付表

表1.1 ＥＩＥカウンターパート名簿（１／２）

Project Department

Mr. Nezih SAYAN	: Head of Project Department
Mr. Engin ERBERİK	: Chief of Reconnaissance and Planning Div.
Mr. Şükrü KARABİBER	: Chief of Dam and HPP Div.
Mr. Necati KUŞKONMAZ	: Chief of Run-of-River HPP Div.
Mr. Yildirim BARIK	: Chief of Basin Planning Div.
Mr. Mehmet GÜNGÖR	: Chief of Electrical and Mechanical Div.
Mr. Erdem ÖZYURT	: Chief of Mapping Div.
Mr. Volkan DİPÇIN	: Civil Engineer
Mr. Muharrem AYBAKIR	: Electrical Engineer
Ms. Muâllâ DEMİRDELEN	: Mechanical Engineer
Ms. Sule AKÇAY	: Civil Engineer
Ms. Gülgün GÜRÇAN	: Civil Engineer
Ms. Hatice TURAN	: Civil Engineer

Geology and Drilling Department

Mr. Aydin KIRMACIOĞLU	: Head of Geology and Drilling Department
Mr. Vedat ÇAĞLAYIK	: Geological Engineer
Mr. Orhan YAĞCI	: Chief of Geotechnical Service Div.
Mr. Yüksel TAN	: Chief of Rock, Foundation and Laboratory Div.
Mr. Mahmut KIRIŞ	: Chief of Drilling Div.
Mr. Osman DEMİRAĞ	: Chief of Geophysic Div.
Mr. Seyhan ÖNÇ	: Geological Engineer (MSc) Responsible Geologist

表1.1 E／Eカウンターパート名簿（2／2）

Hydrological Survey Department

Mr. Mete TÜRKSOY	: Head of Hydrological Survey Department
Mr. Sabahattin YALKIN	: Meteorological Engineer, Hydrologist
Mr. Hüseyin GÜRİPEK	: Chief of Hydrometric Evaluation Division
Mr. Halil MERMER	: Chief of Hydrometric Observation Division
Mr. Adil ALIŞIK	: Chief of Sediment Survey Div.
Mr. Mehmet TANRIKULU	: Chief of Project Hydrology Div.
Mr. Hayati HANÇER	: Meteorological Engineer, Hydrologist

表3.1　トルコの発電設備の構成内訳（1988年）

(Unit: MW)

	TEK	Power Companies	Self Generation	Turkey Total	Proportion in Turkey		
					%	%	%
(1) Solid Fuel							
Hard Coal	129.0	-	52.6	181.6	3.9	2.2	1.3
Lignite	4,328.0	-	128.4	4,456.4	96.1	53.7	30.7
Subtotal	4,457.0	-	181.0	4,638.0	100.0	55.9	31.9
(2) Liquid Fuel							
Fuel Oil	680.0	106.0	761.6	1,547.6	74.0	18.6	10.7
Motorin, Gas Turbine	333.6	-	-	333.6	16.0	4.0	2.3
Diesel	5.6	-	204.8	210.4	10.0	2.5	1.4
Subtotal	1,019.2	106.0	966.4	2,091.6	100.0	25.2	14.4
(3) Others							
Geo Thermal	15.0	-	-	15.0	1.0	0.2	0.1
Natural Gas	1,555.2	-	-	1,555.2	99.0	18.7	10.7
Subtotal	1,570.2	-	-	1,570.2	100.0	18.9	10.8
(4) Thermal Total	7,046.4	106.0	1,147.4	8,299.8	-	100.0	57.2
(5) Hydro Total	5,935.1	272.4	10.8	6,218.3	-	-	42.8
(6) Grand Total	12,981.5	378.4	1,158.2	14,518.1	-	-	100.0

Source: TEK

表3.2 発電設備容量の開発実績

(Unit : MW)

Year	Turkey				T E K			Power Companies			Self Generation, etc.		
	Thermal	Hydro.	Total	Increase (%)	Thermal	Hydro.	Total	Thermal	Hydro.	Total	Thermal	Hydro.	Total
1975	2,407.0	1,779.6	4,186.6	-	1,708.5	1,520.7	3,229.2	106.0	219.8	325.8	592.5	39.1	631.6
76	2,491.6	1,872.6	4,364.2	4.2	1,771.1	1,613.8	3,384.9	106.0	219.8	325.8	614.5	39.0	653.5
77	2,854.6	1,872.6	4,727.2	8.3	2,071.1	1,613.8	3,684.9	106.0	219.8	325.8	678.0	39.0	717.0
78	2,987.9	1,880.8	4,868.7	3.0	2,178.8	1,622.0	3,800.8	106.0	219.8	325.8	703.1	39.0	742.1
79	2,987.9	2,130.8	5,118.7	5.1	2,178.8	1,872.0	4,050.8	106.0	219.8	325.8	703.1	39.0	742.1
80	2,987.9	2,130.8	5,118.7	0.0	2,178.8	1,872.0	4,050.8	106.0	219.8	325.8	703.1	39.0	742.1
81	3,181.3	2,356.3	5,537.6	8.2	2,344.7	2,097.5	4,442.2	106.0	219.8	325.8	730.6	39.0	769.6
82	3,556.3	3,082.3	6,638.6	19.9	2,719.7	2,823.5	5,543.2	106.0	219.8	325.8	730.6	39.0	769.6
83	3,695.8	3,239.3	6,935.1	4.5	2,937.6	2,998.5	5,936.1	106.0	218.4	324.4	652.2	22.4	674.6
84	4,584.3	3,874.8	8,459.1	22.0	3,542.9	3,644.2	7,187.1	106.0	218.4	324.4	935.4	12.2	947.6
85	5,244.3	3,874.8	9,119.1	7.8	4,417.9	3,644.2	7,792.1	106.0	218.4	324.4	990.4	12.2	1,002.6
86	6,235.2	3,877.5	10,112.7	10.9	5,141.8	3,644.2	8,786.0	106.0	222.4	328.4	987.4	10.9	998.3
87	7,489.3	5,003.3	12,492.6	23.5	6,290.8	4,720.1	11,011.0	106.0	272.4	378.4	1,092.4	10.8	1,103.2
88	8,299.8	6,218.3	14,518.1	16.2	7,046.4	5,935.1	12,981.5	106.0	272.4	378.4	1,147.4	10.8	1,158.2

Source: TEK

表3.3 発電電力量の1次エネルギー源別シェアの変化

Year	Hard Coal (%)	Lignite (%)	Oil Products (%)	Other /1 Fuels (%)	Hydraulic (%)	Total Generation (GWh)
1975	9.1	17.2	34.5	1.4	37.8	15,623
76	7.4	16.3	29.6	0.9	45.8	18,283
77	6.2	17.6	33.4	1.1	41.7	20,565
78	5.6	20.1	30.7	0.6	43.0	21,726
79	4.7	23.8	25.1	0.6	45.8	22,522
80	3.9	21.7	25.0	0.6	48.8	23,275
81	3.6	21.3	23.6	0.4	51.1	24,673
82	3.4	20.8	22.4	-	53.4	26,552
83	2.9	28.5	27.1	-	41.5	27,347
84	2.3	30.7	23.0	0.1	43.9	30,613
85	2.1	41.8	20.7	0.2	35.2	34,219
86	2.0	47.0	17.6	3.5	29.9	39,695
87	1.4	38.4	12.4	5.8	42.0	44,353
88	0.7	25.3	6.9	6.8	60.3	48,049

/1: Fire wood generation upto 1981 and natural gas and geothermal after 1984. However, the share of geothermal is nearly zero in the period.

Source: TEK

表3.4 トルコの発電電力量の推移

(Unit: GWh)

Year	Thermal	Hydro.	Total	Increase (%)	Import	Gross Supply	Increase (%)	Distribution of Generation		
								TEK	Power Companies	Self Generation etc.
1975	9,719	5,904	15,623	-	96	15,719	-	12,845	1,730	1,048
76	9,908	8,375	18,283	17.0	332	18,615	18.4	15,454	1,639	1,190
77	11,973	8,592	20,565	12.5	492	21,057	13.1	17,230	1,716	1,617
78	12,361	9,365	21,726	5.6	621	22,347	6.1	17,968	1,875	1,883
79	12,218	10,304	22,522	3.7	1,044	23,566	5.5	18,934	1,554	2,034
80	11,927	11,348	23,275	3.3	1,341	24,616	4.5	19,414	1,610	2,251
81	12,057	12,616	24,673	6.0	1,616	26,289	6.8	20,588	1,937	2,148
82	13,385	14,167	26,552	7.6	1,773	28,325	7.7	23,243	1,590	1,719
83	16,004	11,343	27,347	3.0	2,221	29,568	4.4	23,689	1,618	2,040
84	17,187	13,426	30,613	11.9	2,653	33,266	12.5	26,686	1,691	2,237
85	22,174	12,045	34,219	11.8	2,142	36,361	9.3	30,249	1,592	2,378
86	27,822	11,873	39,695	16.0	777	40,472	11.3	35,470	1,454	2,771
87	25,735	18,618	44,353	11.7	572	44,925	11.0	36,679	1,592	3,082
88	19,099	28,950	48,049	8.3	381	48,430	7.8	43,014	1,858	3,177

Source: TEK

表3.5　トルコの送電線の建設実績

	Transmission Lines					Distribution Lines	
	380kV	220kV 1/	154kV	66kV 2/	Total	3/, 4/	Grand total
1979	2,870	93	11,393	2,436	16,792	161,678	178,470
80	2,870	93	12,937	2,447	18,347	188,781	207,128
81	2,918	93	12,818	2,418	18,247	198,869	217,116
82	3,679	93	13,388	2,279	19,439	213,473	232,912
83	4,068	93	14,247	2,301	20,709	228,039	248,748
84	4,485	15.7	15,184	2,302	21,987	250,743	272,730
85	4,995	15.7	16,472	2,179	23,662	279,014	302,676
86	5,767	95.7	17,468	2,006	25,257	309,815	335,072
87	6,606	87.5	17,985	1,919	26,598	344,839	371,437
88	7,202	87.5	18,832	1,772	27,894	381,850	409,744

1/: For interconnection with foreign power systems only.
2/: 66kV lines were converted to 33kV where demand is small.
3/: 34.5kV and lower tension lines.
4/: Village electrification lines are included. For 1979-85 period, the total is obtained assuming 5km line length for every village. After 1986, actual length is used.

Source: TEK

表3.6　トルコの変圧機の台数と容量の設置実績

	380kV, 3/		154kV		66kV		Sub Total		Distribution Tr.4/		Total	
Capacity		Capacity		Capacity		Capacity		Capacity		Capacity		
Year	Q'ty	(MVA)	Q'ty	(MVA)	Q'ty	(MVA)	Q'ty	(MVA)	Q'ty	(MVA)	Q'ty	(MVA)
1979	17	2,610	248	6,490	293	1,526	558	10,626	34,070	9,241	34,628	19,867
80	20	3,060	279	8,067	295	1,544	594	12,671	37,205	11,066	37,799	23,738
81	22	3,360	294	2,224	294	1,571	610	13,155	38,821	11,402	39,431	24,557
82	25	3,810	307	8,585	297	1,585	629	13,981	41,589	13,060	42,218	27,041
83	29	4,410	323	9,219	299	1,691	651	15,320	45,212	13,411	45,863	28,731
84	30	4,530	354	10,945	298	1,731	682	17,206	47,298	13,566	47,980	30,772
85	36	5,730	392	11,843	265	1,753	693	19,385	51,385	13,823	52,078	33,149
86	49	7,680	427	13,702	167	1,358	643	22,740	62,639	14,612	63,282	37,352
87	55	8,610	450	15,093	159	1,320	664	25,023	65,317	15,499	65,981	40,522
88	56	8,660	478	16,237	150	1,295	684	26,192	80,632	17,997	81,316	44,189

Note: 1/: Figures do not include transformers for voltage regulation, raising and lowering.
2/: Quantity and capacity of station service transformers are not included in the total.
3/: Quantity and capacity of 220kV transformers are included in the figures for 380kV transformers.
4/: 34.5kV and lower tension transformers include village electrification transformers.
For 1979-85 period, the totals are obtained assuming 50kVA for every village electrification transformer.
After 1986, actual values are used.

Source: TEK

表3.7 地方電化の実績

Year	Total village number	Number of electrified village in the year	Number of village with electricity at the end of the year	Percentage of village with electricity
1979	-	2,466	15,460	42.8
1980	36,155	2,885	18,345	50.7
1981	-	1,466	19,811	54.8
1982	-	2,221	22,032	60.9
1983	-	2,404	24,436	67.6
1984	-	2,079	26,515	73.3
1985	36,155	4,076	30,591	84.6
1986	-	3,294	33,885	93.7
1987	35,187	672	34,557	98.2
1988	35,167	227	34,834	99.0

Note: Also covers Sub-District.

Source: TEK

表3.8　地域配電会社による地方電化の現状

Enterprise	Total No. of Village	Villages with Electricity	(%)	Villages Without Electricity: Install. Work Underway	Install. Work not Initiated	Defective Villages	Total
Bosphorus	938	938	(100)	-	-	-	-
Southern-Marmara	2,284	2,272	(99.5)	5	1	6	12
Aegean	2,932	2,914	(99.4)	2	1	15	18
Toroslar	1,688	1,688	(100)	-	-	-	-
Erciyes	1,455	1,451	(99.7)	1	-	3	4
Kah.-Gazi	2,170	2,143	(98.8)	14	3	10	27
Eastern-Anatoria	2,374	2,318	(97.6)	52	3	1	56
Kizikirmak	1,956	1,946	(99.5)	-	-	10	10
Ondokuzmayis	2,141	2,135	(99.7)	2	1	3	6
Porsuk	1,665	1,664	(99.9)	-	-	1	1
Mediterranean	945	945	(100)	-	-	-	-
Meram	1,114	1,113	(99.9)	-	-	1	1
Central-Anatolia	3,120	3,113	(99.8)	-	1	6	7
Dicle (Tigris)	1,924	1,832	(95.2)	26	22	44	92
Firat (Euphrates)	1,305	1,254	(96.1)	27	5	19	51
Van Golu (Lake Van)	1,366	1,341	(98.2)	4	8	13	25
Eastern Black Sea	2,167	2,159	(99.6)	6	-	2	8
Ilgaz	1,839	1,839	(100)	-	-	-	-
Sakarya	709	705	(99.4)	-	-	4	4
Malatya	512	504	(98.4)	4	-	4	8
Erzinkan	563	560	(99.5)	-	-	3	3
Turkey	35,167	34,834	(99.1)	143	45	145	333

Source: 1988 Annual Report of TEK

表3.9 電力系統の運転実績

Year	Gross Generation (GWh)	Installed Capacity (MW)	Peak Demand (MW)	Equivalent Peak Hour (hr, 2/4)	Utilization Factor (%, 4/3)	Annual Load Factor (%, 5/8,760 hr)
1	2	3	4	5	6	7
1975	15,623	4,186.6	2,872.4	5,439	68.6	62.1
76	18,283	4,364.2	3,137.9	5,826	71.9	66.3
77	20,565	4,727.2	3,278.8	6,272	69.4	71.6
78	21,726	4,868.7	3,602.4	6,031	74.0	68.8
79	22,521	5,118.7	3,543.6	6,356	69.2	72.5
80	23,275	5,118.7	3,772.1	6,170	73.7	70.4
81	24,673	5,537.6	3,872.6	6,371	69.9	72.7
82	26,552	6,638.6	4,308.2	6,163	64.9	70.1
83	27,347	6,935.1	4,419.0	6,188	63.7	70.6
84	30,613	8,459.1	5,108.3	5,993	60.4	68.2
85	34,219	9,119.1	5,409.9	6,325	59.3	72.2
86	39,695	10,112.7	6,340.5	6,261	62.7	71.5
87	44,353	12,492.6	7,312.0	6,066	58.5	69.2
88	48,049	14,518.1	7,613.0	6,311	52.4	72.0

Note: Gross generation in 1989 was 51,503 GWh.

Source: TEK

表3.10 経済活動別電力消費量の伸び

(Unit: GWh)

Economic Activity	1979	1980	1981	1982	1983	1984	1985	1986
Total	**19,663.1**	**20,398.2**	**22,030.0**	**23,586.8**	**24,464.2**	**27,671.1**	**30,250.0**	**33,540.0**
Agriculture, forestry hunting and fishing	149.0	160.3	168.9	187.7	197.2	223.1	243.9	280.4
Coal and lignite mining	548.5	557.3	567.0	620.4	651.8	737.2	806.0	905.7
Mining industries other than coal and lignite mining	202.2	182.2	196.7	184.4	193.7	219.0	239.5	273.5
Food, beverage and tobacco industries	1,487.2	1,539.4	1,587.9	1,751.0	1,809.5	2,046.2	2,236.8	2,490.1
Manufacture of textiles, leather and clothing	1,843.4	1,740.4	1,955.3	2,097.1	2,163.1	2,496.9	2,674.7	2,985.6
Manufacture of wood, paper and allied industries	982.0	1,021.6	1,112.0	1,157.4	1,215.9	1,395.4	1,503.5	1,670.0
Manufacture of rubber products	330.8	336.8	368.7	473.8	497.8	563.1	615.5	682.4
Manufacture of chemicals	1,522.4	1,522.2	1,716.9	1,779.7	1,839.7	2,080.9	2,305.1	2,565.8
Manufacture of earthenware and cement	1,977.2	2,001.7	2,286.4	2,358.1	2,407.3	2,722.8	2,976.7	3,308.4
Iron and steel basic industries	1,647.1	1,824.3	1,809.7	2,020.5	2,072.7	2,344.4	2,613.4	2,904.6
Non-ferrous metal basic industries	1,358.6	1,518.5	1,743.6	1,711.2	1,787.7	2,022.0	2,210.7	2,451.1
Manufacture of electrical machinery and transport equipment	396.3	390.2	459.5	518.6	544.8	656.4	718.7	799.9
Manufacturing industries not elsewhere classified	217.0	186.7	249.0	290.0	304.7	344.6	376.9	417.9
Building and public works	29.8	186.7	189.2	235.4	247.4	279.8	305.9	339.2
Public administration and public utilities	1,940.9	1,879.9	1,957.4	2,124.1	2,171.5	2,456.2	2,685.1	3,171.5
Commerce, services and handicrafts	1,345.3	1,371.2	1,494.7	1,686.0	1,751.2	1,980.8	2,165.3	2,271.0
Transportation and communication	193.6	190.0	203.6	236.4	248.7	291.3	307.4	339.9
Public illumination	290.5	289.5	298.4	309.0	333.1	356.7	386.9	462.3
Households	3,201.3	3,499.3	3,665.1	3,846.0	4,026.4	4,454.3	4,878.0	5,220.7

Source: Statistical Yearbook, 1987

表3.11 コンヤ・カラマン両県の受電電力量（1988年）

	Item	Received Energy (MWh)	Sent out Energy (MWh)	Loss (%)
A.	Substations			
	Konya I	216,740	216,740	-
	Konya II	100,093	96,194	3.9
	Karaman	64,779	64,137	1.0
	Ereğli	59,307	56,923	4.1
	Seydişehir	48,540	46,321	4.6
	Akşehir	46,328	43,859	5.4
	Ladik	43,936	41,572	5.4
	Cihanbeyli	32,902	30,437	7.5
	Çurma	28,394	28,796	-1.4
	Alibeyhöyügü	11,238	10,096	9.8
	Göksu	9,065	7,399	18.4
	Karasinir	8,809	7,785	11.7
	Subtotal	670,124	650,259	3.0
B.	Other Provinces			
	Received	2,275	-	-
	Sent out	5,315	-	-
C.	Small Hydro	4,517	-	-
D.	Total	671,601	-	-

Source: TEK, Meram Power Distribution Company

表3.12 コンヤ・カラマン両県の消費電力量（1988年）

Category	Consumed Energy (MWh)	Composition (%)
1. Official Department	29,893	5.0
2. Household	204,229	33.9
3. commerce	29,637	4.9
4. Small Industry	129,376	21.5
5. Big Industry	92,888	15.4
6. State enterprise	48,028	8.0
7. Construction	3,293	0.6
8. Agriculture Irrigation	24,299	4.0
9. Municipality Waterworks	3,629	0.6
10. Village Water-works	1,684	0.3
11. Company Employees	1,738	0.3
12. Charitable Institution	1,732	0.3
13. Various Selling	5,316	0.9
14. Interior Illumi-nation	198	0.0
15. General Illumni-nation	25,633	4.3
16. TEK	1,305	0.2
Total	602,878	100.0

Source: TEK, Meram Power Distribution Company

表3.13　電気料金(1/3)

(Valid from 1/09/1989)

FOR GENERATION - TRANSMISSION ENTERPRISE

	ACTIVE ENERGY	PEAK-LOAD TARIFF (TL/kWh)			POWER	EXCESS POWER	REACTIVE ENERGY
	(TL/kWh)	17-22	22-06	06-17	(TL/kW)	(TL/kW)	(TL/kVARh)
A) TWO-PART TARIFF							
The provinces having priority in development	108.00	106.00	73.00	108.00	4,900.00	7,200.00	47.00
Other provinces	127.00	190.00	85.00	127.00	5,850.00	8,600.00	56.00
Istanbul, Kocaeli, Izmir, Ankara, Bursa, Adana	133.00	197.00	90.00	133.00	6,100.00	9,100.00	58.00
Arc ovens	94.00	135.00	66.00	94.00	3,960.00	7,700.00	41.00
B) ONE-PART TARIFF							
The provinces having priority in development	120.00						47.00
Other provinces	141.00						56.00
Istanbul, Kocaeli, Izmir, Ankara, Bursa, Adana	148.00						58.00
Special sale (ÇEAS and KEPEZ)	91.70						

表3.13　電気料金(2/3)

FOR DISTRIBUTION ENTERPRISES

A) TWO-PART TARIFF Industry							
The provinces having priority in development	115.00	168.00	80.00	115.00	5,200.00	8,600.00	66.00
Other provinces	136.00	200.00	93.00	136.00	6,200.00	10,200.00	77.00
Istanbul, Kocaeli, Izmir, Ankara, Bursa, Adana	143.00	210.00	97.00	143.00	6,500.00	10,750.00	80.00
Arc ovens	94.00	135.00	66.00	94.00	3,960.00	7,700.00	41.00
Organized industrial and small industrial districts							
The provinces having priority in development	109.00	160.00	74.00	109.00	5,000.00	8,300.00	61.00
Other provinces	128.00	190.00	87.00	128.00	5,900.00	9,700.00	72.00
Istanbul, Kocaeli, Izmir, Ankara, Bursa, Adana	135.00	198.00	93.00	135.00	6,200.00	10,200.00	77.00
B) ONE-PART TARIFF Industry							
The provinces having priority in development	128.00						66.00
Other provinces	151.00						77.00
Istanbul, Kocaeli, Izmir, Ankara, Bursa, Adana	159.00						80.00
Organized industrial and small industrial districts							
The provinces having priority in development	120.00						61.00
Other provinces	142.00						72.00
Istanbul, Kocaeli, Izmir, Ankara, Bursa, Adana	150.00						77.00
HOUSEHOLDS							
-up to and including 150 kWh in a month	85.00						
-over 150 kWh in a month	185.00						
Commerce - state organization - office	164.00						77.00
State and public establishments - sport installations	115.00						
Construction sites and temporary subscribers	155.00						77.00
Common parts of buildings	135.00						
Households groups to which whole sale selling is made	135.00						
Agricultural irrigation	48.00						
Domestic water for provinces and counties	151.00						77.00
Domestic water for villages	48.00						
Villages and subscribers of village	85.00						
Illumination of mosque and street							

表3.13 電気料金(3/3)

NOTES:

1) For electricity consumption of subscribers with arc oven in rolling-mills and elsewhere, industrial tariff shall be applied.

