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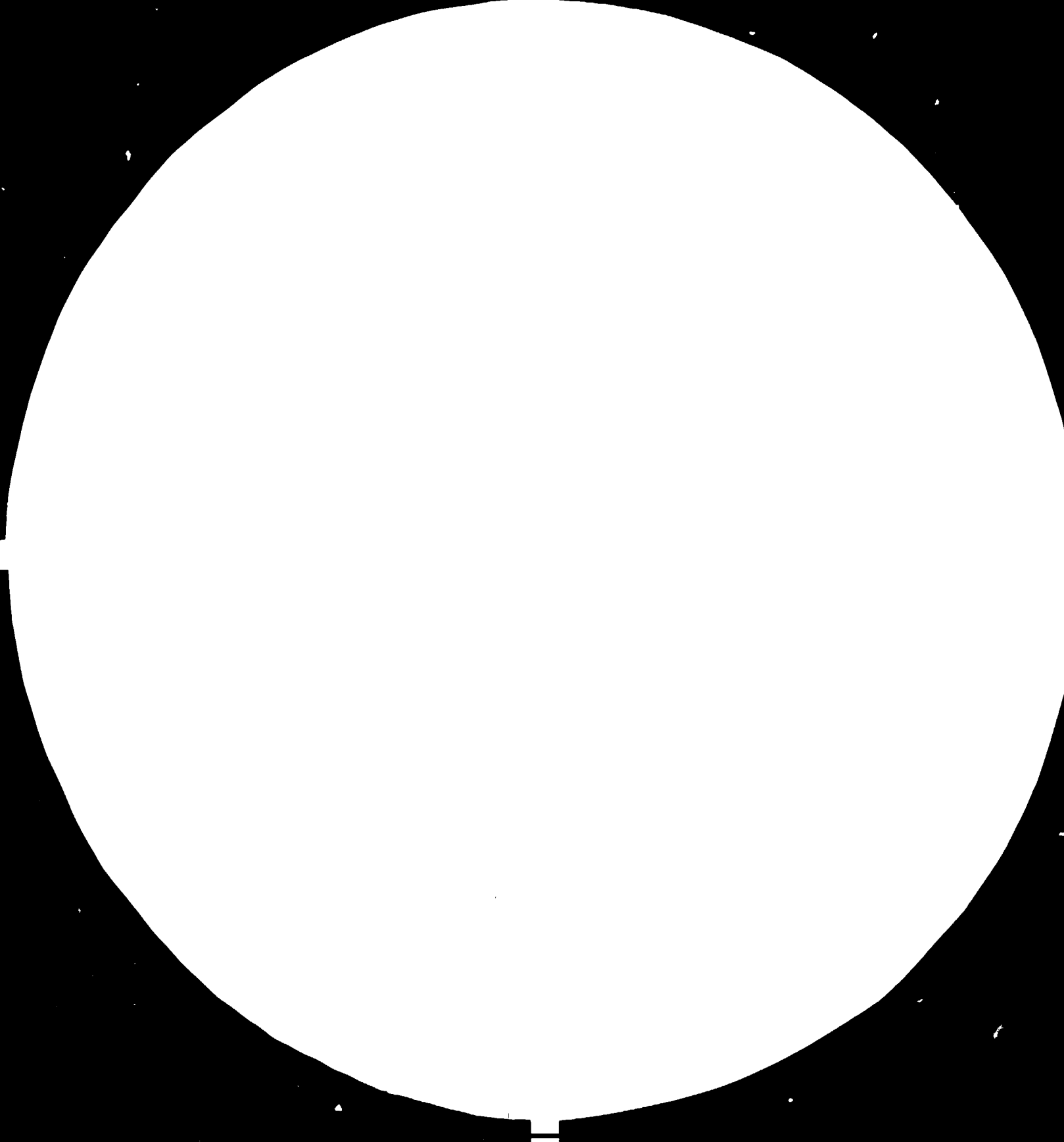

