelectric	1	25	79	25
	GUZELDERE	Hydroelectric	1	73	168	37
	FEKE	Hydroelectric	1	170	426	223
	KIZKAYASI	Hydroelectric	1	114	261	200
	DOGANLI	Hydroelectric	1	462	1,327	850
	AKKOPPU	Hydroelectric	1	115	343	176
	TOHMA	Hydroelectric	1	14	67	0
	DOGANCAY	Hydroelectric	1	19	148	94
	SOYLEMEZ	Hydroelectric	1	46	250	142
	DIM	Hydroelectric	1	36	126	72
	CINE	Hydroelectric	1	36	111	18
	TOKMAKKAYA	Hydroelectric	1	11	24	0
	MANYAS	Hydroelectric	1	20	66	52
	Hydroelectric Total			1,457	4,141	2,288
	Total			4,337	22,861	21,008