2) When measurement is made at the 0.4 kV side, to all items in tariffs 3% price increment shall be applied.

3) To the households, offices of the state establishment and organizations, public sport installations, prayer rooms, charities, embassies, public associations, common parts of households, household groups to which whole sale selling is made, villages, villages' subscribers, public part of villages and domestic water installations of villages having total installed capacity of 500 kVA or less than 500 kVA, reactive energy tariff shall not be applied.

4) Arc ovens tariff shall be applied at the whole voltage levels identically.

5) To the prayer rooms, charities and public associations, the tariff used for state and public organizations and sport installations shall be applied.

6) To the subscribers, inhabiting within the villages and having total installed capacity of 100 kVA or less than 100 kVA, the tariff used for villages and village subscribers shall be applied.

Source: TEK

表3.14 長期電力需要予測(1/2)

(High Scenario)

Year	Peak Demand (MW)	Growth Rate (%)	Required Energy (GWh)	Growth Rate (%)
1989	9,250	-	57,925	-
1990	10,370	12	64,910	12
1991	11,480	11	71,885	10
1992	12,650	10	79,200	10
1993	13,940	10	87,260	10
1994	15,485	11	96,140	10
1995	17,060	10	105,930	10
1996	18,695	9.6	115,710	9
1997	20,485	9.5	126,790	9.6
1998	22,450	9.6	138,940	9.6
1999	24,600	9.6	152,250	9.6
2000	26,955	9.5	166,830	9.6
2001	28,825	7	177,020	6
2002	30,825	7	189,310	7
2003	32,965	7	202,450	7
2004	35,255	7	216,500	7
2005	37,700	7	231,530	7
2006	40,320	7	247,600	7
2007	43,115	7	264,790	7
2008	46,110	7	283,170	7
2009	49,310	7	302,830	7
2010	52,730	7	323,850	7

Average Growth Rate: 8.5% per annum

Source: 1988 Long-Term Generation-Consumption Study (1994-2010), TEK

表3.14 長期電力需要予測(2/2)

(Low Scenario)

Year	Peak Demand (MW)	Growth Rate (%)	Required Energy (GWh)	Growth Rate (%)
1989	8,870	-	55,545	-
1990	9,860	11	61,760	11
1991	10,890	10	68,180	11
1992	12,020	10	75,260	10
1993	13,270	10	83,080	10
1994	14,815	10	91,785	10
1995	16,335	10	101,210	10
1996	17,820	9	110,610	9
1997	19,435	9	120,640	9
1998	21,195	9	131,575	9
1998	23,115	9	143,505	9
2000	25,210	9	156,515	9
2001	27,160	8	165,290	6
2002	29,265	8	178,085	8
2003	31,530	8	191,865	8
2004	33,970	8	206,715	8
2005	36,600	8	222,710	8
2006	39,430	8	239,945	8
2007	42,480	8	258,515	8
2008	45,770	8	278,520	8
2009	49,310	8	300,075	8
2010	53,125	8	323,295	8

Average growth rate: 8.7% per annum

Source: 1988 Long-Term Generation-Consumption Study (1994-2010), TEK

表3.15 ＧＤＰと電力消費量の成長率(1/2)

(Middle Income Countries, per Capita GDP: US$500-6,000)

Country	GDP Growth (%) 1965-80	GDP Growth (%) 1980-87	Energy Consumption Growth (%) 1965-80	Energy Consumption Growth (%) 1980-87
Lower Middle Income Countries (Per Capita GDP: 500-2,000)				
1. Philippine	5.9	-0.5	5.8	-1.4
2. Morocco	5.4	3.2	7.9	2.5
3. Egypt	6.8	6.3	6.2	6.6
4. Thailand	7.2	5.6	10.1	7.3
5. Turkey	6.3	5.2	8.5	7.3 (9.7)
6. Colombia	5.6	2.9	6.0	2.1
7. Chile	1.9	1.0	3.0	1.5
8. Peru	3.9	1.2	5.0	0.2
9. Jordan	-	4.3	9.7	7.9
10.Syria	8.7	0.3	12.4	4.4
11.Malaysia	7.4	4.5	6.7	6.2
12.Mexico	6.5	0.5	7.9	0.6
13.South Africa	4.1	1.0	4.3	3.7
14.Roland	-	-	4.8	0.9
Average	5.7	2.1	5.9	2.4
Higher Middle Income Countries (Per Capita GDP: 2,000-6,000)				
1. Brazil	9.0	3.3	9.9	4.0
2. Hungary	5.6	1.7	3.8	1.1
3. Argentine	3.5	-0.3	4.3	1.5
4. Yugoslavia	6.0	1.5	6.0	3.2
5. Algeria	7.5	3.8	11.9	5.3
6. Korea	9.5	8.6	12.1	5.9
7. Portugal	-	1.4	6.5	2.7 (4.0)
8. Venezuela	3.7	0.2	4.6	2.3
9. Greece	5.6	1.4	8.5	2.7 (4.2)
Average	6.7	3.4	7.3	3.0

Note:
1: The average includes other countries not shown in the above table.
2: ( ) shows growth rate of electric energy consumption for the period of 1980-87, 1989 OECD statistics.

Source: World Development Repot 1989, World Bank

表3.15 ＧＤＰと電力消費量の成長率(2/2)
(High Income Countries, per Capita GDP: US$6,000)

Country	GDP Growth (%) 1965-80	GDP Growth (%) 1980-87	Energy Consumption Growth (%) 1965-80	Energy Consumption Growth (%) 1980-87
1. Spain	4.6	2.1	6.5	1.9 (2.7)
2. Italy	3.8	2.1	3.7	0.0 (1.2)
3. England	2.4	2.6	0.9	1.1 (0.8)
4. Australia	4.2	3.2	5.0	0.6 (4.7)
5. Belgium	3.9	1.3	2.9	0.1 (2.4)
6. Netherlands	4.1	1.5	5.0	1.3 (0.8)
7. Austria	4.3	1.6	4.0	0.9 (2.7)
8. France	4.3	1.6	3.7	0.6 (5.6)
9. W. Germany	3.3	1.6	3.0	0.2 (1.8)
10.Finland	4.0	2.8	5.1	3.1 (4.0)
11.Denmark	2.9	2.5	2.4	1.0 (1.4)
12.Canada	5.0	2.9	4.5	0.9 (4.1)
13.Sweden	2.9	1.3	2.5	2.3 (6.2)
14.Japan	6.3	3.8	6.1	1.7 (3.2)
15.Norway	4.4	3.7	4.1	2.7 (3.1)
16.USA	2.7	3.1	2.3	0.1 (1.7)
17.Switzerland	2.0	1.7	3.1	2.0 (2.8)
OECD Average	3.6	2.7	3.0	0.5

Note:

1. The average includes other countries not shown in the above table.

2. ( ) shows growth rate of electric energy consumption for the period of 1980-87, 1989 OECD statistics.

Source: World Development Report 1989, World Bank

表3.16　電力需要予測のレビュー

	TEK's 1988 Forecast				Adjusted F'cast/1		Team's Forecast			
	High Scenario		Low Scenario		High S. Energy	Low S. Energy	High Scenario		Low Scenario	
	Energy (GWh)	Growth (%)	Energy (GWh)	Growth (%)	(%)	(%)	Energy (GWh)	Growth (%)	Energy (GWh)	Growth (%)
1989	57,925	-	55,545	-	52,062	52,062	52,062	-	52,062	-
90	64,910	12	61,760	11	58,310	57,790	56,485	8.5	55,706	7.0
91	71,885	10	68,180	11	64,140	64,145	61,289	8.5	59,606	7.0
92	79,200	10	75,260	10	70,555	70,560	66,498	8.5	63,778	7.0
93	87,260	10	83,080	10	77,610	77,615	72,151	8.5	68,243	7.0
94	96,140	10	91,785	10	85,370	85,380	78,283	8.5	70,020	7.0
95	105,930	10	101,210	10	93,910	93,915	84,437	8.5	78,131	7.0
96	115,710	9	110,610	9	102,360	102,370	92,157	8.5	83,600	7.0
97	126,790	9.6	120,640	9	112,185	111,580	99,991	8.5	89,452	7.0
98	138,940	9.6	131,575	9	122,955	121,620	108,490	8.5	95,714	7.0
99	152,250	9.6	143,505	9	134,760	132,570	117,711	8.5	102,414	7.0
2000	166,830	9.6	156,515	9	147,700	144,500	127,717	8.5	109,583	7.0
01	177,020	6	165,290	6	156,560	153,170	138,573	8.5	117,254	7.0
02	189,310	7	178,085	8	167,520	165,425	150,351	8.5	125,461	7.0
03	202,450	7	191,865	8	179,245	178,660	163,131	8.5	134,244	7.0
04	216,500	7	206,715	8	191,790	192,950	176,997	8.5	143,641	7.0
05	231,530	7	222,710	8	205,215	208,390	192,042	8.5	153,696	7.0
06	247,600	7	239,945	8	219,580	225,060	208,366	8.5	164,454	7.0
07	264,790	7	258,515	8	234,950	243,060	226,077	8.5	175,966	7.0
08	283,170	7	278,520	8	251,400	262,510	245,293	8.5	188,284	7.0
09	302,830	7	300,075	8	269,000	283,510	266,143	8.5	201,463	7.0
10	323,850	7	323,295	8	287,830	306,190	288,766	8.5	215,566	7.0

/1: Actual result is used for 1989 demand and growth rate is same as the 1988 forecast.

表3.17　日負荷曲線の特徴（2000年）

Item	April	July	December
1. Maximum demand time in a day (o'clock)	21	22	18
2. Minimum demand time in a day (o'clock)	4	7	7
3. Maximum demand day	Thursday	Thursday	Wednesday
4. Ratio of minimum/maximum demand in a day			
Weekday	0.647	0.680	0.625
Saturday	0.668	0.702	0.627
Sunday	0.655	0.694	0.663
5. Ratio against maximum demand in a week			
Sunday peak/weekly peak	0.850	0.855	0.806
Saturday peak/weekly peak	0.952	0.960	0.986
Min. of weekday peak/ weekly peak	0.969	0.979	0.976
6. Daily load factor			
Weekday	0.800	0.826	0.813
Sunday	0.790	0.800	0.803
Saturday	0.820	0.829	0.814

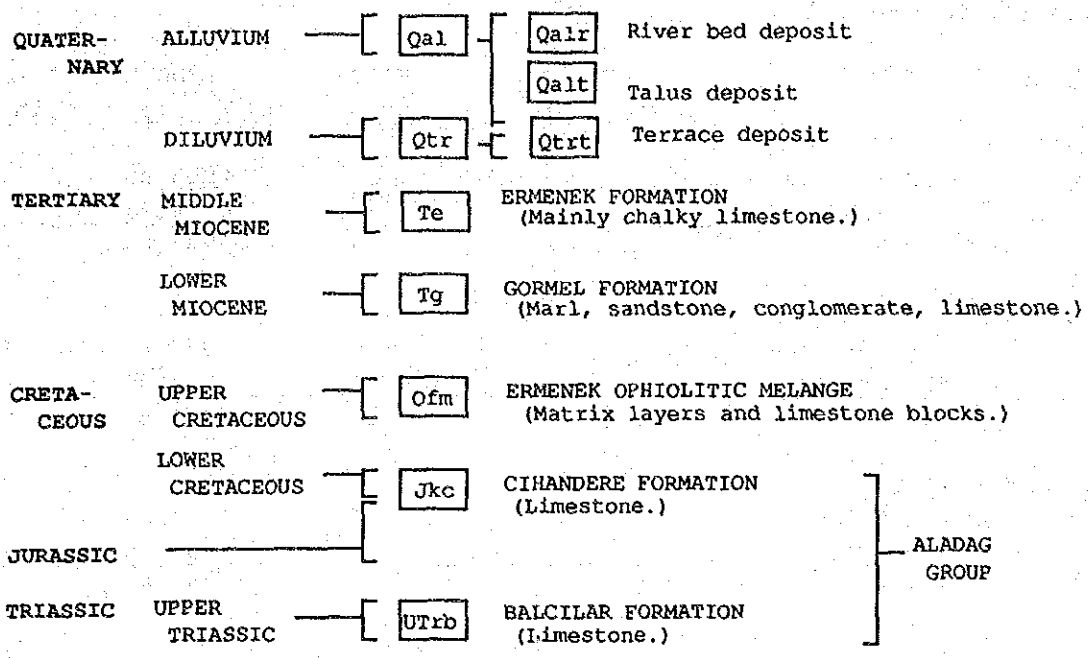
Source: TEK

表3.18 コンヤ・カラマン両県の電力需要予測

Year	General Demand 1/ Peak (MW)	General Demand 1/ Energy (GWh)	Heavy Industry 2/ Peak (MW)	Heavy Industry 2/ Energy (GWh)	Total Peak (MW)	Total Energy (GWh)
1988	140	671	-	-	-	-
89	150	721	146	1,114	296	1,835
90	167	801	152	1,147	319	1,948
91	184	889	159	1,182	343	2,071
92	202	978	166	1,217	368	2,195
93	222	1,075	173	1,254	395	2,329
94	245	1,183	180	1,291	425	2,474
95	269	1,301	187	1,330	456	2,631
96	293	1,418	195	1,370	488	2,788
97	320	1,546	203	1,411	523	2,957
98	348	1,685	211	1,454	559	3,139
99	380	1,837	219	1,497	599	3,334
2000	414	2,002	227	1,542	641	3,544
01	447	2,122	236	1,588	683	3,710
02	483	2,292	245	1,636	728	3,928
03	521	2,475	255	1,685	776	4,160
04	563	2,673	264	1,736	827	4,409
05	608	2,887	274	1,788	882	4,675
06	657	3,118	284	1,841	941	4,959
07	709	3,368	295	1,897	1,004	5,265
08	766	3,637	306	1,953	1,072	5,590
09	828	3,928	317	2,012	1,145	5,940
10	894	4,242	328	2,072	1,222	6,314

1/: Same growth rates as the low scenario forecast are applied.
2/: 3% growth per annum is assumed for the energy demand and 60% load factor is assumed for the increased portion.

表5.1　計画地域の地質



ERMENEK OPHIOLITIC MELANGE

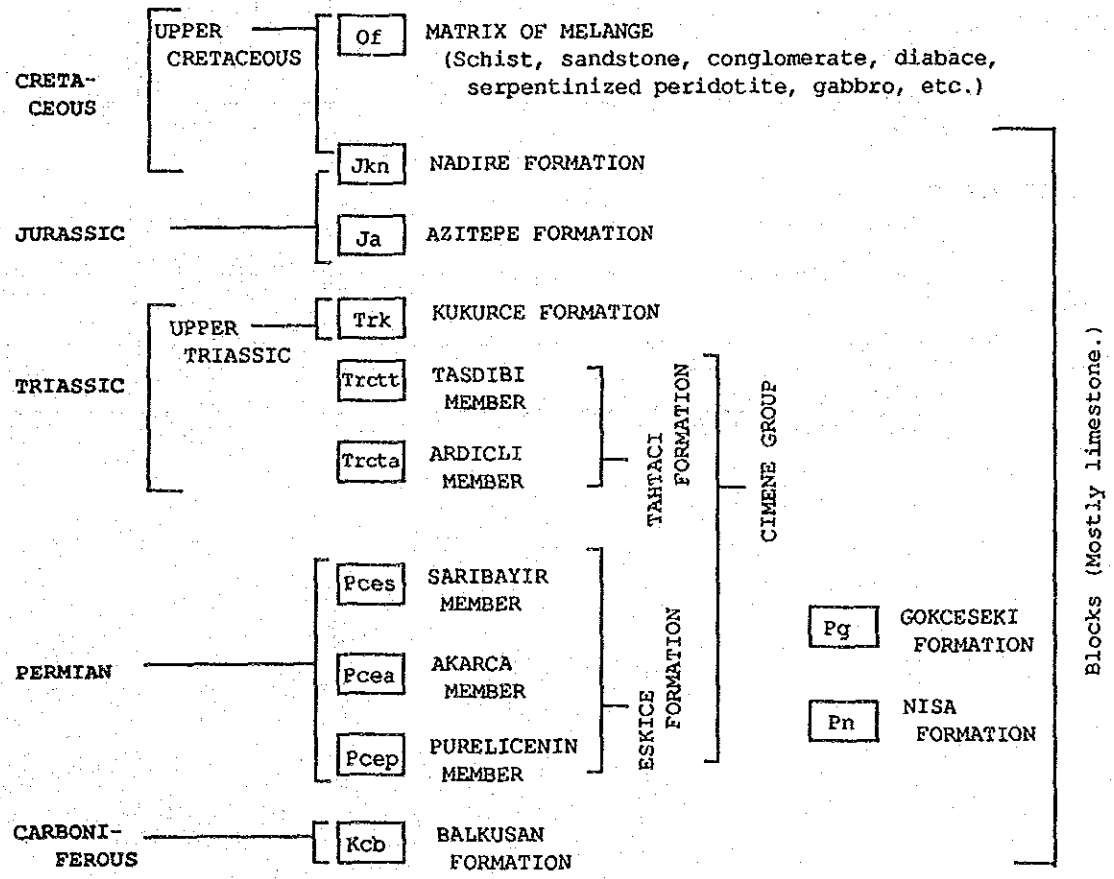


表5.2 コアボーリングの数量(1/4)

1. SUMMARY OF WORK QUANTITY

LOCATION		HOLE (nos)	LENGTH (m)	LU.TEST (times)
DAMSITE I-B AND LANDSLIDE AREA				
	PRE F/S STAGE	17	2005.85	223
	F/S STAGE	2	228.00	30
	TOTAL	19	2233.85	253
DAMSITE I-C				
	PRE F/S STAGE	8	2340.65	697
	F/S STAGE	4	1235.90	171
	TOTAL	12	3576.55	868
POWER HOUSE AREA				
	PRE F/S STAGE	0	0.00	0
	F/S STAGE	5	754.80	22
	TOTAL	5	754.80	22
QUARRY SITE				
	PRE F/S STAGE	0	0.00	0
	F/S STAGE	2	109.00	0
	TOTAL	2	109.00	0
LIMESTONE AREA NEAR NADIRE				
	PRE F/S STAGE	2	546.05	48
	F/S STAGE	0	0.00	0
	TOTAL	2	546.05	48
HEADRACE TUNNEL AREA				
	PRE F/S STAGE	1	218.50	0
	F/S STAGE	0	0.00	0
	TOTAL	1	218.50	0
TOTAL	PRE F/S STAGE	28	5111.05	968
	F/S STAGE	13	2327.70	223
	GRAND TOTAL	41	7438.75	1191

表5.2　コアボーリングの数量(2/4)

2. WORK QUANTITY FOR EACH SITE

(1) DAMSITE I-B AND LANDSLIDE AREA

PRE F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LONG.	LU.TEST (times)
SK-201	200.00	544.30	4,048,094.87	495,429.37	12
SK-202	150.00	613.50	4,048,392.96	495,401.29	30
SK-203	35.00	516.76	4,047,818.36	495,383.80	6
SK-204	33.00	514.21	4,047,761.60	495,379.33	6
SK-205	150.00	524.89	4,047,958.88	495,399.81	23
SK-206	100.00	538.55	4,048,322.36	494,517.04	33
SK-207	200.00	534.14	4,047,633.45	495,464.86	38
SK-208	127.00	547.35	4,047,443.94	495,457.06	18
SK-209	101.00	619.57	4,048,310.69	495,526.30	9
SK-210	101.00	608.36	4,048,276.01	495,636.52	10
SK-211	50.00	553.43	4,048,136.51	495,337.52	4
SK-212	125.00	602.31	4,047,331.59	495,730.59	16
SK-213	100.00	602.56	4,047,330.54	495,731.04	13
SK-214	160.00	715.51	4,048,587.69	495,564.30	5
SK-217	201.20	713.74	4,048,893.91	495,645.81	0
SK-218	85.00	762.49	4,049,271.13	495,534.45	0
SK-219	87.65	709.72	4,048,914.23	495,933.67	0
SUB TOTAL	2005.85				223

F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LONG.	LU.TEST (times)
SK-220	150.00	748.78	4,049,165.13	495,701.12	7
SK-221	78.00	628.26	4,048,465.50	496,032.73	23
SUB TOTAL	228.00				30
TOTAL	2233.85				253

表5.2 コアボーリングの数量(3/4)

(2) DAMSITE I-C

PRE F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LONG.	LU.TEST (times)
SK-301	178.00	668.85	4,048,239.23	496,925.74	70
SK-302	200.65	614.76	4,048,523.65	496,492.08	53
SK-303	143.75	651.83	4,048,805.27	496,324.60	2
SK-304	499.35	676.73	4,048,126.64	497,011.07	170
SK-305	426.50	750.07	4,047,939.09	497,744.97	93
SK-306	425.00	708.54	4,047,369.51	497,635.14	124
SK-307	220.20	663.85	4,048,430.70	496,826.69	87
SK-308	247.20	578.42	4,048,180.55	496,628.42	98
SUB TOTAL	2340.65				697

F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LONG.	LU.TEST (times)
SK-309	190.80	674.07	4,047,374.28	496,882.20	16
SK-310	169.75	520.00			23
SK-313	425.00	729.65	4,048,720.74	497,216.38	87
SK-314	450.35	726.73	4,047,124.12	497,414.95	45
SUB TOTAL	1235.90				171
TOTAL	3576.55				868

(3) POWER HOUSE AREA

PRE F/S STAGE: No boring works.

F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LONG.	LU.TEST (times)
SK-102	341.60	615.25	4,048,303.56	505,971.89	1
SK-106	90.00	369.55	4,048,499.46	506,424.62	6
SK-107	50.00	368.89	4,049,255.17	507,504.22	15
SK-108a	72.00	484.19	4,048,401.81	506,140.73	0
SK-108b	201.20	484.19	4,048,401.81	506,140.73	0
SUB TOTAL	754.80				22
TOTAL	754.80				22

(SK-103, 104 & 105: Canceled.)

表5.2 コアボーリングの数量(4/4)

(4) QUARRY SITE

PRE F/S STAGE: No boring works.

F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LOCATION LONG.	LU.TEST (times)
SK-311	59.00	789.27	4,049,783.04	496,566.96	0
SK-312	50.00	864.52	4,049,521.46	496,600.14	0
SUB TOTAL	109.00				0
TOTAL	109.00				0

(5) LIMESTONE AREA NEAR NADIRE

F/S STAGE: No boring works.

PRE F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LOCATION LONG.	LU.TEST (times)
SK-215	201.05	739.88	4,049,449.32	481,050.10	1
SK-216	345.00	838.28	4,049,100.35	482,217.01	47
SUB TOTAL	546.05				48
TOTAL	546.05				48

(6) HEADRACE TUNNEL AREA

F/S STAGE: No boring works.