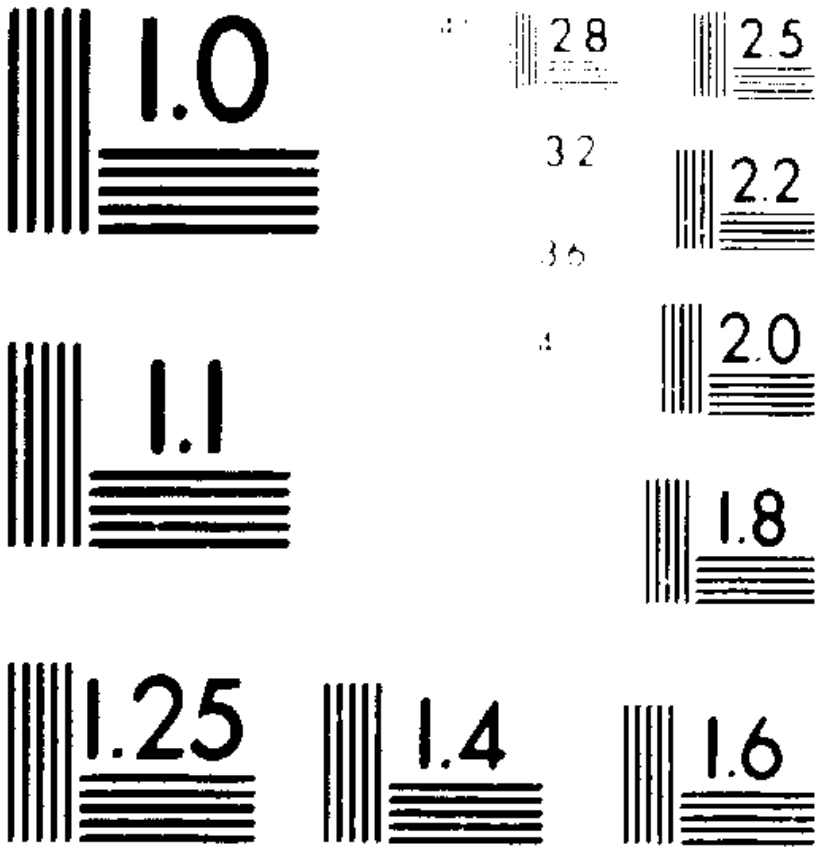

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DEVELOPMENT OF
CAPITAL GOODS INDUSTRIES

DP/TUR/76/034

TURKEY

TECHNICAL REPORT NO. XX – Technical Report on Electromechanical Industry With Special Reference to TEMSAN.

Aralık 1983

DEVELOPMENT OF CAPITAL GOODS

INDUSTRIES

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Birleşmiş Milletler Kalkınma Programı

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DEVELOPMENT PROGRAMME IN TURKEY

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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Sept. 1983

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DEVELOPMENT OF
CAPITAL GOODS INDUSTRIES
DP/TUR/76/034

Technical Report No. XX - Technical Report on Electromechanical Industry
With Special Reference to TEMSAN.

Prepared for the Government of Turkey
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of
Capital Goods Development Project team in Turkey

United Nations Industrial Development Organization
Vienna

This report has not been cleared with the United Nations Industrial Development Organization which does not, therefore, necessarily share the views presented.

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LIST OF CHARTS

(1)

LIST OF GRAPHS

LIST OF ABBREVIATIONS

SPO	State Planning Organisation
CGDP	Capital Goods Development Project
TEMSAN	(Türkiye Elektromekanik Sanayii A.Ş.) Turkish Electromechanics Industry
TEK	(Türkiye Elektrik Kurumu) Turkish Electricity Authority
SITC	Standard International Trade Classification.

UNIDO-CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

INTRODUCTION

In the Capital Goods Development Project being conducted by SPO and UNIDO for planning the future of the capital goods industry in Turkey and short-term strategies for this critical sector of economy, electromechanics have been identified as one of the priority sectors.

SPO has placed heavy emphasis on an analysis by the Capital Goods Development Project of all the major projects conceived for manufacture of different categories of capital goods. One of these was manufacture of electromechanical products by the State Economic Enterprise Turkish Electromechanic Industry (TEMSAN).

This report deals with the demand and capacity for manufacture of electromechanical products with special reference to TEMSAN.

Since SPO was keen on a clear analysis of TEMSAN's investment plan as a matter of high priority, the first exercise was demand projections of items which are proposed to be produced by TEMSAN. The objective was to define the capacity that could be needed in Turkey for these products according to demand forecasts of TEK and analyse them with reference to the capacity in public and private, available as well as planned.

This study was conducted by Mr. Hasan Yilmaz, SPO expert, under the direction of Mr. M.M. Luther, Chief Technical Adviser, Capital Goods Development Project.

The project management is grateful to TEMSAN General Manager Mr. Nejat Akinciturk, TEMSAN experts, Mr. Ersin Gmay and Mr. Siddik Bektas who made themselves available for discussions at different stages of the study.

Mr. Vahit Erdem, National Project Coordinator of the Capital Goods Development Project and head, Sectoral Planning Division, SPO. Mr. Abdullatif Tuna, expert, SPO, were continously associated with the study.

M.M. LUTHER,
C.ENG.F.I.MECH.E.(LOND)F.I.PROD.E.(LOND),
CHIEF TECHNICAL ADVISER,
CAPITAL GOODS PRJECT IN TURKEY.

DEMAND-CAPACITY ANALYSIS OF TEMSAN PRODUCTS

1. THE ORIGINAL PROJECT

1.1. TEMSAN was founded in 1977 to manufacture hydraulic and steam turbines, steam boilers, hydraulic and steam generators, pumps, alternators, transformers, circuit breakers, synchronous, asynchronous and DC motors, energy transmission lines and its equipment.

1.2. These products were planned to be manufactured in following factories:

Site A: DIYARBAKIR

Factory 1 : small water turbine and Pumps.
Factory 2 : small dyraulic generators and motors
Factory 3 : steam and water turbines.
Factory 4:: high capacity generator, steam generators and motors

Site B : MALATYA

Factory 5 : steam boilers
Factory 6 : transmission line hard-ware.

Site C : ELAZIG

Factory 7 : transformers

Site D : ANKARA

Factory 8 : circuit breakers.

1.3. Capacities and product-mix of these factories are as follows:

FACTORY 1 - SMALL WATER TURBINES AND PUMPS

Small water turbines		9 units	0-20 MW
Pumps -	A Type	230 units	1200 m^3/hr.
	B "	250 "	1800 "
	C "	30 "	8000 "
	D "	30 "	20000 "
	E "	24 "	2000 "
	F "	20 "	16000 "
	G "	10 "	100 "
	H "	6 "	1000 "
	K "	300 "	20-80 "
	TOTAL	900	

FACTORY 2 - SMALL HYDRAULIC GENERATORS AND MOTORS

small hydraulic generators		9 units	0-20 MW
Motors -	Asynchronous Motors 350 KW/unit	600 units	210 MW
	Asynchronous Motors 1200 "	250 "	300 "
	Synchronous Motors 380 "	550 "	210 "
	Synchronous Motors 1200 "	150 "	180 "
	Direct Current Motors 750 "	100 "	75 "
	Direct Current Motors 1200 "	50 "	60 "
		Total 1700	

FACTORY 3 - STEAM AND WATER TURBINES

Steam Turbines	2	Units	300MW
	2	"	200MW
TOTAL	4	"	
Water Turbes	3	"	23 MW
	3	"	45 "
	3	"	60 "
	2	"	125"
	1	"	155"
	2	"	175"
TOTAL	14	"	

FACTORY 4 - HIGH CAPACITY GENERATORS, STEAM GENERATORS AND MOTORS *

Steam Generators	2	Units	300 MW
	2	"	200 MW
TOTAL	4	"	
Hydraulic Generators	3	"	23 "
	3	"	45 "
	3	"	60 "
	2	"	125 "
	1	"	155 "
	2	"	175 "
	14	"	

* According to latest feasibility report, all the motors are to be manufactured in Fac.2.

FACTORY 5 - STEAM BOILERS

Steam Boilers	2 Units	300 MW
	2 Units	200 MW

FACTORY 6 - TRANSMISSION LINE HARD-WARE

34,5 KV line hardware	700 tonnes
154,380 KV line hardware	4 [illegible] tonnes

FACTORY 7 - TRANSFORMERS

Transformers	50 MVA-154/35KV	13	Unit/year
"	100 MVA-154/35KV	12	"
"	150 MVA-380/154KV	11	"
"	180 MVA-380/154 KV	7	
		43	

FACTORY 8 - CIRCUIT BREAKERS

Medium voltage circuit breakers	12KV	1050 units
	36KV	750 "
High voltage circuit breakers	170KV	160 "
	420KV	40 "
High voltage isolators	170KV	400 "
	420KV	100 "

2. DEMAND PROJECTIONS

2.1. Demand projections have been made on the basis of TEK's projection of power generation, distribution and transmission upto 2000, as updated by SPO in August 85.