PRE F/S STAGE

HOLE NO.	DEPTH (m)	EL. (m)	LOCATION LAT.	LOCATION LONG.	LU.TEST (times)
SK-101	218.50	980.61	4,048,252.26	501,596.09	0
SUB TOTAL	218.50				0
TOTAL	218.50				0

表5.3 室内材料試験結果一覧：FOUNDATION ROCKS OF I-C DAM SITE (SK-302, 307 AND 313)

Hole No.	Depth	(m)	Physical Test: Compressive strength (kg/cm2)	Water absorption (x10-3 %)	Bulk specific gravity (g/cm3)	Density (g/cm3)	Super Sonic Test: Longt. velocity Vp(m/sn)	Transv. velocity Vs(m/sn)	Poisson's ratio	Dynum. shear modulus G(kg/cm2)	Dynum. elast. modulus E(kg/cm2)
SK-302	21.60 -	21.85	499	1.75	2.04	2.78	5,890	2,896	0.34	245,614	658,534
	21.85 -	22.25	1,036	1.04	1.67	2.85	6,273	2,924	0.36	248,641	676,906
	22.25 -	22.50	726	1.01	2.23	2.77	5,847	2,875	0.34	233,630	626,394
	22.70 -	23.00	647	1.67	1.67	2.79	5,938	2,836	0.35	228,976	619,264
	Average		727	1.37	1.90	2.80	5,987	2,883	0.35	239,215	645,275
SK-307	40.50 -	40.80	601	0.79	2.24	2.83	6,131	2,877	0.36	239,023	649,574
	40.80 -	41.07	338	1.90	2.23	2.85	6,268	2,883	0.37	241,717	660,293
	45.60 -	45.85	561	0.59	2.25	2.89	6,444	2,862	0.38	241,552	665,301
	46.15 -	46.55	632	0.59	2.24	2.80	6,007	2,808	0.36	225,282	612,854
	Average		533	0.97	2.24	2.84	6,213	2,858	0.37	236,894	647,006
SK-313	22.50 -	23.00	712	1.00	2.34	2.83	6,143	3,052	0.34	268,986	718,802
	23.15 -	23.35	288	1.90	2.33	2.85	6,267	3,091	0.34	277,854	744,242
	26.65 -	27.00	1,301	1.20	2.33	2.89	6,458	3,185	0.34	299,151	801,303
	28.00 -	28.25	683	1.30	2.31	2.90	6,489	3,210	0.34	304,917	815,959
	29.20 -	29.40	1,060	1.50	2.32	2.90	6,500	3,204	0.34	303,778	813,835
	51.30 -	51.60	1,366	0.79	2.30	2.88	6,402	3,178	0.34	296,807	793,365
	57.50 -	57.70	521	1.70	2.31	2.85	6,258	3,108	0.34	280,919	750,780
	74.70 -	75.00	518	1.80	2.31	2.84	6,224	3,091	0.34	276,879	739,992
	79.00 -	79.30	1,150	1.40	2.29	2.90	6,475	3,261	0.33	314,683	837,107
	79.30 -	79.50	518	0.57	2.30	2.85	6,232	3,116	0.33	282,367	752,978
	Average		812	1.32	2.31	2.87	6,345	3,150	0.34	290,634	776,836
	Average of all		731	1.25	2.21	2.85	6,236	3,025	0.35	267,265	718,749

表5.4 エルマネック計画の岩石分類表

(1) HARDNESS

Class.	Explanation
A	Hard rocks. Very strong.
B	Medium hard rocks. Strong.
C	Soft rocks and moderately friable rocks. Moderately strong.
D	Very soft rocks and highly friable rocks. Weak.
E	Decomposed rocks. Rocks are almost decomposed by weathering, alteration and/or fault fracturing. Very weak.

(2) WEATHERING CONDITION

Class.	Explanation
a	Fresh rocks. No visible sign of weathering and discoloration on joint surface.
b	Slightly weathered rocks. Discoloration is generally seen on joint surface.
c	Moderately weathered rocks. Weathering is seen along some joints. Discoloration and thin weathered materials are generally seen on joint surface.
d	Highly weathered rocks. Weathering is seen along most of joints. Discoloration and rather thick weathered materials are observed on joint surface.
e	Decomposed rocks. Rocks are almost decomposed by weathering.

(3) JOINT SPACING

Class.		Spacing(cm)	Nos of joints(/m)
I	Extremely wide	More than 200	0
II	Very wide	60 - 200	0 - 2
III	Wide	20 - 60	2 - 5
IV	Moderately wide	6 - 20	5 - 20
V	Narrow	2 - 6	More than 20
VI	Very narrow	Less than 2	-

表5.5　計画地域の岩石の物性値

Rock Classification for Ermenek Project									Rock Classification and Estimated Rock Properties (K.Kikuchi Et.al.)					
Hard Rock: Limestone, etc.			Medium Hard Rock: Sandstone, Congiomerate, etc.			Soft Rock: Marl, Siltstone, Schist, etc.				Static Modulus of Elasticity (kg/cm2)	Modulus of Deformation (kg/cm2)	Cohesion (kg/cm2)	Internal Friction Angle (degree)	Elastic Wave Velocity (km/sec)
Hard.	Weath.	Joint.	Hard.	Weath.	Joint.	Hard.	Weath.	Joint.						
A	a	I							A					
A-B	b	I-III	B	a	I-III				B	80,000 or more	50,000 or more	40 or more	55 to 65	3.7 or more
B	b-c	III-IV	B-C	a-c	III-IV				CH	80,000 to 40,000	50,000 to 20,000	40 to 20	40 to 55	3.7 to 3.0
C	c	IV-V	C	b-c	IV-V	C-D	a-b	I-IV	CM	40,000 to 15,000	20,000 to 5,000	20 to 10	30 to 45	3.0 to 1.5
D	d	V	D	d	V	D	c-d	IV-V	CL	15,000 or less	5,000 or less	10 or less	15 to 38	1.5 or less
E	e	VI	E	e	VI	E	e	VI	D					

Notes.
Hard.: Hardness.
Weath.: Weathering condition.
Joint.: Joint frecuency.

Compressive Strength in Fresh Rock Condition (kg/cm2)	
Hard rock	More than "800 - 1,000"
Medium Hard Rock	"200 - 300" to "800 - 1,000"
Soft Rock	Less than "200 - 300"

表5.6 計画サイトにおける最大確度地震時の地盤加速度

Reference	Maximum Magnitude M	Epicneral Distance d (km)	Deth of Hypocenter R (km)	Ground Acceleration
1.Project Earthquake	6.0	0	25	0.0361-0.2932
2.Linear No.1	5.4	97	100	0.0006-0.0141
3.Linear No.2	5.5	154	156	0.0007-0.0080
4.E.A.F No.3	6.8	252	253	0.0018-0.0093
5.Earth-quake A	5.2	106	109	0.0009-0.0109
6.Earth-quake B	5.0	112	115	0.0005-0.0089
7.Earth-quake C	5.6	118	121	0.0017-0.0123

表5.7 テストピット調査の数量

BORROW AREA	PRE F/S STAGE PIT NO.	DEPTH (m)	SAMPLE (nos)	F/S STAGE PIT NO.	DEPTH (m)	SAMPLE (nos)
Aa	A-1	5.0	1			
	A-3	5.0	1			
Ab	A-2	4.0	1			
	A-4	3.0	1			
B	B-1	2.5	1			
C	C-1	5.0	1			
	C-2	3.0	1			
	C-3	5.0	1			
	C-4	2.0	1			
D	D-1	5.0	1			
	D-2	5.0	1			
	D-3	5.0	1			
	D-4	5.0	1			
E	E-1	3.5	1			
Ec				E-2	4.5	2
				E-3	3.2	2
Ea				E-4	3.5	2
				E-5	4.0	2
Eb				E-6	1.6	2
Fb	F-1	5.0	1			
	F-2	5.0	1			
	F-3	5.0	1			
Fa				F-4	3.5	2
				F-5	5.0	2
Ga	G-1	2.0	1			
	G-2	2.1	1			
	G-6	0.8	1			
Gb	G-5	0.8	1			
Gc	G-7	2.0	1	G-12	2.9	2
Gd	G-3	0.8	1	G-10	2.4	2
	G-4	1.7	1	G-11	1.8	2
Ge	G-8	3.6	1	G-13	2.0	2
	G-9	4.5	0			
H	H-1	3.0	1			
				H-2	1.0	0
				H-3	1.0	0
				H-4	1.0	0
				H-5	1.0	0
				H-6	1.0	0
I	I-1	3.0	1			
TOTAL	28	97.3	27	16	39.4	22

Notes:
(1) Borrow areas A, B, C, D, E, F, H & I ; for impervious materials.
(2) Borrow area Ga to Ge; for filter and concrete aggregate materials.
(3) Test pit H-1; downstream of I-B damsite.

表5.8 室内試験の数量

(1) Core Materials

Test item	Test quantity Pre-F/S stage	F/S stage	
Grain size analysis	19	14	samples
Natural moisture content	19	14	samples
Liquid & plastic limits	19	14	samples
Specific gravity	19	14	samples
Compaction test	19	14	cases
Permeability test	19	14	cases
Triaxial UU test	0	14	cases
Triaxial CU test	0	14	cases
Shear test	10	0	cases

(2) Filter Materials for Fill Dam and Concrete Aggregates

Test item	Test quantity Pre-F/S stage	F/S stage	
Grain size analysis	8	8	samples
Specific gravity & water absorption	8	12	samples
Soft rock ratio	0	4	samples
Soundness	8	12	samples
Abrasion	8	12	samples
Alkali aggregate reaction	0	12	samples

(3) Rock Materials for Fill Dam

Test item	Test quantity Pre-F/S stage	F/S stage	
Specific gravity & water absorption	0	17	samples
Unconfined compression test	0	17	samples
Super sonic wave test	0	17	samples

(4) Foundation Rock for Damsite I-C

Test item	Test quantity Pre-F/S stage	F/S stage	
Specific gravity & water absorption	0	18	samples
Unconfined compression test	0	18	samples
Super sonic wave test	0	18	samples

表5.9　コア材の室内試験結果(1/4)

Borrow Area　Aa

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
A-1	9.52	3	31	66	33.7	25.0	8.7	19.9	OL-ML	17.9	17.5	1.72											0.1700
A-3	9.52	1	17	82	30.4	22.8	7.6	20.0	OL-ML	21.4	18.0	1.68											0.2200
Average	9.52	2	24	74	32.1	23.9	8.2	20.0		19.7	17.8	1.70											0.1950
Max.	9.52	3	31	82	33.7	25.0	8.7	20.0		21.4	18.0	1.72											0.2200
Min.	9.52	1	17	66	30.4	22.8	7.6	19.9		17.9	17.5	1.68											0.1700

Borrow Area　Ab

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
A-2	0.59	0	51	49					SP	13.7	13.0	1.84											1.2000
A-4	0.59	0	63	37					SP	9.7	13.2	1.81											1.4500
Average	0.59	0	57	43						11.7	13.1	1.83											1.3250
Max.	0.59	0	63	49						13.7	13.2	1.84											1.4500
Min.	0.59	0	51	37						9.7	13.0	1.81											1.2000

Borrow Area　Fa

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
F-4A	38.10	2	26	72	36.2	25.7	10.5		CL	17.0	15.0	1.87	1.14	39	1.12	39	0.82	9					0.0170
F-4B	38.10	8	35	57	37.2	23.7	13.5		CL	17.0	16.0	1.83	1.19	25	1.10	26	1.84	11					0.0210
F-5A	19.10	1	9	90	36.8	24.3	12.5		CL	17.0	12.0	1.88	0.62	39	0.66	38	1.73	21					0.0120
F-5B	19.10	2	8	90	37.0	21.4	15.6		CL	17.0	14.0	1.91	0.53	33	0.38	34	1.46	24					0.0130
Average	28.60	3	20	77	36.8	23.8	13.0			17.0	14.3	1.87	0.87	34	0.82	34	1.46	16					0.0158
Max.	38.10	8	35	90	37.2	25.7	15.6			17.0	16.0	1.91	1.19	39	1.12	26	1.84	24					0.0210
Min.	19.10	1	8	57	36.2	21.4	10.5			17.0	12.0	1.83	0.53	25	0.38	39	0.82	9					0.0120

表5.9 コア材の室内試験結果(2/4)

Borrow Area Fb

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist. Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
F-1	4.76	0	23	77	34.0	22.0	12.0	11.5	CL		18.5	1.70							0.81	21.7	0.89	25.5	0.0320
F-2	9.52	1	9	90	39.4	24.8	14.6	10.5	CL		20.3	1.64							0.45	20.0	0.56	22.0	0.0014
F-3	4.76	0	6	94	36.0	20.0	16.0	12.2	CL		16.5	1.67							0.58	22.0	0.67	25.6	0.0260
Average	6.35	0	13	87	36.5	22.3	14.2	11.4			18.4	1.67							0.61	21.2	0.70	24.4	0.0198
Max.	9.52	1	23	94	39.4	24.8	16.0	12.2			20.3	1.70							0.81	22.0	0.89	25.6	0.0320
Min.	4.76	0	6	77	34.0	20.0	12.0	10.5			16.5	1.64							0.45	20.0	0.56	22.0	0.0014

Borrow Area C

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist. Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
C-1	9.52	2	17	81	60.5	26.6	33.9	20.7	CH	20.5	23.3	1.55											0.0320
C-2	9.52	2	21	77	31.7	19.3	12.4	12.8	CL	15.0	19.0	1.66											0.0280
C-3	19.10	7	21	72	56.1	33.4	22.7	24.3	CH-MH	20.3	21.1	1.56											0.3100
C-4	19.10	5	23	72	32.3	21.8	10.5	19.4	CL	17.7	19.5	1.65											0.0550
Average	14.31	4	21	76	45.2	25.3	19.9	19.3		18.4	20.7	1.61											0.1063
Max.	19.10	7	23	81	60.5	33.4	33.9	24.3		20.5	23.3	1.66											0.3100
Min.	9.52	2	17	72	31.7	19.3	10.5	12.8		15.0	19.0	1.55											0.0200

Borrow Area D

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist. Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
D-1	19.10	2	9	89	34.5	22.5	12.0	9.0	CL-ML		18.5	1.72							0.17	24.9	0.20	28.7	0.0610
D-2	19.10	2	10	88	40.4	24.0	16.4	10.9	CL		19.2	1.67							0.51	25.8	0.57	29.8	0.0025
D-3	9.52	1	18	81	36.1	23.6	12.5	10.6	CL-ML		17.5	1.70							0.52	25.2	0.55	29.7	0.0410
D-4	4.76	0	6	94	38.7	23.4	15.3	9.5	CL		19.3	1.66							0.19	18.7	0.21	21.8	0.0180
Average	13.12	1	11	88	37.4	23.4	14.1	10.0			18.6	1.69							0.35	23.7	0.38	27.5	0.0306
Max.	19.10	2	18	94	40.4	24.0	16.4	10.9			19.3	1.72							0.52	25.8	0.57	29.8	0.0610
Min.	4.76	0	6	81	34.5	22.5	12.0	9.0			17.5	1.66							0.17	18.7	0.21	21.8	0.0025

表5.9　コア材の室内試験結果(3/4)

Borrow Area B and I

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
B-1	4.76	0	17	83	29.5	21.4	8.1	17.5	CL	16.1	18.4	1.70											0.0410
I-1	19.10	3	21	76	49.3	30.4	18.9	17.3	ML		22.0	1.61							0.50	27.1	0.60	29.2	0.0220

Borrow Area Ea

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
E-4A	4.76	0	24	76	35.3	21.6	13.7		CL	20.0	18.5	1.69	0.23	28	0.11	31	0.61	14					0.0210
E-4B	4.76	0	21	79	35.6	21.5	14.1		CL	20.0	18.8	1.70	0.17	28	0.23	28	0.89	10					0.0220
E-5A	4.76	0	10	90	31.3	20.5	10.8		CL	23.0	17.6	1.76	0.30	27	0.11	32	0.70	4					0.0140
E-5B	4.76	0	10	90	30.4	20.3	10.1		CL	21.0	17.5	1.75	0.29	28	0.26	29	1.53	13					0.0120
Average	4.76	0	16	84	33.2	21.0	12.2			21.0	18.1	1.73	0.25	28	0.18	30	0.93	10					0.0173
Max.	4.76	0	24	90	35.6	21.6	14.1			23.0	18.8	1.76	0.30	28	0.26	32	1.84	14					0.0220
Min.	4.76	0	10	76	30.4	20.3	10.1			20.0	17.5	1.69	0.17	27	0.11	28	0.61	4					0.0120

Borrow Area Eb

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
E-6A	4.76	0	36	64	32.0	20.5	11.5		CL	17.0	20.8	1.67	0.19	28	0.23	29	0.98	1					0.0350
E-6B	4.76	0	25	75	36.3	25.5	10.8		CL	16.0	19.5	1.62	0.16	27	0.03	32	1.84	18					0.0290
Average	4.76	0	31	70	34.2	23.0	11.2			16.5	20.2	1.65	0.18	28	0.13	31	1.41	10					0.0320
Max.	4.76	0	36	75	36.3	25.5	11.5			17.0	20.8	1.67	0.19	28	0.23	32	1.84	18					0.0350
Min.	4.76	0	25	64	32.0	20.5	10.8			16.0	19.5	1.62	0.16	27	0.03	29	0.98	1					0.0290

表5.9　コア材の室内試験結果(4/4)

Borrow Area Ec

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist. Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
E-2A	38.10	15	36	49	36.4	25.1	11.3		SC-CL	21.0	16.0	1.86	0.92	30	0.90	30	0.92	19					0.2800
E-2B	90.00	45	26	29	38.0	25.0	13.0		GC-CL	19.0	16.0	1.88	0.77	31	0.68	32	1.85	20					0.1300
E-3A	38.10	19	30	51	33.7	23.0	10.7		CL	16.0	14.0	1.92	1.88	24	1.92	23	1.68	24					0.0200
E-3B	38.10	17	42	41	32.3	21.7	10.6		SC	16.0	14.0	1.94	0.46	36	0.32	37	1.38	15					0.0190
Average	51.08	24	34	43	35.1	23.7	11.4			18.0	15.0	1.90	1.01	30	0.96	31	1.46	20					0.1123
Max.	90.00	45	42	51	38.0	25.1	13.0			21.0	16.0	1.94	1.88	36	1.92	37	1.85	24					0.2800
Min.	38.10	15	26	29	32.3	21.7	10.6			16.0	14.0	1.86	0.46	24	0.32	23	0.92	15					0.0190

Other Test Results

Test pit No.	Particle Size Distribution				Atterberg Limits				USC	Natural Moist. Content	Compaction		Triaxial Compression(CU)				Triaxial Compression(UU)		Shear Test				Permeability
	MGS (mm)	G (%)	S (%)	SC (%)	LL (%)	PL (%)	PI	BL		(%)	OMC (%)	rd max (t/m3)	Cu (kg/cm2)	ou (deg.)	c' (kg/cm2)	o (deg.)	Cu (kg/cm2)	ou (deg.)	c (kg/cm2)	o (deg.)	c' (kg/cm2)	o (deg.)	k (x10-5 cm/s)
E-1	19.10	13	54	33					SP		14.3	1.85							0.21	35.3	0.19	40.3	1.4000
H-1	38.10	20	27	53	33.0	21.0	12.0	13.0	CL		13.1	1.74							0.25	31.9	0.24	36.7	0.0021

表5.10 骨材の室内試験結果(1/2)

BORROW AREA Ga

Test Pit No.	Unit Weight Sand (t/m3)	Unit Weight Gravel (t/m3)	Particle Size Distribution MGS (mm)	G (%)	S (%)	SC (%)	Passing No.200 sieve Sand (%)	Passing No.200 sieve Gravel (%)	Clay lumps Sand (%)	Clay lumps Gravel (%)	Specific Gravity Sand (g/cm3)	Specific Gravity Gravel (g/cm3)	Water Absorption Sand (%)	Water Absorption Gravel (%)	Soundness Sand (%)	Soundness Gravel (%)	Los Angels Abrasion (500cycles) (%)
G-1	1.46	1.76	50.80	33	40	27	40.00	3.90	57.20	2.56	2.52	2.69	3.9	0.8	11.5	8.3	22.6
G-2	1.74	1.62	50.80	61	36	3	8.00	0.10	3.73	0.20	2.60	2.67	3.3	1.0	10.8	6.6	23.9
G-6	1.71	1.79	76.20	58	39	3	8.20	0.20	1.61	0.33	2.63	2.66	3.7	1.2	11.0	11.0	23.9
Average	1.64	1.72		51	38	11	18.73	1.40	20.85	1.03	2.58	2.67	3.6	1.0	11.1	8.6	23.5
Max.	1.74	1.79	76.20	61	40	27	40.00	3.90	57.20	2.56	2.63	2.69	3.9	1.2	11.5	11.0	23.9
Min.	1.46	1.62	50.80	33	36	3	8.00	0.10	1.61	0.20	2.52	2.66	3.3	0.8	10.8	6.6	22.6

BORROW AREA Gb

Test Pit No.	Unit Weight Sand (t/m3)	Unit Weight Gravel (t/m3)	Particle Size Distribution MGS (mm)	G (%)	S (%)	SC (%)	Passing No.200 sieve Sand (%)	Passing No.200 sieve Gravel (%)	Clay lumps Sand (%)	Clay lumps Gravel (%)	Specific Gravity Sand (g/cm3)	Specific Gravity Gravel (g/cm3)	Water Absorption Sand (%)	Water Absorption Gravel (%)	Soundness Sand (%)	Soundness Gravel (%)	Los Angels Abrasion (500cycles) (%)
G-5	1.67		76.20	18	78	4	4.90	0.60	8.37	1.40	2.58	2.58	3.9	3.1	8.8	6.2	

BORROW AREA Gc

Test Pit No.	Unit Weight Sand (t/m3)	Unit Weight Gravel (t/m3)	Particle Size Distribution MGS (mm)	G (%)	S (%)	SC (%)	Passing No.200 sieve Sand (%)	Passing No.200 sieve Gravel (%)	Clay lumps Sand (%)	Clay lumps Gravel (%)	Specific Gravity Sand (g/cm3)	Specific Gravity Gravel (g/cm3)	Water Absorption Sand (%)	Water Absorption Gravel (%)	Soundness Sand (%)	Soundness Gravel (%)	Los Angels Abrasion (500cycles) (%)
G-7	1.59	1.69	76.20	56	33	11	24.00	0.60	16.00	0.94	2.60	2.66	3.3	1.1	12.3	6.0	24.4
G-12A			76.20	60	33	7					2.68	2.65	1.8	1.2	13.7	9.9	25.6
G-12B			76.20	66	29	5					2.61	2.65	2.9	1.2	13.3	8.2	26.6
Average			76.20	61	32	8					2.63	2.65	2.7	1.2	13.1	8.0	25.5
Max.				66	33	11					2.68	2.66	3.3	1.2	13.7	9.9	26.6
Min.				56	29	5					2.60	2.65	1.8	1.1	12.3	6.0	24.4

Notes: SC (silt - clay) of samples G-10A to G-13B; % of No.100 sieve passing.
G-1 to G-8; tested in 1987, G-10 to -13; tested in 1990.
MSC: Maximum gravel size. G: Gravel S: Sand

表5.10 骨材の室内試験結果(2/2)

BORROW AREA Gd

Test Pit No.	Unit Weight Sand (t/m3)	Unit Weight Gravel (t/m3)	Particle Size Distribution MGS (mm)	G (%)	S (%)	SC (%)	Passing No.200 sieve Sand (%)	Passing No.200 sieve Gravel (%)	Clay lumps Sand (%)	Clay lumps Gravel (%)	Specific Gravity Sand (g/cm3)	Specific Gravity Gravel (g/cm3)	Water Absorption Sand (%)	Water Absorption Gravel (%)	Soundness Sand (%)	Soundness Gravel (%)	Los Angels Abrasion (500cycles) (%)
G-3	1.79	1.69	76.20	43	53	4	7.30	0.50	1.62	0.13	2.63	2.65	2.5	1.1	7.8	8.8	25.0
G-4	1.82	1.69	76.20	46	48	6	10.50	0.20	2.21	0.48	2.65	2.67	2.5	0.9	8.3	10.6	25.0
G-10A			102.00	76	23	1					2.71	2.65	0.8	1.1	12.1	7.1	23.9
G-10B			102.00	70	29	1					2.70	2.70	1.2	0.5	10.1	13.5	28.6
G-11A			102.00	68	31	1					2.68	2.69	1.8	0.9	11.7	5.7	24.7
G-11B			102.00	59	40	1					2.70	2.66	1.6	1.0	12.7	6.2	24.6
Average	1.81	1.69		60	37	2	8.90	0.35	1.92	0.31	2.68	2.67	1.7	0.9	10.5	8.7	25.3
Max.			102.00	76	53	6					2.71	2.70	2.5	1.1	12.7	13.5	28.6
Min.			76.20	43	23	1					2.63	2.65	0.8	0.5	7.8	5.7	23.9

BORROW AREA Ge

Test Pit No.	Unit Weight Sand (t/m3)	Unit Weight Gravel (t/m3)	Particle Size Distribution MGS (mm)	G (%)	S (%)	SC (%)	Passing No.200 sieve Sand (%)	Passing No.200 sieve Gravel (%)	Clay lumps Sand (%)	Clay lumps Gravel (%)	Specific Gravity Sand (g/cm3)	Specific Gravity Gravel (g/cm3)	Water Absorption Sand (%)	Water Absorption Gravel (%)	Soundness Sand (%)	Soundness Gravel (%)	Los Angels Abrasion (500cycles) (%)
G-8	1.55		50.80	14	75	11	12.30	1.50	36.40	2.36	2.66	2.65	2.0	1.2	11.9	7.6	
G-13A			76.20	70	25	5					2.66	2.67	2.0	1.0	15.3	9.4	23.1
G-13B			76.20	56	34	10					2.65	2.66	2.5	1.1	14.7	6.5	24.7
Average				47	45	9					2.66	2.66	2.2	1.1	14.0	7.8	23.9
Max.			76.2	70	75	11					2.66	2.67	2.5	1.2	15.3	9.4	
Min.			50.8	14	25	5					2.65	2.65	2.0	1.0	11.9	6.5	

Notes: SC (silt - clay) of samples G-10A to G-13B; % of No.100 sieve passing.
G-1 to G-8; tested in 1987, G-10 to -13; tested in 1990.
MSC: Maximum gravel size. G: Gravel S: Sand

表5.11　ロック材の室内試験結果：**QUARRY SITE (SK-311 AND SK-312)**

			Physical Test			Super Sonic Test						
Hole No.	Depth	(m)	Compressive strength (kg/cm2)	Water absorption (x10-3 %)	Bulk specific gravity (g/cm3)	Density (g/cm3)	Longt. velocity Vp(m/sn)	Transv. velocity Vs(m/sn)	Poisson's ratio	Dynum. shear modulus G(kg/cm2)	Dynum. elast. modulus E(kg/cm2)	Bulk modulus k(kg/cm2)
SK-311	12.20 -	12.50		2.50	1.68							
	12.80 -	19.15		1.24	2.28							
	18.80 -	19.15	1,322			2.89	6,468	3,147	0.34	297,508	797,324	830,546
	22.95 -	23.20	1,244	1.29	2.12	2.89	6,429	3,103	0.35	289,248	780,968	867,744
	32.65 -	32.87	170	1.65	2.23	2.72	5,586	2,793	0.33	220,551	586,664	575,162
	35.05 -	35.35	409	0.98	1.92	2.83	6,164	3,030	0.34	270,068	723,783	753,946
	44.70 -	44.90	617	1.36	2.16	2.89	6,436	3,066	0.35	282,386	762,440	847,157
	51.25 -	51.55		1.30	2.25							
	54.45 -	54.60	366	0.62	2.23	2.86	6,292	3,094	0.34	304,982	762,695	794,479
	55.05 -	55.30	1,509	3.37	1.82	2.88	6,409	3,147	0.34	296,478	794,560	827,670
	58.75 -	59.00	972	1.48	2.23	2.87	6,325	3,136	0.34	293,388	786,280	819,043
	Average		826	1.58	2.09	2.85	6,264	3,065	0.34	281,826	749,339	574,159
SK-312	15.70 -	16.10		0.35	2.28							
	21.60 -	21.90	1,313	1.50	2.19	2.88	6,389	3,194	0.33	305,400	812,364	796,437
	27.20 -	27.45	508	0.66	2.24	2.89	6,441	3,192	0.34	306,073	820,277	854,458
	31.25 -	31.55	441	0.61	2.33	2.89	6,468	3,264	0.33	320,043	851,317	834,624
	35.50 -	35.65	1,253	0.89	2.17	2.89	6,470	3,113	0.35	291,114	786,005	873,342
	37.00 -	37.30	685	2.10	2.29	2.89	6,435	3,159	0.34	299,782	803,411	836,888
	40.70 -	41.10	941	0.55	2.05	2.92	6,589	3,205	0.35	311,773	841,793	935,330
	43.90 -	44.10	1,301	1.50	2.16	2.87	6,351	3,147	0.34	295,448	791,797	824,784
	44.85 -	45.00	798	0.73	2.25	2.88	6,376	3,048	0.35	278,113	750,907	834,339
	45.00 -	45.35	1,244	0.79	2.29	2.88	6,389	3,194	0.33	305,400	812,364	796,437
	45.00 -	45.35		0.62	2.33							
	Average		943	0.94	2.23	2.89	6,434	3,168	0.34	301,461	807,804	842,960
	Average of all		888	1.24	2.17	2.87	6,354	3,120	0.34	292,221	780,291	817,787

AGGREGATE TEST RESULTS

Sample No.	Water absorption (%)	Bulk specific gravity (g/cm3)	Soundness (%)	Los Angeles Abrasion (500cycles, %)
SK-311A	0.10	2.68	0.2	23.2
SK-311B	0.10	2.69	2.8	21.1
SK-312A	0.20	2.68	3.9	25.5
SK-312B	0.10	2.70	1.1	23.6
Average	0.13	2.69	2.0	23.4

表5.12　アルカリ骨材反応試験の結果

(1) Sand and Gravel Materials

Sample No.	Decrease in Alkali (m mol/l)	Dissolved Silica (m mol/l)
G-10A	190	67
G-10B	150	64
G-11A	170	40
G-11B	130	19
G-12A	160	32
G-12B	190	56
G-13A	190	71
G-13B	180	71
Average	170	53

(2) Core Samples (Boreholes SK-311 and SK-312)

Sample No.	Decrease in Alkali (m mol/l)	Dissolved Silica (m mol/l)	Content Ratio of CaCO3 (%)
SK-311A	50	2	94.3
SK-311B	50	3	94.8
SK-312A	50	1	95.3
SK-312B	50	2	94.3
Average	50	2	94.7

表5.13　軟石率試験の結果

Sample No.	Soft Rock Ratio (%)
G-10	2.3
G-11	0.9
G-12	1.9
G-13	9.0
Average	3.5

表5.14　1965～1987年の流量記録から算定した平均流出率（1965～1987年）

Sub-basin	River	Drainage Area (km^2)	Mean Annual Runoff (m^3/s)	Annual Runoff (MCM)	Runoff (mm)	Mean Annual Rainfall (mm)	Runoff Coeffi-cient	Loss (mm)
>17-14 1/	Ermenek	2000.0	44.6	1406	703	960	0.73	257
17-14 - 1719 2/	Ermenek	1499.6	17.8	561	374	635	0.59	261
>1712	Göksu	2689.2	32.0	1008	375	620	0.62	245
1712 - 1720	Göksu	1614.8	19.1	604	374	675	0.55	301
1720 - 1714 1719	Göksu downstream	2261.6	15.5	488	216	647	0.33	431

1/:　the sub-basin upstream from the station 17-14

2/:　the sub-basin between the stations 17-14 and 1719

表5.15 測水所17-14の推定流量から算定された流出率（1965～1987年）

Sub-basin	Drainage Area (km^2)	Mean Annual Runoff (m^3/s)	Annual Runoff (MCM)	Runoff (mm)	Mean Annual Rainfall (mm)	Runoff Coefficient	Loss (mm)
>Nadire	1318.8	33.4	1053	799	1090	0.73	291
Nadire - 17-14	681.2	11.2/44.6	353	519	721	0.72	202
17-14 - Görmel B. (Zeyve Creek)	156.0	2.9	91.4	586	825	0.71	239
17-14 - II-B	428.4	4.0	126	294	520	0.57	226
II-B - II-A (Erik R.)	238.8	3.8	120	502	830	0.61	328
II-A - Gezende	326.8	3.3/58.6	104	318	600	0.53	282
Gezende - 1719	341.1	3.8/62.4	120	351	650	0.54	299

表5.16 流域別の推定平均年流出高（1946～1987年）

Sub-basin	Drainage Area (km^2)	Mean Annual Runoff (m^3/s)	Mean Annual Runoff (MCM)	Mean Annual Runoff (mm)	Mean Annual Rainfall (mm)	Runoff Coefficient	Loss (mm)
>Nadire	1318.8	30.3	956	725	-	-	-
Nadire - 17-14	681.2	10.1/40.4	319	468	-	-	-
17-14 - Görmel B.	156.0	2.6/43.0	82	526	-	-	-
Görmel B.- II-B	428.4	3.7	117	272	-	-	-
II-B - II-A (Erik)	238.8	3.5	110	462	-	-	-
II-A - Gezende	326.8	3.0/53.2	95	289	-	-	-
Gezende - 1719	341.1	3.5/56.7	110	324	-	-	-

表5.17　測水所17-14の年最大ピーク流量記録

Year	Date day, month	Peak Discharge m^3/s
1965	21 JAN	480
1966	25 JAN	730 *
1967	12 JAN	540
1968	13 MAR	680
1969	-	-
1970	-	-
1971	-	-
1972	10 APR	240
1973	26 FEB	160
1974	15 MAR	870
1975	20 DEC	560
1976	12 APR	880
1977	3 DEC	820
1978	20 JAN	700 *
1979	3 JAN	880
1980	14 DEC	1,200
1981	6 JAN	630
1982	16 NOV	855 *
1983	27 DEC	410
1984	1 DEC	750
1985	1 APR	280

Note: * indicates that the value was revised after rechecking daily water level and discharge data and rating curves at 17-14 (DSI)

表5.18　測水所17-14の確率洪水ピーク流量

(Unit : m^3/s)

Return Period (yr)	Third Type of Log-Pearson	Probable Flood Gumbel
1.01	173	143
1.5	465	497
2	582	610
5	904	889
10	1137	1074
25	1452	1308
50	1701	1481
100	1960	1653
200	2233	1824

表5.19　測水所17-14の確率洪水ボリューム

(Unit : 10^6 m)

Return Period (yr)	Duration (day)					
	1	2	3	5	7	10
1.01	6	19	30	55	75	92
1.50	33	54	72	102	129	164
2	42	65	85	117	146	187
5	63	92	118	153	189	243
10	77	110	140	178	217	281
25	95	133	167	208	253	328
50	108	150	187	231	279	363
100	121	167	207	253	306	398
200	134	184	228	276	332	433

表5.20 シリフケ～ギュルナール～エルマネック道路上の橋

Distance (km)	Bridge			Remarks
	Gross Length (m)	Net Width (m)	Nos. of Span	
0	-	-	-	Silifke junction Asphalt paved road
6	-	-	-	Branch from Route 35
65	-	-	-	Gülnar town, El. 1,000 m
111		6	1	RC
111	50	6	2	Olukpinar Bridge, RC, El. 1,100 m Gravel stabilized road from hear to Görmel Bridge
	-	-	-	Hairpins and steep slope to climb up to the plateau
	-	-	-	Highest point at El. 1,550 m
136	55	4.5	2	Görmel Bridge, Stone, El. 1,550 m, Asphalt paved road
146	-	-	-	Junction with the Mut-Ermenek road
150	-	-	-	Ermenek town

表5.21 シリフケ～ムット～エルマネック道路上の橋(1/2)

Distance (km)	Bridge: Gross Length (m)	Bridge: Net Width (m)	Bridge: Nos. of Span	Remarks
0	-	-	-	Silifke junction Asphalt paved Route 35
15	90	5.5	3	Göksu Bridge on the main stream of Göksu, RC, Upstream from Kayraktepe dam site
36	34	5.5	1	Kargicak Bridge, RC
52	85	6	4	RC, on a branch stream with river water
67	27	7	1	
80			1	Mut town
83	-	-	-	Branch from Route 35 towards Ermenek
86	8	6	1	RC + Stone arch
88	60	3.5		Kadi Bridge, stone bridge on Branch Göksu
90	11	3.5	1	RC
92	16	3.5	1	RC, stone abutment
104	-	-	-	Branch to Gezende P.S.
107	30	3.5	1	After Evren Village
115	-	-	-	Hairpin curve
120	-	-	-	Partly narrow section
122	-	-	-	Partly narrow section
125	-	-	-	Narrow section for about 2 km, with rock cliff on the right side

表5.21 シリフケ～ムット～エルマネック道路上の橋(2/2)

Distance (km)	Bridge: Gross Length (m)	Bridge: Net Width (m)	Bridge: Nos. of Span	Remarks
136	-	-	-	Branch to Gezende dam site
151	30	5.5	1	Yerköprü Bridge, steel truss, load capacity 36 t
171	-	-	-	Ermenek town

表6.1 エルマネック郡の土地利用 (1988年)

Land use	Area (ha)	Share (%)
Cultivated land	32,075	13.8
Cereals	12,360	5.4
Follow	10,556	4.5
Pulses	1,150	0.5
Industrial crops	654	0.3
Fodder crops	73	0.0
Vegetables	677	0.3
Vineyards	4,925	2.1
Fruits	1,680	0.7
Pasture / meadow	31,300	13.5
Forests	161,000	69.4
Settlements	700	0.3
Ponds and marshland	500	0.2
Land unsuited to production activities	6,350	2.8
TOTAL	231,925	100.0

Source : Ermenek District Agricultural Office

表6.2　エルマネック病院の患者数

Disease	Nos. of Patients
Infectious hepatitis	23
Rabies	37
Tuberculosis	2
Diarrhoea	277
Death of new borne by diarrhoea	2

Remarks;　January to October 1989

表6.3 エルマネック川の水質

Sampling point and date	Water Temperature °C	pH	Na	K	Ca/Mg	CO_3	HCO_3	Cl	SO_4	Total Salt ppm	BOD mg/l
Görmel											
18.2.1987	10	8.0	0.11	0.03	3.20	0.10	2.90	0.18	0.16	195	1.60
25.8.1987	16	8.2	0.10	0.03	3.30	0.40	2.20	0.20	0.63	187	0.00
Çavusköyü											
10.8.1988	18	8.2	0.08	0.00	3.10	0.40	1.90	0.22	0.68	183	0.70
7.2.1989	8	8.1	0.15	0.00	3.70	0.30	2.90	0.20	0.48	227	0.90

Note : No or trace ammonia/nitrate/nitrite has been detected.

Source : DSİ

表6.4 エルマネック流域で生息が確認されている鳥類

Accipitridae	Vulture (Akbaba in Turkish), Sparrow-hawk (Atmaca) Eagle (Kartal)
Falconidae	Peregrine (Sahin)
Ciconidae	Stork (Leylek)
Fringillidae	Goldfinch (Saka)

Source: Combination by the JICA Study Team in consultation with scholars.

表6.5 エルマネック流域の樹種

Botanical name	Common name
Shrubs	
Quercus coccifera/illex	Holly oak
Arbutus andrachne	Strawberry tree
Laurus nobilis	Laurel
Olea europea var.	Wild olive
Pistacea trebinthus/lentiscus	Terebinth
Cistus villosus/salviifolius	Rockroses
Forest trees	
Acacia cyanophylla	Cypress acacia
Pinus brutia	Turkish red pine
Cedrus Libani	Cedar
Juniperus feoditissima/excelsa/ axyeedrus/phoenicea	Junipers
Pinus nigra	Black pine
Others	
Staphyles pinnata	Bead tree
Crataegrus manegya	Fig
Euphorbis tinctoris	Euphorbia
Creminea	
Durphacca	Elecampane
Verbaseum olympicum	
Mentha	Pepper
Astragalus	Gum-tragacanth
Thymus serpylum	Thyme
Acer	
Platanus orientalis	Plane tree
Salix alba	Willow
Ostrya Carpinifolia	
Corylus	Hazelnut
Polypodium yulgave	
Rosa canina	
Selvia	
Rubus ideus	Blackberry
Phas coriaia	Sumac

Remarks: Existence confirmed by the Ermenek Regional Office of General Directorate of Forestry.

表6.6 ギュクス河水系の魚種

Scientific name	English name	Turkish name
* Anguilla anguilla	Eel fish	Yilan balìgì
* Salmotrutta macrostigma	Trout	Dere alasì
* Cyprinus carpio	Carp	Sazan balìgì
* Vimba vimba tenella		Tahta balìgì, Karagöz
Acanthorutilus anatolicus		Yag balìgì
Pararhodeus kervilleri		
* Chondrostoma nasus		Kababurun
* Leuciscus cephalus	Chub	Tatlìsu kefali
L.borysthenicus		Tatlìsu kefali
L.lepidus		Akbalìk
* Barbus capito pectoralis	Barbel fish	Bìyìklì balìk
* B.plebejus escherichi	Barbel fish	Bìyìklì balìk
Capoeta capoeta angorae		Karabalìk
Cobitis taenia	Spined loach	Tasyiyen balìgì
Nemacheilus angorae	Ankara stone loach	Cöpcü balìgì
* Silurus glanis	Wels	Yayìn balìgì
Aphanius chantrei fontinalis		Dislisazapcìk balìklarì
A. sophiae mentoides		〃
* Mugil cephalus	Mullet	Deniz kefali
* M. ramade	Mullet	Deniz kefali
* Stizastedion lucioperca	Pike perch	Aklevrek (Sudak)
Blennius fluviatilis		Horos bina balìgì

Source: Combination by the JICA Study Team in consultation with scholars.

表6.7　地域別および都市別人口の伸び（20,000人超）

Urban Settlement	Province	Population 1975	1980	1985	Annual Growth (%) 1975-1980	1980-1985	1975-1985
Regional Centers							
Manavgat	ANTALYA	10804	14255	21520	5.70	8.59	7.13
Ilgin	KONYA	11830	16762	22539	7.22	6.10	6.66
Cumra	KONYA	19225	20919	24175	1.70	2.94	2.32
Erdemli	IÇEL	19936	21234	26074	1.27	4.19	2.72
Silifke	IÇEL	19257	22041	28111	2.74	4.99	3.86
Anamur	IÇEL	21475	23025	28726	1.40	4.52	2.95
Alanya	ANTALYA	18520	22190	28733	3.68	5.30	4.49
Seydisehir	KONYA	25651	30065	37226	3.23	4.37	3.79
Aksehir	KONYA	35544	40312	45320	2.55	2.37	2.46
Karaman	KARAMAN	43759	51208	64735	3.19	4.80	3.99
Eregli	KONYA	50354	56931	68749	2.49	3.84	3.16
Tarsus	IÇEL	102186	121074	146502	3.45	3.89	3.67
Antalya	ANTALYA	130774	173501	261114	5.82	8.52	7.16
Mersin	IÇEL	152236	216308	314350	7.28	7.76	7.52
Konya	KONYA	300882	374290	478635	4.46	5.04	4.75
National Centers							
Bursa		346103	445113	612510	5.16	6.59	5.87
Adana		475384	574515	777554	3.86	6.24	5.04
Izmir		1701004	1877755	2235035	2.00	3.54	2.77
Ankara		2547364	2772708	5475982	1.71	14.58	7.95
Istanbul		5706689	6427945	10590853	2.41	10.50	6.38
Total Population of Turkey		40347719	44736957	50664458	2.09	2.52	2.30

Source: Statistical Yearbook of Turkey, 1987, SIS.

表6.8 エルマネック計画の環境リスク予備評価マトリクス

Aspect of Environment	Possible Impact: Preconstruction	Possible Impact: Construction	Possible Impact: Operation	Note
1. Socio-economy				
(1) Demography	0	±	+	- Relocation of people + Employment opportunities
(2) Agriculture	0	0	-	- Inundation of agricultural land
(3) Fishery	0	0	+	+ Aquaculture in the long run
(4) Industry	0	0	±	+ Konya and Karaman Provinces - Negative effect on coal mines
(5) Trade	0	0	+	+ Use of reservoir
(6) Tourism	0	0	+	+ Better access, increased opportunities
(7) Land tenure	-	0	0	- Problem associated with resettlement
(8) Health	0	0	x	
2. Natural/Physical Aspects				
(1) Topography	0	-	±	- Submergence of canyon, minor disruption + Better landscape by reservoir
(2) Geology	0	0	x	
(3) Vegetation	-	-	0	- Tree cutting, Erosion
(4) Meteoro-hydrology	0	0	x	
(5) Water quality	0	-	-	- Discharge of sediment, wastes etc.
3. Fauna and Flora				
(1) Terrestrial fauna	0	0	x	
(2) Terrestrial flora	0	0	x	
(3) Aquatic fauna	0	-	±	- Effect by lower water quality + Increased productivity
(4) Aquatic flora	0	-	±	- Effect by lower water quality + Diversification

表9.1 労働単価

	Description	Unit	L.C(TL)	F.C(US$)
1.	Foreman			
	a) Chief of Common labor	m.d	46,340	20.1
	b) Chief of skilled labor	m.d	29,580	12.9
2.	Operator			
	a) Heavy equipment	m.d	53,020	23.1
	b) Light equipment	m.d	36,280	15.8
3.	Driver			
	a) Driver	m.d	29,580	12.9
	b) Trailer driver	m.d	32,920	14.3
4.	Mechanic	m.d	29,580	12.9
5.	Welder	m.d	29,580	12.9
6.	Concrete worker	m.d	27,910	12.1
7.	Carpenter	m.d	39,630	17.2
8.	Steel worker	m.d	39,630	17.2
9.	Common laber	m.d	21,200	9.2
10.	Skilled labor	m.d	22,960	10.0
11.	Driller	m.d	23,550	10.2

Source: Surveyed by the JICA Study Team

表9.2 建設材料の市場価格

	Description	Unit	L.C(TL)	F.C(US$)
1.	Cement			
	a) Cement (in bag)	ton	138,470	60.2
	b) Cement (in bulk)	bag	147,000	63.9
2.	Aggregate			
	a) gravel	m3	25,000	10.9
	b) sand	m3	25,000	10.9
3.	Fuel & lubricant			
	a) Gasoline	l	1,040	0.5
	b) Diesel	l	963	0.4
	c) Heavy oil	l	591	0.3
4.	Gas			
	a) Propan gas	l	985	0.4
5.	Steel materials			
	a) Reinforcement bar	ton	1,045,000	454.3
6.	Wooden Materials			
	a) plywood	m3	420,000	182.6
	b) Pine,plank	M3	910,000	395.7
7.	Dynamite	kg	5,500	2.4

Source: Surveyed by the JICA Study Team

表9.3 建設機械の市場価格

	Description	Capacity	L.C(1000TL)	F.C(US$)
1.	Bulldozer	D9N 43t	780,045	339,150
2.	- do -	D8N 32t	610,995	265,650
3.	- do -	D8L 32t	678,615	295,050
4.	- do -	D7H 24t	490,245	213,150
5.	- do -	D7G 24t	425,040	184,800
6.	Wheel loader	980C 3.2m3	584,430	254,100
7.	- do -	966E 2.8m3	364,665	158,550
8.	- do - (side dump)	950E 2.1m3	312,869	136,030
9.	Back hoe	235C 1.5m3	615,825	267,750
10.	- do -	0.6m3	185,587	80,690
11.	- do -	0.4m3	120,865	52,550
12.	Dump truck	D35C 32t	647,220	281,400
13.	- do -	D30C 27t	594,090	258,300
14.	- do -	D25C 23t	497,490	216,300
15.	Crawler jumbo	2 booms	1,030,055	447,850
16.	Crawler drill	1 boom	106,168	46,160
17.	Rocker shovel	0.4 m3	191,107	83,090
18.	Battery Locomotive	12 t	467,176	203,120
19.	Raise Climber	STH 5E	416,300	181,000
20.	Truck crane	20 t	329,820	143,400
21.	Truck mixer	4.5 m3	122,038	53,060
22.	Concrete pump	65 m3	363,837	158,190
23.	Batcher plant	45 m3	717,002	311,740
24.	- do -	85 m3	1,005,169	437,030

Source: Surveyed by the JICA Study Team

表9.4 エルマネック計画の総投資額一覧

	Foreign (Ml.$)	Local (Ml.$)	Total (Ml.$)
1.Land Acquisition	0.23	13.65	13.88
2.Preparatory Works	2.52	9.63	12.14
3.Civil Works			
2.1 River Diversion Works	1.07	2.43	3.50
2.2 Dam and Spillway	39.73	86.90	126.63
2.3 Power WaterWay	22.22	43.93	66.15
2.4 Power House	6.03	15.90	21.93
2.5 Tailrace tunnel	3.15	6.47	9.62
2.6 Outdoor Switchyard	0.15	0.16	0.31
2.7 Erik Diversion Scheme	2.31	4.68	6.99
(Sub-Total)	74.66	160.46	235.12
4.Hydraulic Works	11.09	4.80	15.89
5.Mechanical and Electric Equipment	44.46	11.12	55.58
6.Engineering and Administration Free	15.45	21.39	36.84
7.Transmission Line	21.58	14.38	35.96
8.Tax (VAT 10%)	17.00	23.54	40.54
9.Interest During Construction	28.90	77.20	106.10
Grand Total	215.88	336.18	552.06

Note: Local currency is expressed in US$ equivalents at an exchange rate of US$1.00 = TL2,300.