2.2. The projections are in terms of 15 digit codes of equipment based on SITC evolved by the Capital Goods Project in Turkey. These codes for the items covered by TEMSAN are at Ann. I.

2.3. As will be seen from these codes, they identify the nomenclature, the major specifications and principal manufacturing characteristics and origin of supplies. The manufacturing characteristics are identical to those in codes for other items of capital goods.

2.4. The methodology including computerisation of data leading to these projections is fully explained in Technical Report No. XVIII, dealing with TEK.

2.4.1. Weight Computation.

In the absence of details of weights of products in the feasibility reports of TEMSAN, the data of weights in each 15 digit code of relevant capital goods (e.g. turbines, generators) as given in the plant survey forms by TEK has been used as the basis for computation by weight of demand and capacity of different items.

3. FACTORY I

3.1. SMALL WATER TURBINES 0-20 MW

3.1.1. 0-20 MW water turbine factory (which will also manufacture pumps, is already complete. Except one, all machine tools have been assembled and tested. Cranes, furnaces and electricity supply systems have been installed. Shot blasting and painting units and some laboratory equipment are expected during 1986.

3.1.2. The annual demand is shown in Chart 1A and 1B and Graph 1. The average demand for 0-20 MW water turbines during the period 1985-1998 is 198 MW(19 units, 2077 tonnes) and is evenly spread.

/..

3.1.3. The planned annual capacity of this factory, 150MW (9 units 2000 tonnes) should be urgently realised. There is no capacity for these in the private sector.

3.1.4. It will be crucial for the government to take a policy decision that DSI should order all their small water turbine needs on TEMSAN if TEMSAN will take the necessary managerial and other steps to build up its manufacture in good time.

3.2. PUMPS

TEMSAN is planning to manufacture 9 different types of pumps in the same factory at Diyarbakir.

3.2.1. Capacity and product-mix of these pumps are given in Cahpter I Para 1.3.

3.2.2. It is understood from TEMSAN that no adidtional machinery other than what is already installed is required in the small hydraulic turbine factory to machine and assemble pumps.

3.2.3. It is recommended that TEMSAN should develop its capability to produce pumps ONLY for boiler-feed in thermal power stations and leave others such as those required for irrigation etc. to other manufacturers.

CHART I A Water

Item code	Un.	1985	1986	1987	1988	1989	1990	1991
71881 - 10124 - 16771	WT	-	-	200	1300	400	500	-
	MW	-	-	10	65	20	25	-
71881 - 10233 - 16782	WT	-	1026	228	1254	228	228	228
	MW	-	135	30	165	30	30	30
71881 - 10321 - 17782	WT	1512	432	-	1296	-	1080	1512
	MW	322	92	-	276	-	230	322
71881 - 10432 - 17792	WT	582	873	-	1455	582	873	-
	MW	124	186	-	310	124	186	-
71881 - 10542 - 18792	WT	-	-	-	-	-	-	820
	MW	-	-	-	-	-	-	270
71881 - 10641 - 18792	WT	1308	-	-	-	-	-	-
	MW	543	-	-	-	-	-	-
71881 - 10742 - 18792	WT	-	-	-	-	-	920	-
	MW	-	-	-	-	-	400	-
71881 - 10841 - 18782	WT	628	628	-	-	628	628	628
	MW	600	600	-	-	600	600	600
TOTAL 0-20 MW	MW	-	135	40	230	50	55	30
	WT	-	1026	428	2554	628	728	728
TOTAL 20-150 MW	WT	446	278	-	886	124	416	592
	MW	2096	1035	-	2757	562	1953	2332
TOTAL 150-300 MW	WT	1143	600	-	-	600	1080	600
	MW	1936	628	-	-	628	1548	628

turbine demand (weight in tonnes, power in MWs)

1992	1993	1994	1995	1996	1997	1998
-	2600	1600	1700	2700	1000	900
-	130	80	85	135	50	45
228	3192	2166	1938	1710	1710	2052
30	420	285	255	225	225	270
1295	2808	3888	3240	1728	1728	648
276	598	828	690	368	368	138
-	3201	873	873	3492	2328	1746
-	682	186	186	744	496	372
820	-	1230	2050	-	820	-
270	-	405	675	-	270	-
1308	-	-	-	-	-	1308
543	-	-	-	-	-	543
-	5060	-	-	-	-	-
-	2200	-	-	-	-	-
628	-	-	-	-	-	-
600	-	-	-	-	-	-
30	550	365	340	360	275	315
228	5792	3766	3638	4410	2710	2952
546	1280	1419	1551	1112	1134	510
2116	6000	6811	6613	5220	4826	2394
1143	2200	-	-	-	-	-
1936	5060	-	-	-	-	-