表9.5 エルマネック計画の建設費内訳(1/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
1.	Land Acquisition									
1.1	Land acquisition & compensation	L.S.				9,730		22,379.00		9,730.00
1.2	Relocation road	m	13,800	15.00	207.00	130	299.00	4,126.20	145.00	2,001.00
	Sub-total				207.00			26,505.20		11,731.00
	Physical contingency (20% of 1.1 & 10% of 1.2)				20.70			4,888.42		2,146.10
	Total of land acquisition				227.70			31,393.62		13,877.10
2.	Preparatory Works									
2.1	Access road									
	- Access roads	m	42,000	15.00	630.00	130	299.00	12,558.00	145.00	6,090.00
	- Bridges near switchyard	nos.	1	10,000.00	10.00	90,000	207,000.00	207.00	100,000.00	100.00
2.2	Improvement of existing road	m	10,000	15.00	150.00	130	299.00	2,990.00	145.00	1,450.00
2.3	Camp facilities for owner & engineers incl. power, water etc.	L.S.			1,500.00			4,370.00		3,400.00
	Sub-total				2,290.00			20,125.00		11,040.00
	Physical contingency (10 %)				229.00			2,012.50		1,104.00
	Total of Preparatory Works				2,519.00			22,137.50		12,144.00
3.	River Diversion Works									
3.1	Access tunnel to diversion tunnel (D7)									
	- excavation, tunnel	c.m.	1,400	14.49	20.29	22	49.47	69.26	36.00	50.40
	- slab concrete, tunnel	c.m.	64	41.10	2.63	69	158.47	10.14	110.00	7.04
	- reinforcing bar (20 kg/m3)	ton	1	22.60	0.03	697	1,604.02	2.05	720.00	0.92
	- access road (W=6 m)	m	700	15.00	10.50	130	299.00	209.30	145.00	101.50

表9.5 エルマネック計画の建設費内訳(2/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
3.2	Diversion tunnel (D7.0)									
	- excavation, w. rock	c.m.	1,000	1.00	1.00	1	2.30	2.30	2.00	2.00
	- excavation, rock	c.m.	1,000	2.00	2.00	2	4.60	4.60	4.00	4.00
	- excavation, tunnel	c.m.	21,600	14.00	302.40	22	50.60	1,092.96	36.00	777.60
	- shotcrete	c.m.	72	92.00	6.62	273	627.90	45.21	365.00	26.28
	- concrete, open	c.m.	500	28.00	14.00	47	108.10	54.05	75.00	37.50
	- lining concrete, tunnel	c.m.	6,771	41.00	277.61	69	158.70	1,074.56	110.00	744.81
	- reinforcing bar (40 kg/m3)	ton	291	23.00	6.69	697	1,603.10	466.25	720.00	209.40
	- consolidation grout	m	1,825	2.00	3.65	28	64.40	117.53	30.00	54.75
	- plugging works	lot	1	113,000.00	113.00	387,000	890,100.00	890.10	500,000.00	500.00
3.3	Coffer dam									
	- excavation, w. rock	c.m.	2,000	1.00	2.00	1	2.30	4.60	2.00	4.00
	- embankment	c.m.	7,700	2.00	15.40	2	4.60	35.42	4.00	30.80
	- concrete, open	c.m.	3,860	28.00	108.08	47	108.10	417.27	75.00	289.50
	- reinforcing bar (20 kg/m3)	ton	77	23.00	1.78	697	1,603.10	123.76	720.00	55.58
	Sub-total				887.68			4,619.35		2,896.09
	Others (5%)				44.38			230.97		144.80
	Sub-total of item3.				932.06			4,850.32		3,040.89

表9.5 エルマネック計画の建設費内訳(3/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
4.	Dam and Spillway									
4.1	Access tunnel to dam site (D7 at crest and riverbed)									
	- excavation, tunnel	c.m.	76,900	14.00	1,076.60	22	50.60	3,891.14	36.00	2,768.40
	- shotcrete	c.m.	512	92.00	47.10	273	627.90	321.48	365.00	186.88
	- slab concrete, tunnel	c.m.	2,730	41.00	111.93	69	158.70	433.25	110.00	300.30
	- reinforcing bar (20 kg/m3)	ton	109	23.00	2.51	697	1,603.10	174.74	720.00	78.48
	- access road at crest (W=6 m)	m	2,000	15.00	30.00	130	299.00	598.00	145.00	290.00
	- access road at riverbed (W=6 m	m	2,000	15.00	30.00	130	299.00	598.00	145.00	290.00
4.2	Main dam									
	- excavation, w. rock	c.m.	399,060	4.00	1,596.24	6	13.80	5,507.03	10.00	3,990.60
	- excavation, rock	c.m.	405,860	4.00	1,623.44	6	13.80	5,600.87	10.00	4,058.60
	- concrete, open (10 %)	c.m.	27,000	28.00	756.00	47	108.10	2,918.70	75.00	2,025.00
	- dam concrete	c.m.	270,000	50.00	13,500.00	80	184.00	49,680.00	130.00	35,100.00
	- reinforcing bar (5 kg/m3)	ton	1,485	23.00	34.16	697	1,603.10	2,380.60	720.00	1,069.20
	- consolidation grout	m	7,038	8.00	56.30	22	50.60	356.12	30.00	211.14
4.3	Access tunnel to grout gallery (B2.6 x H2.5)									
	- excavation, tunnel	c.m.	56,600	14.00	792.40	43	98.90	5,597.74	57.00	3,226.20
	- shotcrete	c.m.	549	92.00	50.51	273	627.90	344.72	365.00	200.39
	- access road (W=6 m)	m	4,000	15.00	60.00	130	299.00	1,196.00	145.00	580.00
	- temporary bridge	nos.	1	4,000.00	4.00	31,000	71,300.00	71.30	35,000.00	35.00
4.4	Vertical shafts to grout gallery									
	- excavation, shaft	c.m.	23,400	62.00	1,450.80	38	87.40	2,045.16	100.00	2,340.00
	- shotcrete	c.m.	1,360	92.00	125.12	273	627.90	853.94	365.00	496.40
	- rockbolts	m	18,900	6.00	113.40	14	32.20	608.58	20.00	378.00
	- lining concrete, shaft	c.m.	8,670	52.00	450.84	123	282.90	2,452.74	175.00	1,517.25
	- reinforcing bar (40 kg/m3)	ton	347	23.00	7.98	697	1,603.10	555.96	720.00	249.70

表9.5 エルマネック計画の建設費内訳(4/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
4.5	Grout tunnels and curtain grout									
	- excavation, tunnel (D3.5)	c.m.	200,700	14.00	2,809.80	43	98.90	19,849.23	57.00	11,439.90
	- lining concrete, tunnel	c.m.	76,100	41.00	3,120.10	69	158.70	12,077.07	110.00	8,371.00
	- reinforcing bar (40 kg/m3)	ton	3,044	23.00	70.01	697	1,603.10	4,879.84	720.00	2,191.68
	- grout hole drilling	m	385,891	1.80	694.60	12.1	27.83	10,739.35	13.90	5,363.88
	- grouting (100 kg/m)	ton	38,589	69.00	2,662.65	318	731.40	28,224.07	387.00	14,933.98
	- replacement concrete	c.m.	22,000	45.00	990.00	60	138.00	3,036.00	105.00	2,310.00
4.6	Spillway tunnel (D9.0)									
	- excavation, w. rock	c.m.	300	1.00	0.30	1	2.30	0.69	2.00	0.60
	- excavation, rock	c.m.	2,700	2.00	5.40	2	4.60	12.42	4.00	10.80
	- excavation, tunnel	c.m.	29,300	16.00	468.80	24	55.20	1,617.36	40.00	1,172.00
	- excavation, shaft	c.m.	11,100	62.00	688.20	38	87.40	970.14	100.00	1,110.00
	- shotcrete	c.m.	480	92.00	44.16	273	627.90	301.39	365.00	175.20
	- rockbolts	m	3,480	6.00	20.88	14	32.20	112.06	20.00	69.60
	- concrete, open	c.m.	2,000	28.00	56.00	47	108.10	216.20	75.00	150.00
	- lining concrete, tunnel	c.m.	10,190	41.00	417.79	69	158.70	1,617.15	110.00	1,120.90
	- lining concrete, shaft	c.m.	3,430	52.00	178.36	123	282.90	970.35	175.00	600.25
	- reinforcing bar (40 kg/m3)	ton	625	23.00	14.37	697	1,603.10	1,001.62	720.00	449.86
	- consolidation grout	m	5,390	8.00	43.12	22	50.60	272.73	30.00	161.70
	Sub-total				34,203.87			172,083.73		109,022.88
	Others (1%)				342.04			1,720.84		1,090.23
	Sub-total of item 4.				34,545.91			173,804.57		110,113.11

表9.5 エルマネック計画の建設費内訳(5/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
5.	Power Waterway									
5.1	Work adit (D7.0)									
	- excavation, w. rock	c.m.	400	1.00	0.40	1	2.30	0.92	2.00	0.80
	- excavation, rock	c.m.	2,000	2.00	4.00	2	4.60	9.20	4.00	8.00
	- excavation, tunnel	c.m.	102,900	14.00	1,440.60	21	48.30	4,970.07	35.00	3,601.50
	- steel support	ton	330	287.70	94.94	482	1,109.29	366.07	770.00	254.10
	- shotcrete	c.m.	1,510	92.00	138.92	273	627.90	948.13	365.00	551.15
	- rockbolts	m	14,600	6.00	87.60	14	32.20	470.12	20.00	292.00
	- concrete, open	c.m.	800	28.00	22.40	47	108.10	86.48	75.00	60.00
	- lining concrete, tunnel	c.m.	8,980	41.00	368.18	69	158.70	1,425.13	110.00	987.80
	- slab concrete, tunnel	c.m.	2,550	41.00	104.55	69	158.70	404.69	110.00	280.50
	- reinforcing bar (20 kg/m3)	ton	67	23.00	1.54	697	1,603.10	107.41	720.00	48.24
	- plugging works	nos.	5	45,000.00	225.00	155,000	356,500.00	1,782.50	200,000.00	1,000.00
5.2	Intake									
	- excavation, w. rock	c.m.	1,000	1.00	1.00	1	2.30	2.30	2.00	2.00
	- excavation, rock	c.m.	2,000	2.00	4.00	2	4.60	9.20	4.00	8.00
	- excavation, shaft	c.m.	9,700	27.00	261.90	16	36.80	356.96	43.00	417.10
	- shotcrete	c.m.	339	92.00	31.19	273	627.90	212.86	365.00	123.74
	- rockbolts	m	3,700	6.00	22.20	14	32.20	119.14	20.00	74.00
	- concrete, open	c.m.	500	28.00	14.00	47	108.10	54.05	75.00	37.50
	- lining concrete, shaft	c.m.	3,580	52.00	186.16	123	282.90	1,012.78	175.00	626.50
	- reinforcing bar (40 kg/m3)	ton	163	23.00	3.75	697	1,603.10	261.63	720.00	117.50
	- consolidation grout	m	3,600	2.00	7.20	28	64.40	231.84	30.00	108.00
5.3	Headrace tunnel (D6.1)									
	- excavation, tunnel	c.m.	397,700	16.00	6,363.20	24	55.20	21,953.04	40.00	15,908.00
	- shotcrete	c.m.	12,660	92.00	1,164.72	273	627.90	7,949.21	365.00	4,620.90
	- rockbolts	m	79,100	6.00	474.60	14	32.20	2,547.02	20.00	1,582.00

表9.5 エルマネック計画の建設費内訳(6/10)

No.	Work Item	Unit	Q'ty	Foreign Currency		Local Currency			Total in US$	
				Unit Price US$	Amount US$1,000	Unit Price US$	Unit Price 1,000TL	Amount TL million	Unit Price US$	Amount US$1,000
	- concrete, lining	c.m.	133,500	41.00	5,473.50	69	158.70	21,186.45	110.00	14,685.00
	- reinforcing bar (40 kg/m3)	ton	5,340	23.00	122.82	697	1,603.10	8,560.55	720.00	3,844.80
	- consolidation grout	m	36,230	2.00	72.46	28	64.40	2,333.21	30.00	1,086.90
	- replacement concrete	c.m.	2,400	45.00	108.00	60	138.00	331.20	105.00	252.00
5.4	Surge tank & ventilation tunnel									
	- excavation, shaft	c.m.	15,100	18.00	271.80	25	57.50	868.25	43.00	649.30
	- excavation, tunnel	c.m.	18,400	16.00	294.40	24	55.20	1,015.68	40.00	736.00
	- shotcrete	ton	451	92.00	41.49	273	627.90	283.18	365.00	164.62
	- rockbolts	m	6,300	6.00	37.80	14	32.20	202.86	20.00	126.00
	- lining concrete, shaft	c.m.	3,840	52.00	199.68	123	282.90	1,086.34	175.00	672.00
	- lining concrete, tunnel	c.m.	2,500	41.00	102.50	69	158.70	396.75	110.00	275.00
	- slab concrete, tunnel	c.m.	100	41.00	4.10	69	158.70	15.87	110.00	11.00
	- reinforcing bar (40 kg/m3)	ton	258	23.00	5.92	697	1,603.10	412.96	720.00	185.47
	- consolidation grout	m	2,650	2.00	5.30	28	64.40	170.66	30.00	79.50
5.5	Pressure shaft & access tunnel									
	- excavation, shaft	c.m.	17,160	62.00	1,063.92	38	87.40	1,499.78	100.00	1,716.00
	- excavation, tunnel	c.m.	8,300	16.00	132.80	24	55.20	458.16	40.00	332.00
	- shotcrete	c.m.	675	92.00	62.10	273	627.90	423.83	365.00	246.38
	- rockbolts	m	5,530	6.00	33.18	14	32.20	178.07	20.00	110.60
	- concrete, open	c.m.	200	28.00	5.60	47	108.10	21.62	75.00	15.00
	- backfill concrete	c.m.	7,630	6.00	45.78	89	204.70	1,561.86	95.00	724.85
	- slab concrete, tunnel	c.m.	300	41.00	12.30	69	158.70	47.61	110.00	33.00
	- reinforcing bar (40 kg/m3)	ton	325	23.00	7.48	697	1,603.10	521.33	720.00	234.14
	- consolidation grout	m	2,000	2.00	4.00	28	64.40	128.80	30.00	60.00
	Sub-total				19,128.99			86,985.76		56,948.89
	Others (1%)				191.29			869.86		569.49
	Sub-total of item 5.				19,320.28			87,855.62		57,518.37

表9.5 エルマネック計画の建設費内訳(7/10)

No.	Work Item	Unit	Q'ty	Foreign Currency		Local Currency			Total in US$	
				Unit Price US$	Amount US$1,000	Unit Price US$	Unit Price 1,000TL	Amount TL million	Unit Price US$	Amount US$1,000
6.	Power House									
6.1	Access and ventilation tunnel									
	- excavation, common	c.m.	2,000	0.50	1.00	0.5	1.15	2.30	1.00	2.00
	- excavation, w.rock	c.m.	1,000	1.00	1.00	1	2.30	2.30	2.00	2.00
	- excavation, rock	c.m.	500	2.00	1.00	2	4.60	2.30	4.00	2.00
	- excavation, tunnel	c.m.	67,300	14.00	942.20	22	50.60	3,405.38	36.00	2,422.80
	- steel support	ton	33	288.00	9.50	482	1,108.60	36.58	770.00	25.41
	- shotcrete	c.m.	820	92.00	75.44	273	627.90	514.88	365.00	299.30
	- rockbolts	m	7,700	6.00	46.20	14	32.20	247.94	20.00	154.00
	- concrete, open	c.m.	400	28.00	11.20	47	108.10	43.24	75.00	30.00
	- lining concrete, tunnel	ton	900	41.00	36.90	69	158.70	142.83	110.00	99.00
	- slab concrete, tunnel	c.m.	2,300	41.00	94.30	69	158.70	365.01	110.00	253.00
	- reinforcing bar (20 kg/m3)	ton	72	23.00	1.66	697	1,603.10	115.42	720.00	51.84
6.2.	Underground power house including tailrace surge tank									
	- excavation, underground	c.m.	132,500	12.00	1,590.00	18	41.40	5,485.50	30.00	3,975.00
	- shotcrete	c.m.	3,920	92.00	360.64	273	627.90	2,461.37	365.00	1,430.80
	- rockbolts	m	44,000	6.00	264.00	14	32.20	1,416.80	20.00	880.00
	- concrete, underground	c.m.	17,800	38.00	676.40	87	200.10	3,561.78	125.00	2,225.00
	- reinforcing bar (60 kg/m3)	ton	1,068	23.00	24.56	697	1,603.10	1,712.11	720.00	768.96
	- PC anchor	m	33,000	6.00	198.00	79	181.70	5,996.10	85.00	2,805.00
	- minor items (12 %)				373.63			2,476.04		1,450.17
	- architectural works (14 %)				488.21			3,235.36		1,894.89
	- aboveground control room	m2	500		0.00	220	506.00	253.00	220.00	110.00
	Sub-total				5,195.85			31,476.24		18,881.17
	Others(1%)				51.96			314.76		188.81
	Sub-total of item 6.				5,247.81			31,791.00		19,069.98

表9.5 エルマネック計画の建設費内訳(8/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
7.	Tailrace tunnel (D6.1)									
	- excavation, common	c.m.	1,000	0.50	0.50	0.5	1.15	1.15	1.00	1.00
	- excavation, w. rock	ton	2,000	1.00	2.00	1	2.30	4.60	2.00	4.00
	- excavation, rock	c.m.	500	2.00	1.00	2	4.60	2.30	4.00	2.00
	- excavation, tunnel	c.m.	77,600	16.00	1,241.60	24	55.20	4,283.52	40.00	3,104.00
	- steel support	ton	50	288.00	14.40	482	1,108.60	55.43	770.00	38.50
	- shotcrete	c.m.	2,470	92.00	227.24	273	627.90	1,550.91	365.00	901.55
	- rockbolts	m	15,400	6.00	92.40	14	32.20	495.88	20.00	308.00
	- concrete, open	c.m.	1,000	28.00	28.00	47	108.10	108.10	75.00	75.00
	- lining concrete, tunnel	c.m.	26,000	41.00	1,066.00	69	158.70	4,126.20	110.00	2,860.00
	- reinforcing bar (40 kg/m3)	ton	1,080	23.00	24.84	697	1,603.10	1,731.35	720.00	777.60
	- consolidation grout	m	7,070	2.00	14.14	28	64.40	455.31	30.00	212.10
	Sub-total				2,712.12			12,814.75		8,283.75
	Others (1%)				27.12			128.15		82.84
	Sub-total of item 7.				2,739.24			12,942.90		8,366.59
8.	Outdoor Switchyard (100 x 60 m)									
	- excavation, common	c.m.	1,000	0.50	0.50	0.5	1.15	1.15	1.00	1.00
	- excavation, w.rock	c.m.	500	1.00	0.50	1	2.30	1.15	2.00	1.00
	- excavation, rock	c.m.	100	2.00	0.20	2	4.60	0.46	4.00	0.40
	- embankment	c.m.	30,000	3.00	90.00	1	2.30	69.00	4.00	120.00
	- concrete, open	c.m.	1,000	28.00	28.00	47	108.10	108.10	75.00	75.00
	- reinforcing bar (80 kg/m3)	ton	80	23.00	1.84	697	1,603.10	128.25	720.00	57.60
	Sub-total				121.04			308.11		255.00
	Others (5%)				6.05			15.41		12.75
	Sub-total of item 8.				127.09			323.51		267.75

表9.5 エルマネック計画の建設費内訳(9/10)

No.	Work Item	Unit	Q'ty	Foreign Currency		Local Currency			Total in US$	
				Unit Price US$	Amount US$1,000	Unit Price US$	Unit Price 1,000TL	Amount TL million	Unit Price US$	Amount US$1,000
9.	Erik Diversion Scheme									
	- excavation, common	c.m.	1,500	0.50	0.75	0.5	1.15	1.73	1.00	1.50
	- excavation, w. rock	c.m.	9,200	1.00	9.20	1	2.30	21.16	2.00	18.40
	- excavation, rock	c.m.	40,700	2.00	81.40	2	4.60	187.22	4.00	162.80
	- excavation, tunnel	c.m.	31,000	22.94	711.22	34	78.33	2,428.30	57.00	1,767.00
	- excavation, shaft	c.m.	5,200	10.00	52.00	33	75.90	394.68	43.00	223.60
	- concrete, open	c.m.	9,850	28.00	275.80	47	108.10	1,064.79	75.00	738.75
	- lining concrete, tunnel	c.m.	11,260	41.00	461.66	69	158.70	1,786.96	110.00	1,238.60
	- lining concrete, shaft	m	2,300	52.00	119.60	123	282.90	650.67	175.00	402.50
	- reinforcing bar (40 kg/m3)	ton	936	23.00	21.54	697	1,603.10	1,501.14	720.00	674.21
	- consolidation grout	m	750	2.00	1.50	28	64.40	48.30	30.00	22.50
	- minor items (5 %)				86.73			404.25		262.49
	- architectural works (5 %)				91.07			424.46		275.62
	Sub-total				1,912.47			8,913.65		5,787.97
	Others (5%)				95.62			445.68		289.40
	Sub-total of item 9.				2,008.09			9,359.33		6,077.37
	Total of main civil works (items 3. to 9.)				64,920.48			320,927.26		204,454.07
	Physical contingency (15 %)				9,738.07			48,139.09		30,668.11
	Grand total of civil works				74,658.55			369,066.35		235,122.18
10.	Metal Works									
10.1	Penstock pipe	ton	2,280	2,275.00	5,187.00	1,225	2,817.50	6,423.90	3,500.00	7,980.00
10.2	Steel liner	ton	146	2,275.00	332.15	1,225	2,817.50	411.36	3,500.00	511.00
10.3	Low head gate and trashracks	ton	549	2,800.00	1,537.20	1,200	2,760.00	1,515.24	4,000.00	2,196.00
10.4	High head gate and trashracks	ton	510	6,400.00	3,264.00	1,600	3,680.00	1,876.80	8,000.00	4,080.00

表9.5 エルマネック計画の建設費内訳(10/10)

No.	Work Item	Unit	Q'ty	Foreign Currency Unit Price US$	Foreign Currency Amount US$1,000	Local Currency Unit Price US$	Local Currency Unit Price 1,000TL	Local Currency Amount TL million	Total in US$ Unit Price US$	Total in US$ Amount US$1,000
10.5	Metal for Erik scheme	ton	105	2,275.00	238.88	1,225	2,817.50	295.84	3,500.00	367.50
	Sub-total				10,559.23			10,523.13		15,134.50
	Physical contingency (5 %)				527.96			526.16		756.73
	Total of Metal Works				11,087.19			11,049.29		15,891.23
11.	Generating Equipment									
11.1	Ermenek plant	kW	320,000	126.40	40,448.00	32	72.68	23,257.60	158.00	50,560.00
11.2	Erik plant	kW	6,700	283.20	1,897.44	71	162.84	1,091.03	354.00	2,371.80
	Sub-total				42,345.44			24,348.63		52,931.80
	Physical contingency (5 %)				2,117.27			1,217.43		2,646.59
	Total of Generating Equipment				44,462.71			25,566.06		55,578.39
12.	Transmission Line									
12.1	380 kV line, 1-cct, 3x954 MCM	km	160	114,000.00	18,240.00	76,000	174,800.00	27,968.00	190,000.00	30,400.00
12.2	380 kV, 1-cct				420.00	280		644.00		700.00
12.3	SR,SC				810.00	540		1,242.00		1,350.00
12.4	34.5 kV line	km	16	9,000.00	144.00	6,000	13,800.00	220.80	15,000.00	240.00
	Sub-total				19,614.00			30,074.80		32,690.00
	Physical contingency (10%)				1,961.40			3,007.48		3,269.00
	Total of Transmission Line				21,575.40			33,082.28		35,959.00
	Total of direct cost				139,936.14			432,504.02		327,981.37
	Total of physical contingency				14,594.41			59,791.08		40,590.53
	Total				154,530.55			492,295.09		368,571.89
13.	Administration and engineering (10%)				15,453.05			49,229.51		36,857.19
	Grand total				169,983.60			541,524.60		405,429.08

表10.1　経済費用と便益のフロー

Year	Construction Cost	Disbursement (%)	OMR and PFG	Total Cost	Power Benefit	Present Worth Factor	Present Worth of Cost	Present Worth of Benefit	Present Worth of B-C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1.73	0.5		1.73		0.9556	1.66	0.00	-1.66
2	6.58	1.9		6.58		0.8727	5.74	0.00	-5.74
3	20.09	5.8		20.09		0.7970	16.01	0.00	-16.01
4	10.74	3.1		10.74		0.7279	7.82	0.00	-7.82
5	27.02	7.8		27.02		0.6647	17.96	0.00	-17.96
6	38.10	11.0		38.10		0.6070	23.13	0.00	-23.13
7	41.57	12.0		41.57		0.5544	23.04	0.00	-23.04
8	71.70	20.7		71.70	-2.20	0.5063	36.30	-1.11	-37.42
9	89.37	25.8		89.37	-8.79	0.4624	41.32	-4.06	-45.39
10	39.49	11.4	0.18	39.67	10.77	0.4222	16.75	4.55	-12.20
11			1.34	1.34	79.93	0.3856	0.52	30.82	30.31
12			1.34	1.34	79.93	0.3522	0.47	28.15	27.68
13			1.34	1.34	79.93	0.3216	0.43	25.71	25.27
14			1.34	1.34	79.93	0.2937	0.39	23.48	23.08
15			1.34	1.34	79.93	0.2682	0.36	21.44	21.08
16			1.34	1.34	79.93	0.2450	0.33	19.58	19.25
17			1.34	1.34	79.93	0.2237	0.30	17.88	17.58
18			1.34	1.34	79.93	0.2043	0.27	16.33	16.06
19			1.34	1.34	79.93	0.1866	0.25	14.91	14.66
20			1.34	1.34	79.93	0.1704	0.23	13.62	13.39
21			1.34	1.34	79.93	0.1556	0.21	12.44	12.23
22			1.34	1.34	79.93	0.1421	0.19	11.36	11.17
23			1.34	1.34	79.93	0.1298	0.17	10.37	10.20
24			1.34	1.34	79.93	0.1185	0.16	9.47	9.31
25			1.34	1.34	79.93	0.1082	0.15	8.65	8.51
26			1.34	1.34	79.93	0.0988	0.13	7.90	7.77
27			1.34	1.34	79.93	0.0903	0.12	7.21	7.09
28			1.34	1.34	79.93	0.0824	0.11	6.59	6.48
29			1.34	1.34	79.93	0.0753	0.10	6.02	5.92
30			1.34	1.34	79.93	0.0688	0.09	5.50	5.40
31			1.34	1.34	79.93	0.0628	0.08	5.02	4.93
32			1.34	1.34	79.93	0.0573	0.08	4.58	4.51
33			1.34	1.34	79.93	0.0524	0.07	4.19	4.12
34			1.34	1.34	79.93	0.0478	0.06	3.82	3.76
35			1.34	1.34	79.93	0.0437	0.06	3.49	3.43
36			1.34	1.34	79.93	0.0399	0.05	3.19	3.13
37			1.34	1.34	79.93	0.0364	0.05	2.91	2.86
38			1.34	1.34	79.93	0.0333	0.04	2.66	2.61
39			1.34	1.34	79.93	0.0304	0.04	2.43	2.39
40			108.74	108.74	79.93	0.0277	3.02	2.22	-0.80
41			1.34	1.34	79.93	0.0253	0.03	2.03	1.99
59			1.34	1.34	79.93	0.0049	0.01	0.40	0.39
60			1.34	1.34	79.93	0.0045	0.01	0.36	0.35
Total	346.40	100.00	174.58	520.98	3996.28	10.97	198.61	350.83	152.22

(1) Discount rate: 9.5 %

(2) OMR means operation, maintenance & replacement; PFG mean production foregone

表10.2 卸売り物価指数と換算レートの実績と将来動向の一試算

(1) Actual records

YEAR	WPI	TL/US$	INFLATION %/YEAR
1980		89	
1981	100	132	
1982	127	185	27.00
1983	166	280	30.47
1984	249	442	50.33
1985	357	574	43.24
1986	462	756	29.57
1987	610	1018	32.04
1988	1027	1682	68.30
1989	1787	2300	73.97

Note: Source of figures for 1980-1989: SIS and SPO.

(2) PHASE 1: 1990-1994
(DECREASING INFLATION BY 20%/YEAR)

	1990	2845	3661	59.18
1	1991	4192	5394	47.34
2	1992	5779	7437	37.87
3	1993	7530	9691	30.30
4	1994	9355	12039	24.24

(3) PHASE 2: 1995-1999
(DECREASING INFLATION BY 10%/YEAR)

5	1995	11396	14666	21.81
6	1996	13633	17545	19.63
7	1997	16042	20645	17.67
8	1998	18594	23929	15.90
9	1999	21255	27354	14.31

(4) PHASE 3: 2000 +
(STEADY INFLATION OF 10%/YEAR)

10	2000	23380	30089	10.00
11	2001	25718	33098	10.00
12	2002	28290	36408	10.00
13	2003	31119	40048	10.00
14	2004	34231	44053	10.00
15	2005	37654	48458	10.00
16	2006	41420	53304	10.00
17	2007	45562	58635	10.00
18	2008	50118	64498	10.00
19	2009	55130	70948	10.00
20	2010	60643	78043	10.00

表10.3　財務支出と収入のフロー

(1) interest rate: 8.7 %
(2) Power tariff: US$0.0570/kWh
(3) Annual energy generation : 1,054 GWh
(4) Energy loss rate : 12 %

Year	Expenditure: Construction Cost (Mil.$)	Expenditure: Construction Cost (%)	Expenditure: OMR Cost (Mil.$)	Expenditure: Total (Mil.$)	Operating Revenue: Energy Sold (GWh)	Operating Revenue: Gross Revenue (Mil.$)	Operating Revenue: Net Income (Mil.$)	Present Worth Factor	Present Worth of net Income	Accumulated Net Income (Mil.$)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	4.5	1.0		4.5			-4.5	0.9591	-4.3	-4.3
2	8.0	1.8		8.0			-8.0	0.8823	-7.1	-11.4
3	25.9	5.8		25.9			-25.9	0.8117	-21.0	-32.4
4	59.8	13.4		59.8			-59.8	0.7467	-44.6	-77.0
5	26.3	5.9		26.3			-26.3	0.6869	-18.1	-95.1
6	48.6	10.9		48.6			-48.6	0.6319	-30.7	-125.8
7	51.7	11.6		51.7			-51.7	0.5813	-30.1	-155.9
8	69.1	15.5		69.1			-69.1	0.5348	-37.0	-192.8
9	78.1	17.5		78.1			-78.1	0.4920	-38.4	-231.2
10	37.0	8.3	0.8	37.9	348	19.8	-18.0	0.4526	-8.2	-239.4
11	37.0	8.3	2.3	39.3	928	52.9	13.6	0.4163	5.7	-233.7
12			2.3	2.3	928	52.9	50.6	0.3830	19.4	-214.3
13			2.3	2.3	928	52.9	50.6	0.3523	17.8	-196.5
14			2.3	2.3	928	52.9	50.6	0.3241	16.4	-180.1
15			2.3	2.3	928	52.9	50.6	0.2982	15.1	-165.0
16			2.3	2.3	928	52.9	50.6	0.2743	13.9	-151.1
17			2.3	2.3	928	52.9	50.6	0.2523	12.8	-138.3
18			2.3	2.3	928	52.9	50.6	0.2321	11.8	-126.6
39			2.3	2.3	928	52.9	50.6	0.0402	2.0	-15.0
40			120.3	120.3	928	52.9	-67.4	0.0370	-2.5	-17.5
41			2.3	2.3	928	52.9	50.6	0.0341	1.7	-15.7
59			2.3	2.3	928	52.9	50.6	0.0076	0.4	-0.4
60			2.3	2.3	928	52.9	50.6	0.0070	0.4	0.0
Total	446.0	100.0	231.3	677.3	46724	2663.3	1985.9	11.9	0.0	

表10.4 ローン償還計画

Year	Loan-1 Loan Disburse - Capital (Mil.$)	Loan-1 Loan Disburse - IDC (Mil.$)	Loan-1 Accumu. Loan (Mil.$)	Loan-1 Repayment Interest (Mil.$)	Loan-1 Repayment Capital (Mil.$)	Loan-1 Repayment Total (Mil.$)	Loan-2 Loan Disburse - Capital (Mil.$)	Loan-2 Loan Disburse - IDC (Mil.$)	Loan-2 Accumu. Loan (Mil.$)	Loan-2 Repayment Interest (Mil.$)	Loan-2 Repayment Capital (Mil.$)	Loan-2 Repayment Total (Mil.$)	O&M Costs (Mil.$)	Annual Expenditu (Mil.$)	Annual Revenue (Mil.$)	Annual Surplus (Mil.$)	Accumu. (Mil.$)
(1)	(2)	(3)	(4)				(2)	(3)	(4)								
1	3.3	0.1	3.4				1.1	0.1	1.2					0.0		0.0	0.0
2	6.0	0.3	9.7				2.0	0.3	3.5					0.0		0.0	0.0
3	19.4	0.8	30.0				6.5	0.8	10.7					0.0		0.0	0.0
4	44.8	2.2	77.0				14.9	2.1	27.7					0.0		0.0	0.0
5	19.7	2.8	99.5				6.6	2.7	37.0					0.0		0.0	0.0
6	36.5	3.9	139.9				12.2	3.9	53.1					0.0		0.0	0.0
7	38.8	5.2	183.9				12.9	5.3	71.4					0.0		0.0	0.0
8	51.8	6.8	242.6				17.3	7.1	95.7					0.0		0.0	0.0
9	58.5	8.7	309.9				19.5	9.2	124.5					0.0		0.0	0.0
10	27.8	9.8	347.4				9.3	10.7	144.4				0.8	0.8	19.8	19.0	19.0
11	27.8	10.9	371.5	11.2	14.5	25.7	9.3	12.3	154.5	13.3	11.5	24.7	2.3	52.7	52.9	0.2	19.2
12			356.6	10.8	14.9	25.7			142.1	12.4	12.4	24.7	2.3	52.7	52.9	0.2	19.3
13			341.2	10.3	15.4	25.7			128.8	11.4	13.4	24.7	2.3	52.7	52.9	0.2	19.5
14			325.4	9.9	15.8	25.7			114.3	10.3	14.4	24.7	2.3	52.7	52.9	0.2	19.7
15			309.2	9.4	16.3	25.7			98.8	9.1	15.6	24.7	2.3	52.7	52.9	0.2	19.9
16			292.4	9.0	16.7	25.7			81.9	7.9	16.8	24.7	2.3	52.7	52.9	0.2	20.0
17			275.2	8.5	17.2	25.7			63.7	6.6	18.2	24.7	2.3	52.7	52.9	0.2	20.2
18			257.4	8.0	17.7	25.7			44.1	5.1	19.6	24.7	2.3	52.7	52.9	0.2	20.4
19			239.2	7.5	18.2	25.7			22.9	3.5	21.2	24.7	2.3	52.7	52.9	0.2	20.6
20			220.4	6.9	18.8	25.7			0.0	1.8	22.9	24.7	2.3	52.7	52.9	0.2	20.7
27			72.9	2.8	22.9	25.7							2.3	28.0	52.9	24.9	195.1
28			49.3	2.1	23.6	25.7							2.3	28.0	52.9	24.9	220.0
29			25.0	1.4	24.3	25.7							2.3	28.0	52.9	24.9	244.9
30			0.0	0.7	25.0	25.7							2.3	28.0	52.9	24.9	269.8
Total	334.5	51.6	5475.9	128.1	386.1	514.2	111.5	54.5	1420.4	81.4	166.0	247.3	45.8	807.4	1077.2	269.8	

Loan-1: Interest rate 2.9 % Repayment period, net 20.0 yr

Loan-2: Interest rate 8.0 % Repayment period, net 10.0 yr

Power tariff: US¢5.7/kWh

付図

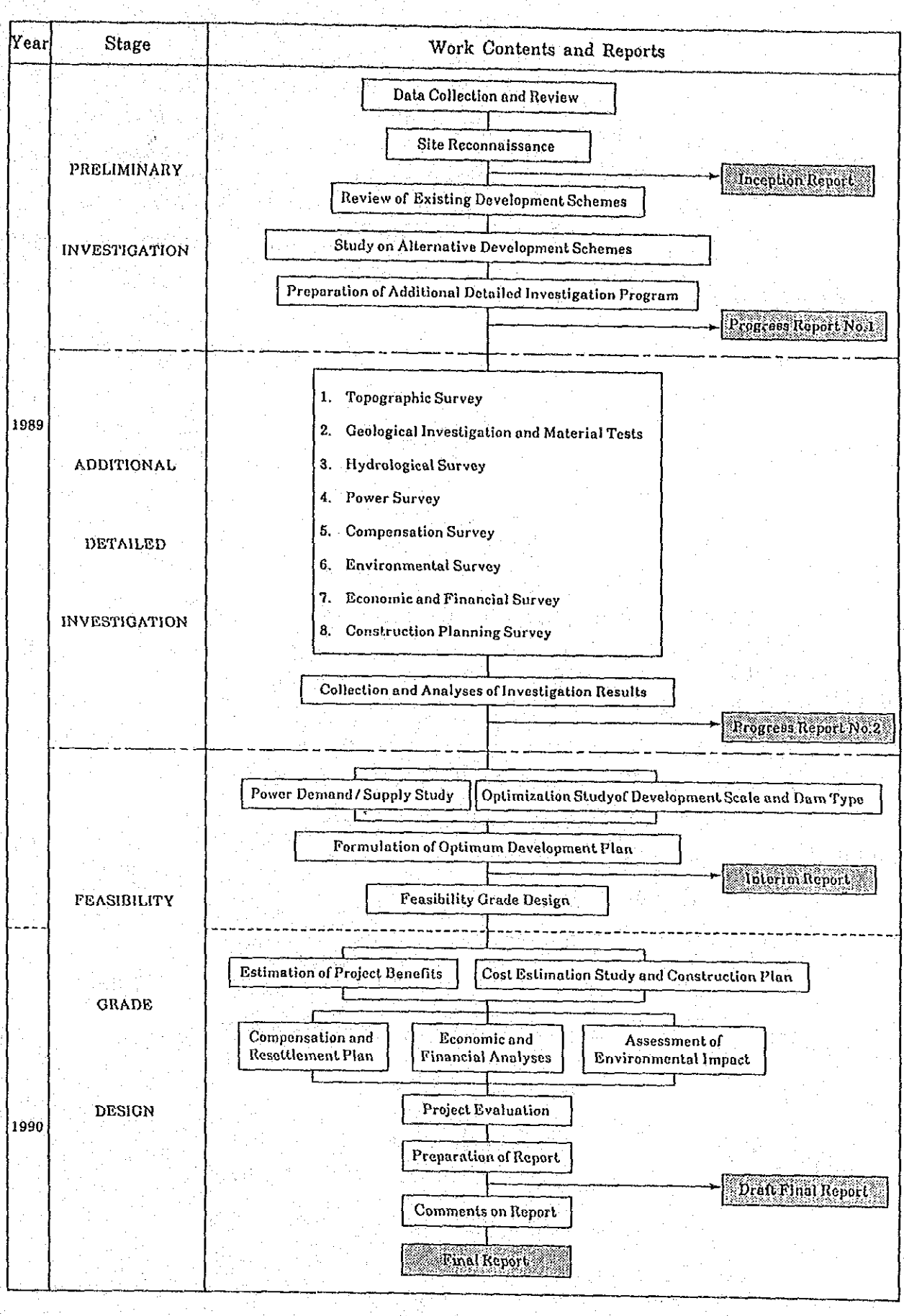


図1.1　フィージビリティスタディのフローチャート

FEASIBILITY STUDY ON ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT

GENERAL WORK SCHEDULE

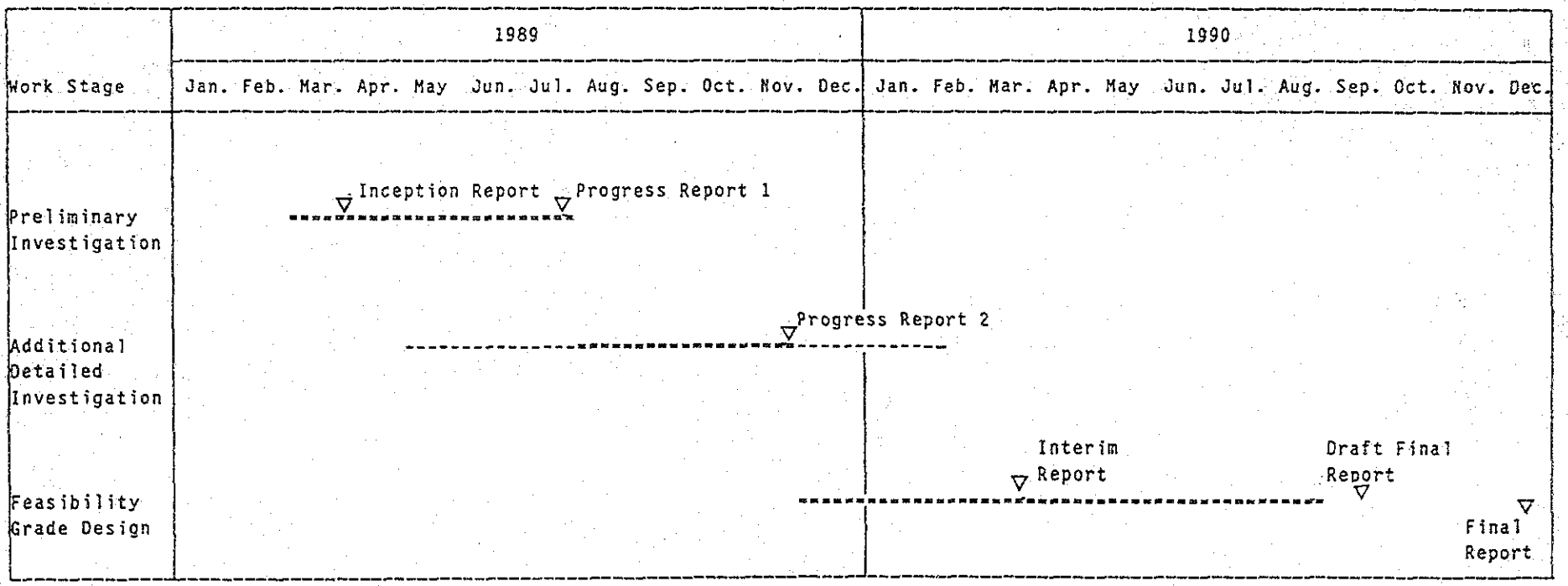


図1.2 フィージビリティスタディの一般工程

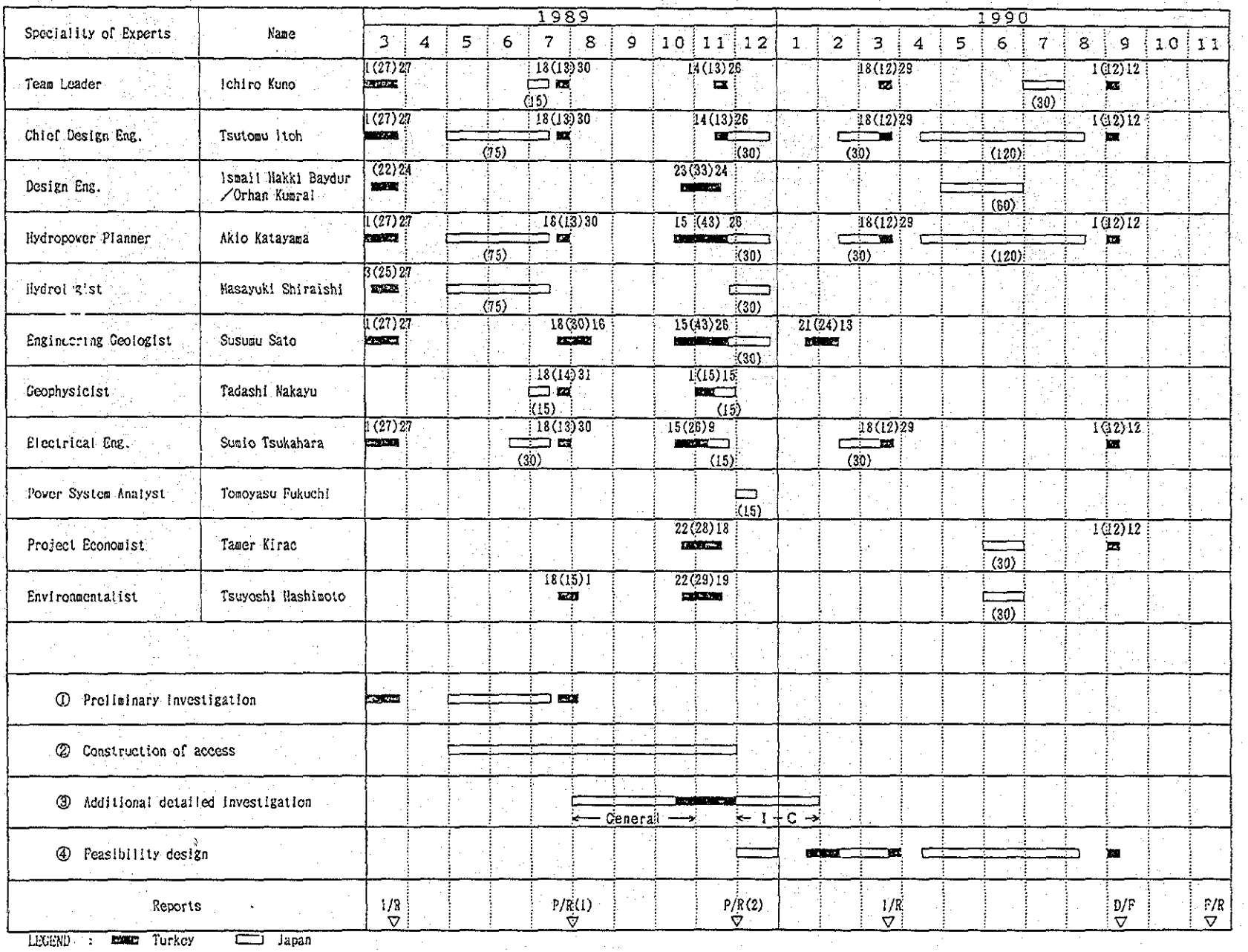


図1.3　ＪＩＣＡ調査団の要員計画

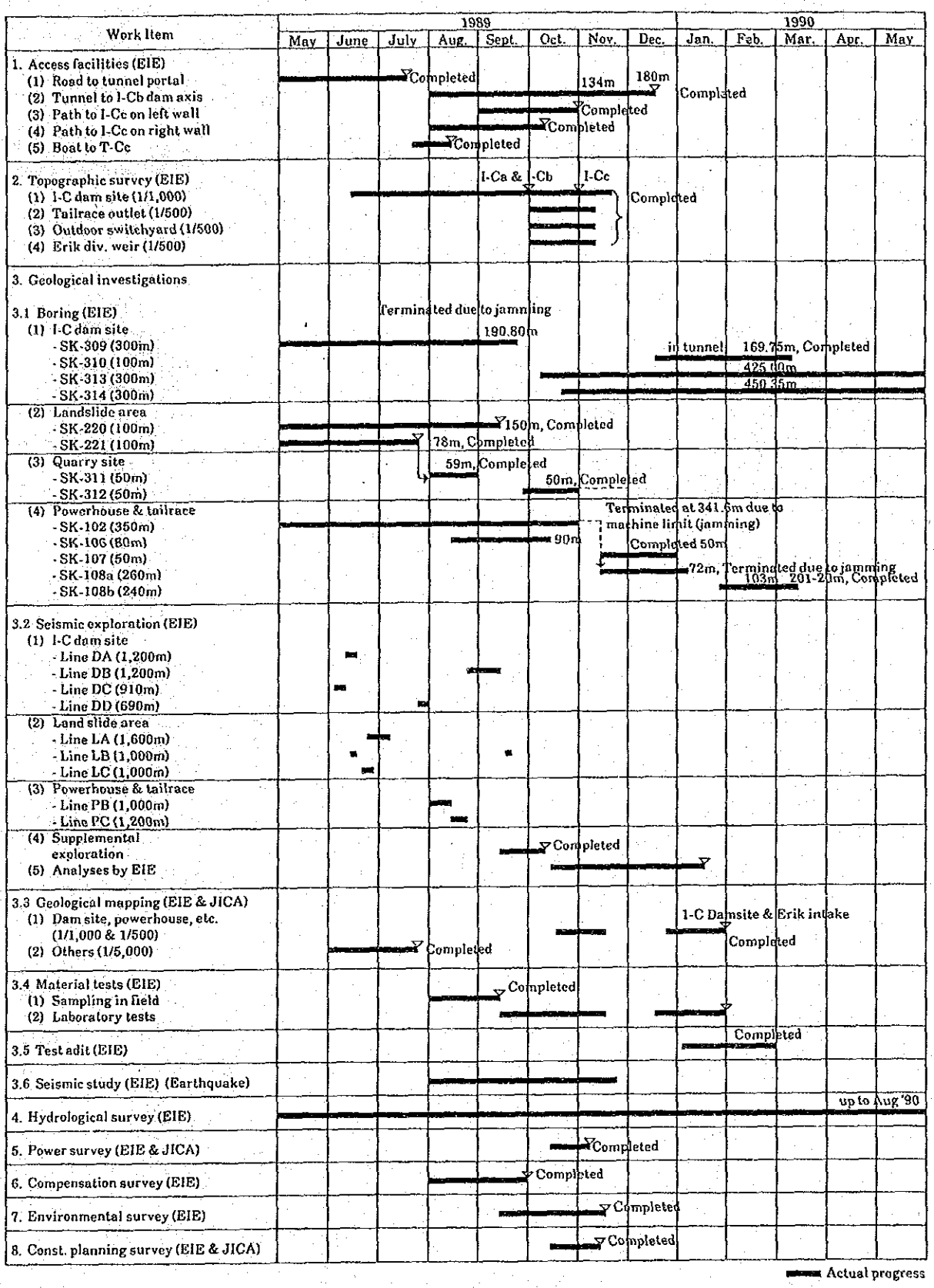
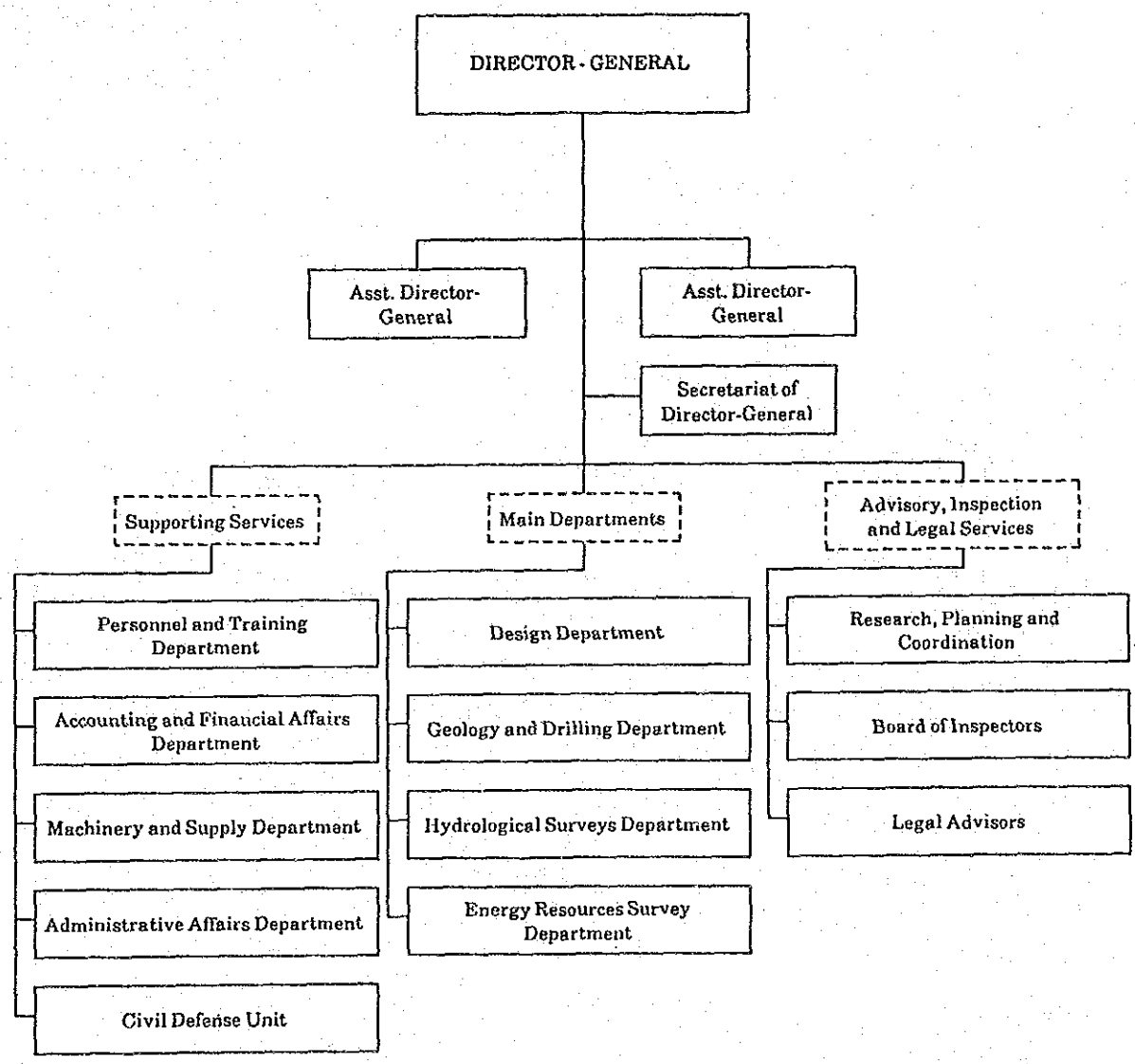


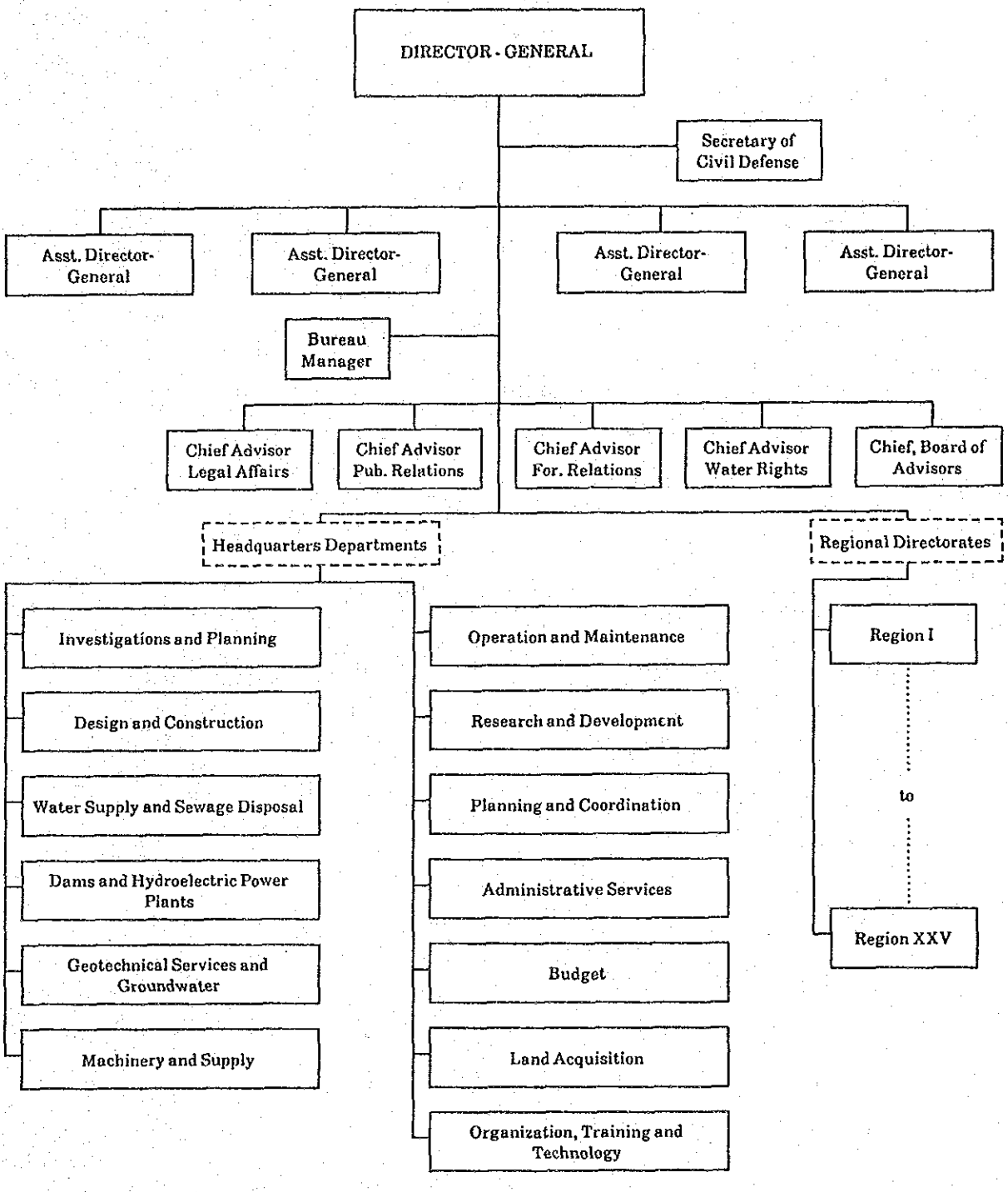
図1.4　追加詳細調査の工程

FIG. NO.



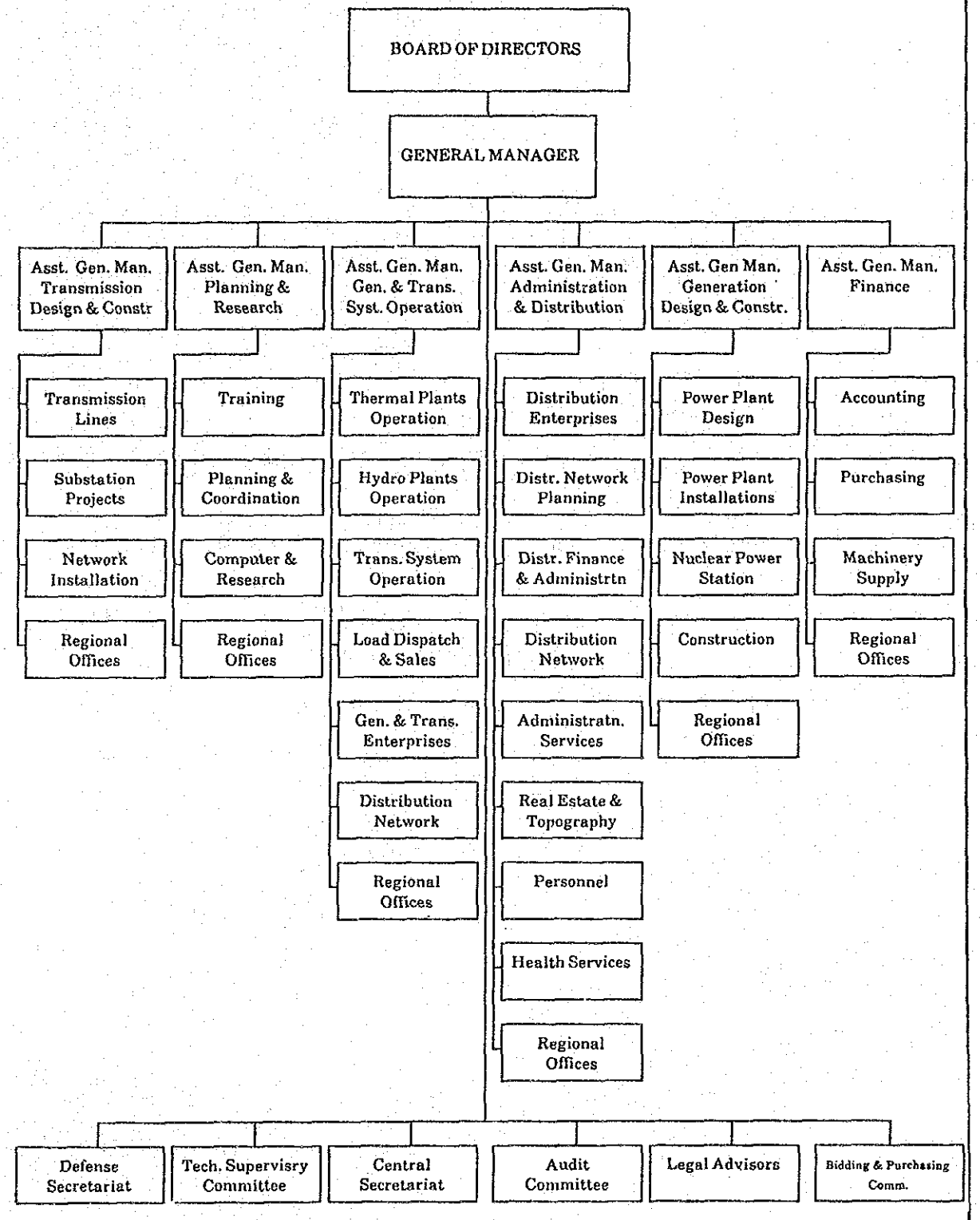
	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜĞÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.1 EIEの組織図

FIG. NO.



	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.2 ＤＳ１の組織図

FIG. NO.



	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.3 TEKの組織図

FIG. NO.

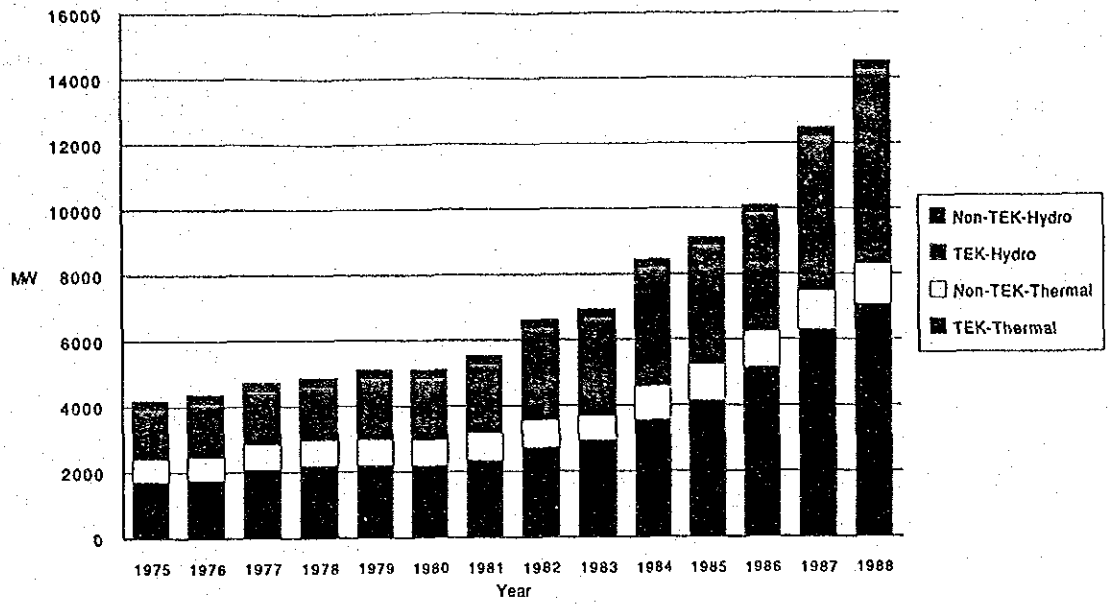


図3.4　発電設備の開発実績

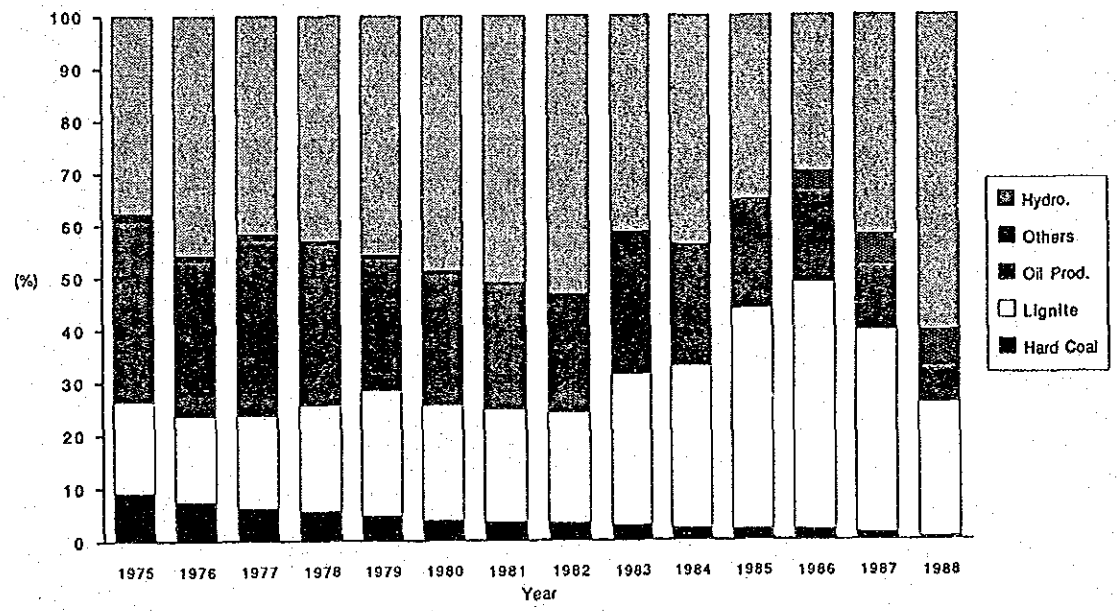
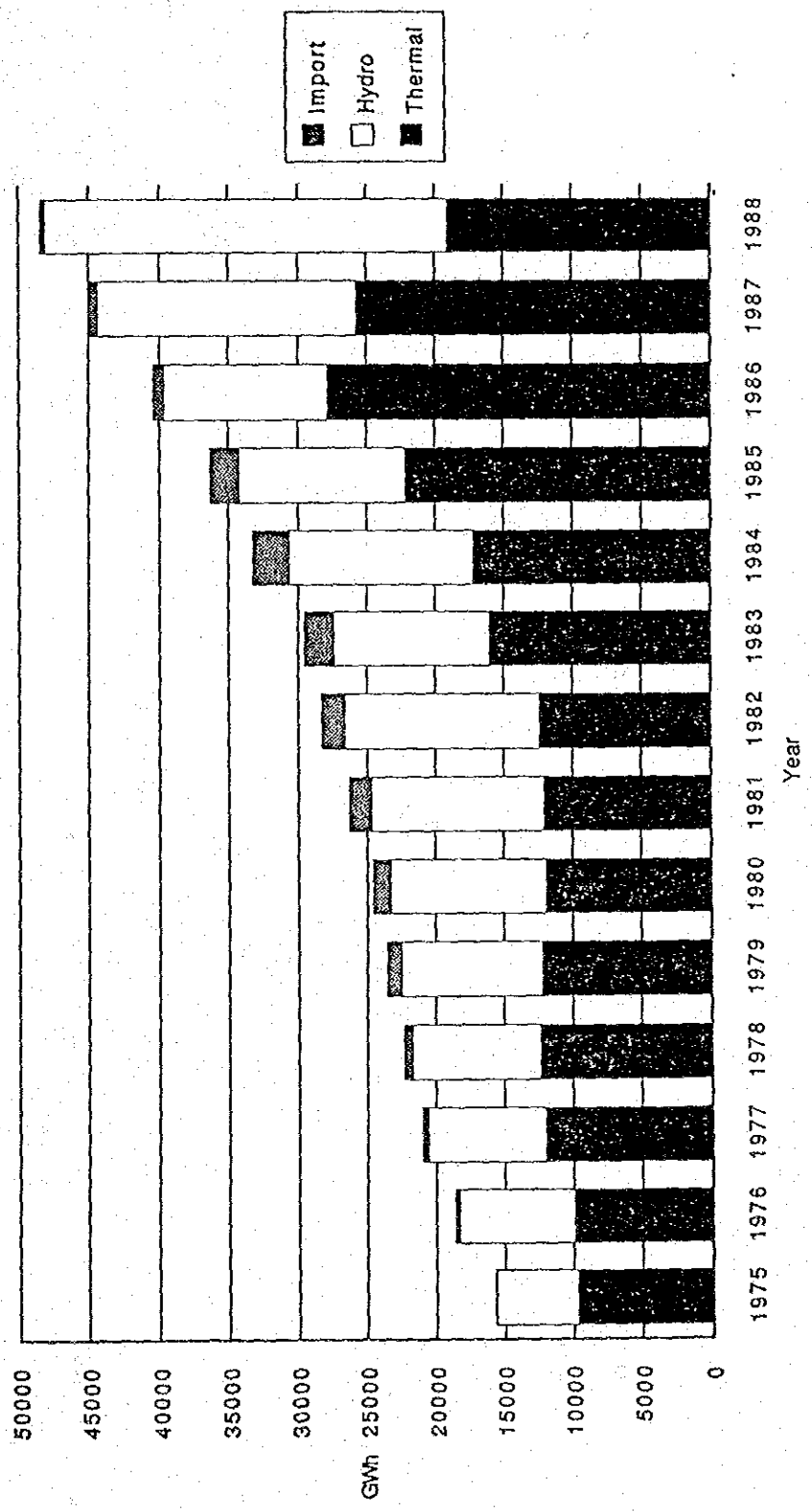


図3.5　総発電電力量に占める１次エネルギー源別のシェアの推移

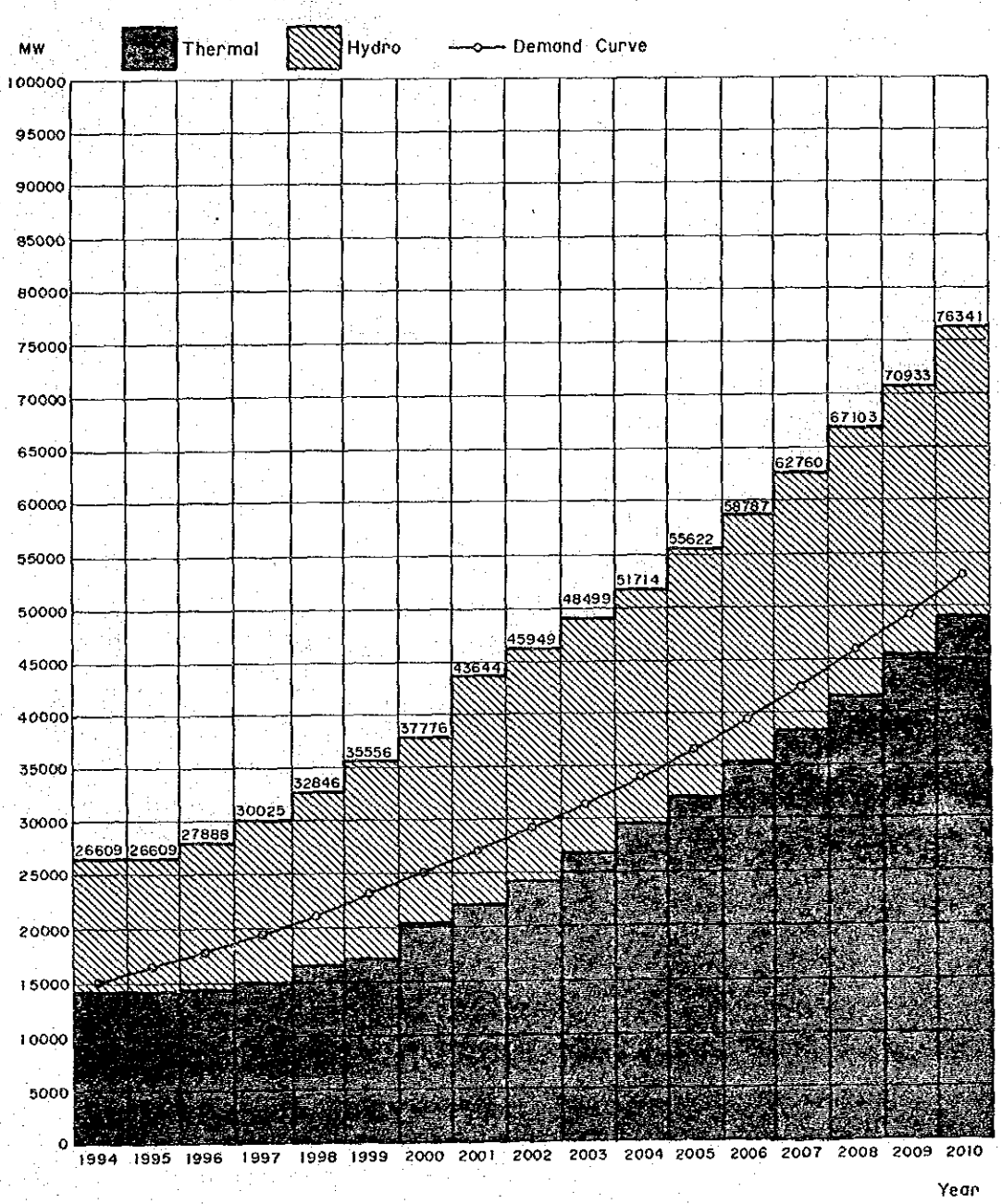
	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.4、図3.5

FIG. NO.



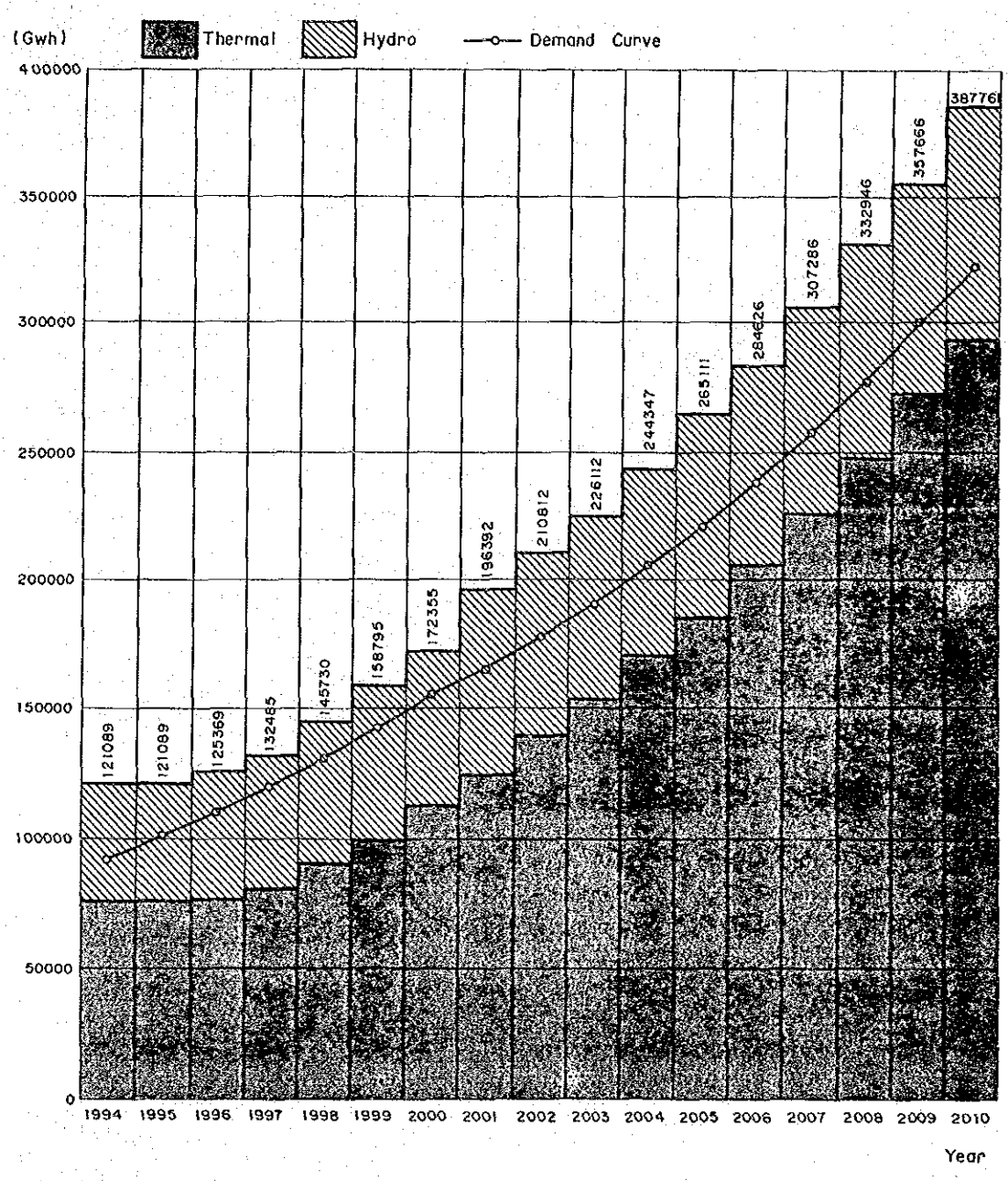
THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.6 発電電力量の伸び

FIG NO.



	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.7 ピーク電力需要予測と 供給設備計画

FIG NO.



THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜĞÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.8 電力量需要予測と運転計画	

FIG. NO.

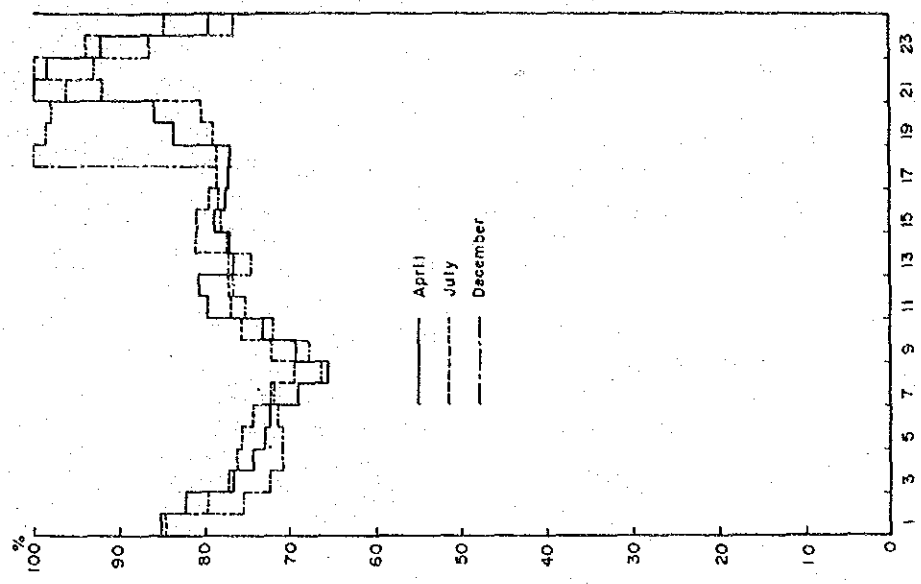


図3.10 日曜日の日負荷曲線（2000年）

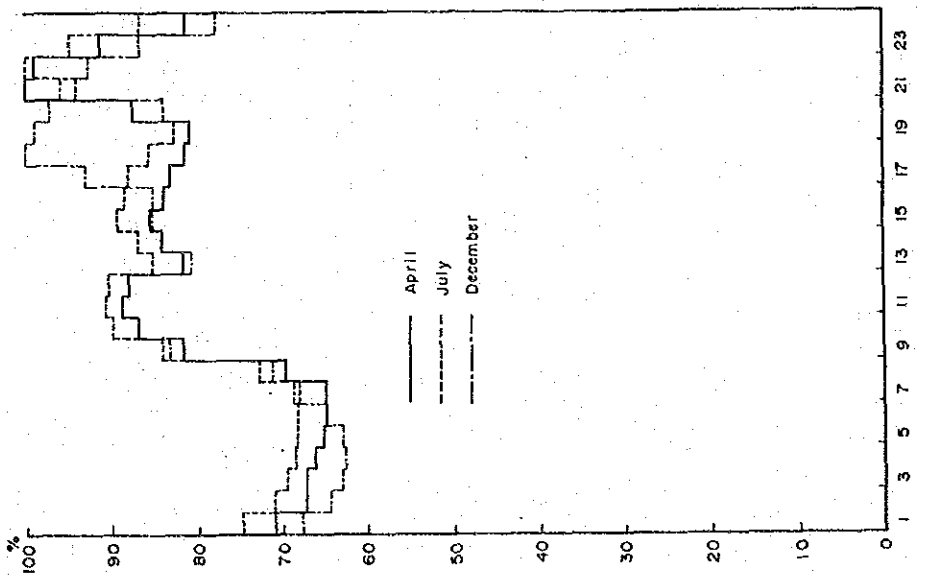


図3.9 平日の日負荷曲線（2000年）

	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図3.9、図3.10

FIG. NO.

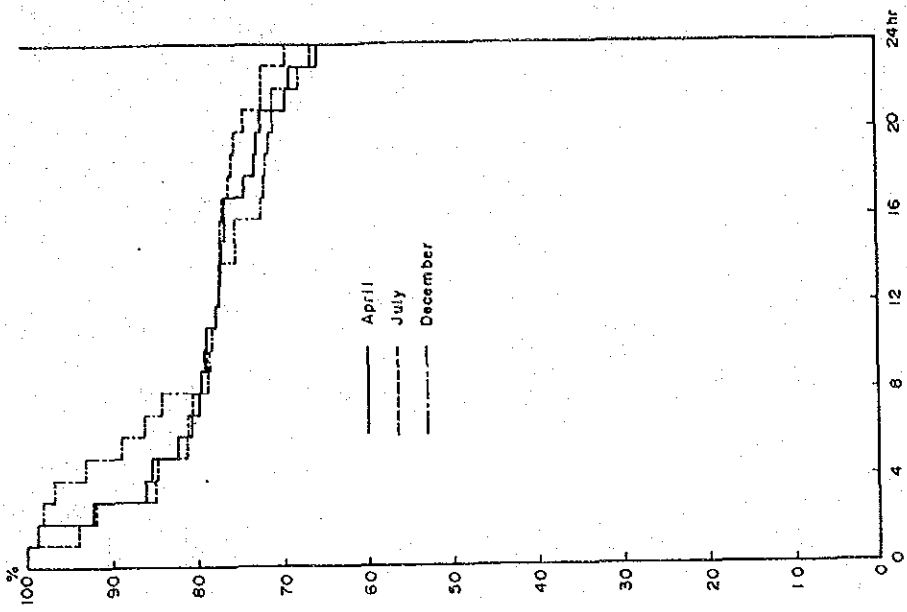


図3.12　日曜日の日負荷持続曲線（2000年）

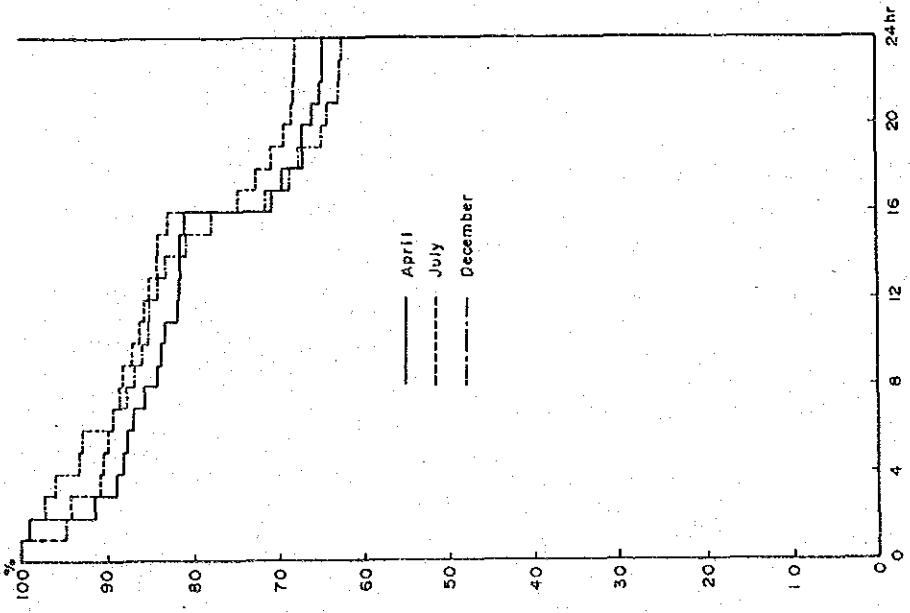
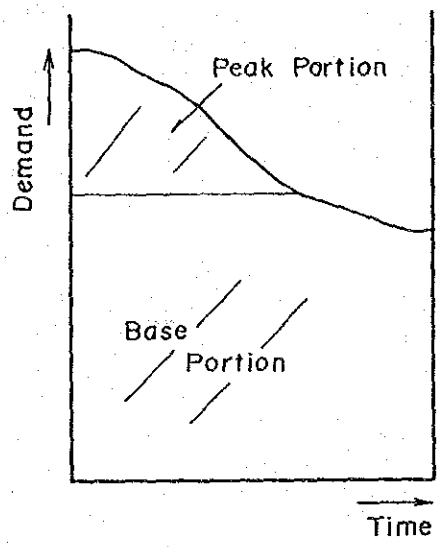
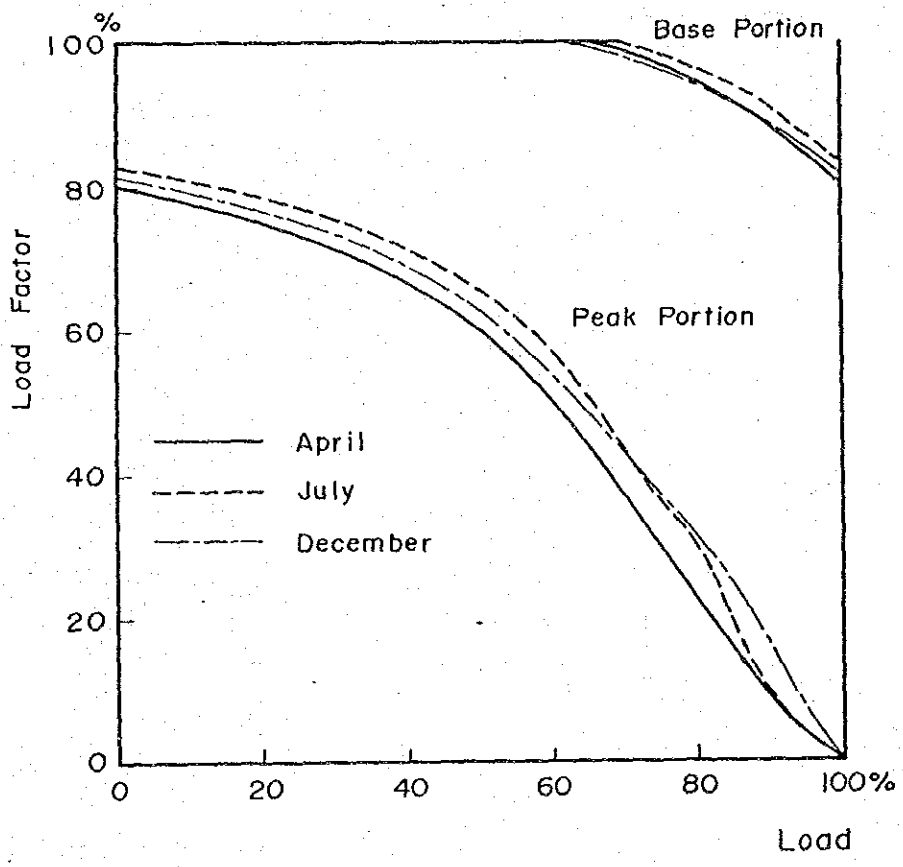


図3.11　平日の日負荷持続曲線（2000年）

THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT	TITLE	図3.11、図3.12
	JAPAN INTERNATIONAL COOPERATION AGENCY		

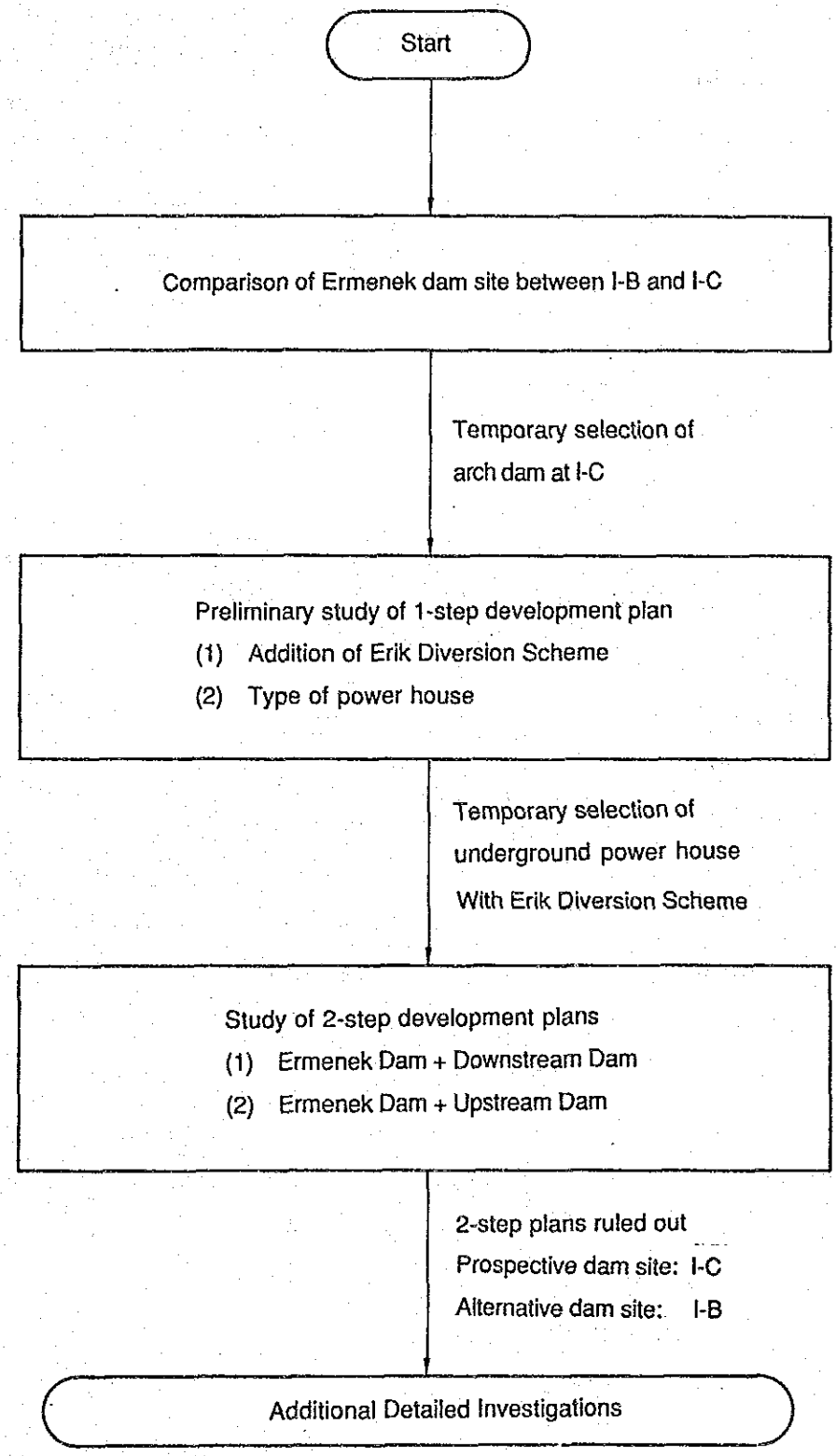
FIG. NO.





	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	図3.13 ピークおよびベース部分毎の負荷率（平日、2000年）

FIG. NO.



	THE REPUBLIC OF TURKEY ELEKTRİK İŞLERİ ETÜD İDARESİ GENEL MÜDÜRLÜGÜ	ERMENEK HYDROELECTRIC POWER DEVELOPMENT PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE 図4.1 予備検討作業の フローチャート