Page 9

CHART 1-5

Water Turbine Demand

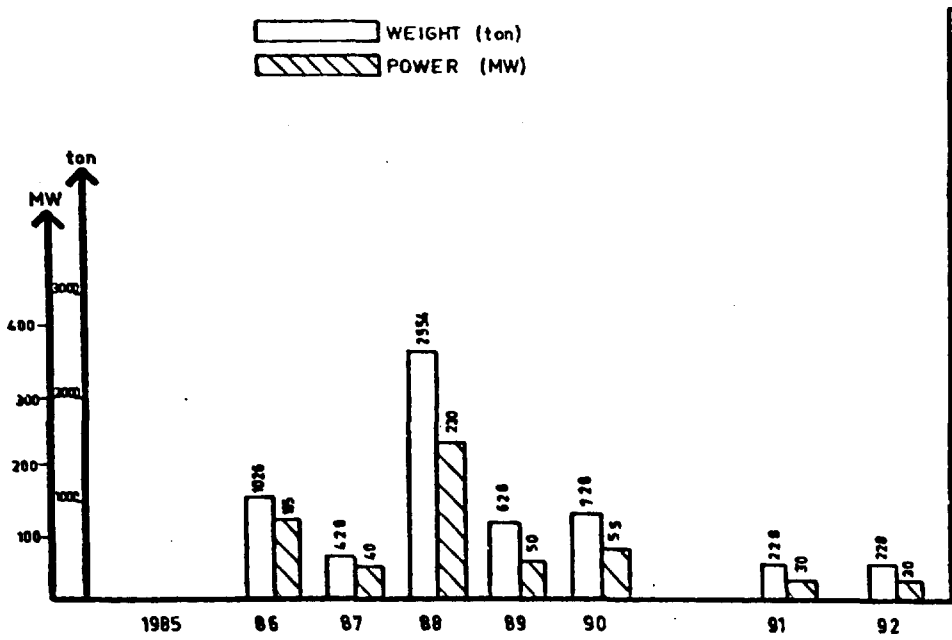
(Wt. in tonnes, Power in MWs)

	Average Demand/year			Capacity		
	Weigth	Power	Units	Weight	Power	Units
A- 0-20 MW	2077	138	19	2000	150	2
B- 20-150 MW	3201	714	12	2686 *	1139 *	14 *
C- 150-300 MW	883	529	2	* *	* *	* *

* These figures are the proposed capacity of Temsan for 20-175 MW water turbines in the original feasibility report. It is recommended that it may manufacture water turbines upto 150MW only.

* * It is also recommended that TEMSAN should make a revised study on its original feasibility report to manufacture 150-300 MW water turbines.

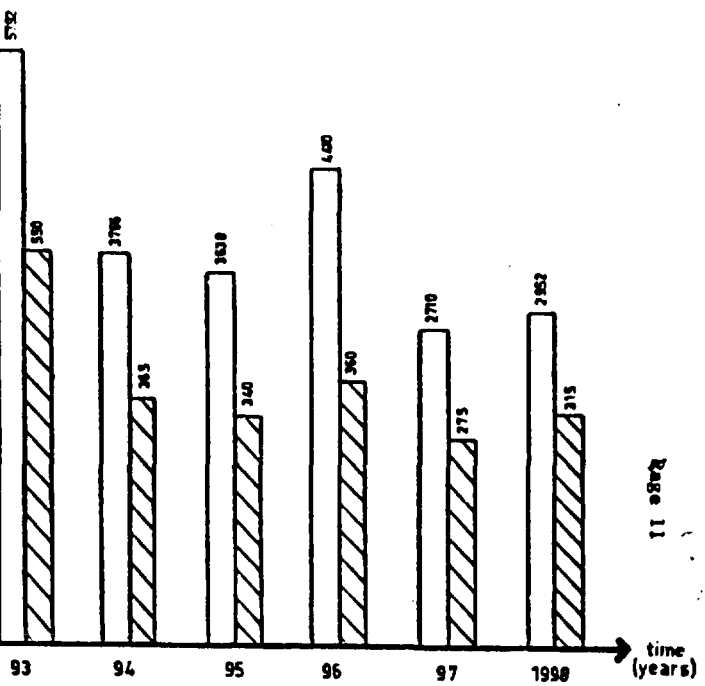
UNIDO CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY



GRAPH I

WATER TURBINE DEMAND

(0-20 MW)



4. FACTORY 2

4.1. SMALL HYDRAULIC GENERATORS

4.1.1. Small hydraulic generators (0-20 MW) for similar capacity water turbines are proposed to be manufactured in the small generator and motor factory at Diyarbakir.

4.1.2. For fabrication operations, machinery and plant have already been installed. TEMSAN plans to install the necessary special purpose machine tools in 1983.

4.1.3. Detailed demand figures during 1985-1998 on tonne and MW basis are given in Chart IIA & IIB Graph II. Average demand for 0-20 MW hydraulic generators during the period 1985-1998 is 198 MW (19 units, 1642 tonnes).

4.1.4. The planned capacity of this factory, 150 MW (9 units, 1500 tonnes) should be urgently realised. There is no capacity for these in the private sector.

4.1.5. It will be necessary for DSI to coordinate its future demands for small hydraulic generators with TEMSAN so that the latter's capacity is fully utilised.

4.2. MOTORS

In the original feasibility report, TEMSAN planned to manufacture motors of different capacities in two factories. In 1982 a revised feasibility was prepared and TEMSAN decided to decrease its range of manufacture and concentrate it in a single factory.

4.2.1. Proposed capacity and product-mix of this factory is given in Chapter I Para 1.3.

4.2.2. Demand data for motors has bot been studied by Capital Goods Development Project.

CHART VI-A HYDRAULIC GENERATOR DEMAND
(Weight in tonnes, Power in MW)

I.E.C. CODE	U.N.	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
71622 - 00334 - 57692 -	WT	-	-	110	734	220	275	-	-	1127	878	933	487	549	494	-	-
	MW	-	-	30	65	20	25	-	-	130	80	85	135	50	45		
71622 - 00334 - 57692 -	WT	-	1008	224	1232	224	224	224	224	2136	2128	1904	1680	1680	2016		
	MW	-	135	30	165	30	30	30	30	420	285	255	225	225	270		
71622 - 10324 - 19692 -	WT	2065	590	-	1770	-	1475	2065	1770	3835	5310	4425	2360	2360	885		
	MW	322	92	-	276	-	230	322	270	598	828	690	368	368	138		
71622 - 10424 - 19692 -	WT	1200	1800	-	3000	1200	1800	-	-	6600	1800	1800	7200	4800	3600		
	MW	124	186	-	310	124	186	-	-	682	186	186	744	496	372		
71622 - 10524 - 19692 -	WT	-	-	-	-	-	-	1016	1016	-	1524	2540		1016	-		
	MW	-	-	-	-	-	-	270	270	-	405	675	-	270	-		
71622 - 10524 - 19692 -	WT	2478	-	-	-	-	-	-	2478	-	-	-	-	-	2478		
	MW	543	-	-	-	-	-	-	543	-	-	-	-	-	543		
71622 - 10644 - 19692 -	WT	-	-	-	-	-	1800	-	-	9900	-	-	-	-	-		
	MW	-	-	-	-	-	400	-	-	2200	-	-	-	-	-		
71622 - 10715 - 19692 -	WT	2280	2280	-	-	2280	2280	2280	2280	-	-	-	-	-	-		
	MW	600	600	-	-	600	600	600	600	-	-	-	-	-	-		
TOTAL 0-20MW	MW	-	135	40	230	50	55	30	30	550	365	340	360	275	315		
	WT	-	1008	334	1946	444	499	224	224	4563	3006	2837	3162	2229	2510		
TOTAL 20-150 MW	MW	446	278	-	586	124	416	592	546	1280	1419	1551	1132	1134	510		
	WT	3265	2390	-	4770	1200	3275	3081	2786	10435	8634	8765	9560	8176	4485		
TOTAL 150-300 MW	MW	1143	600	-	-	600	1000	600	1143	2200	-	-	-	-	-		
	WT	4758	2280	-	-	2280	4080	2280	4758	9900	-	-	-	-	-		

CHART II B

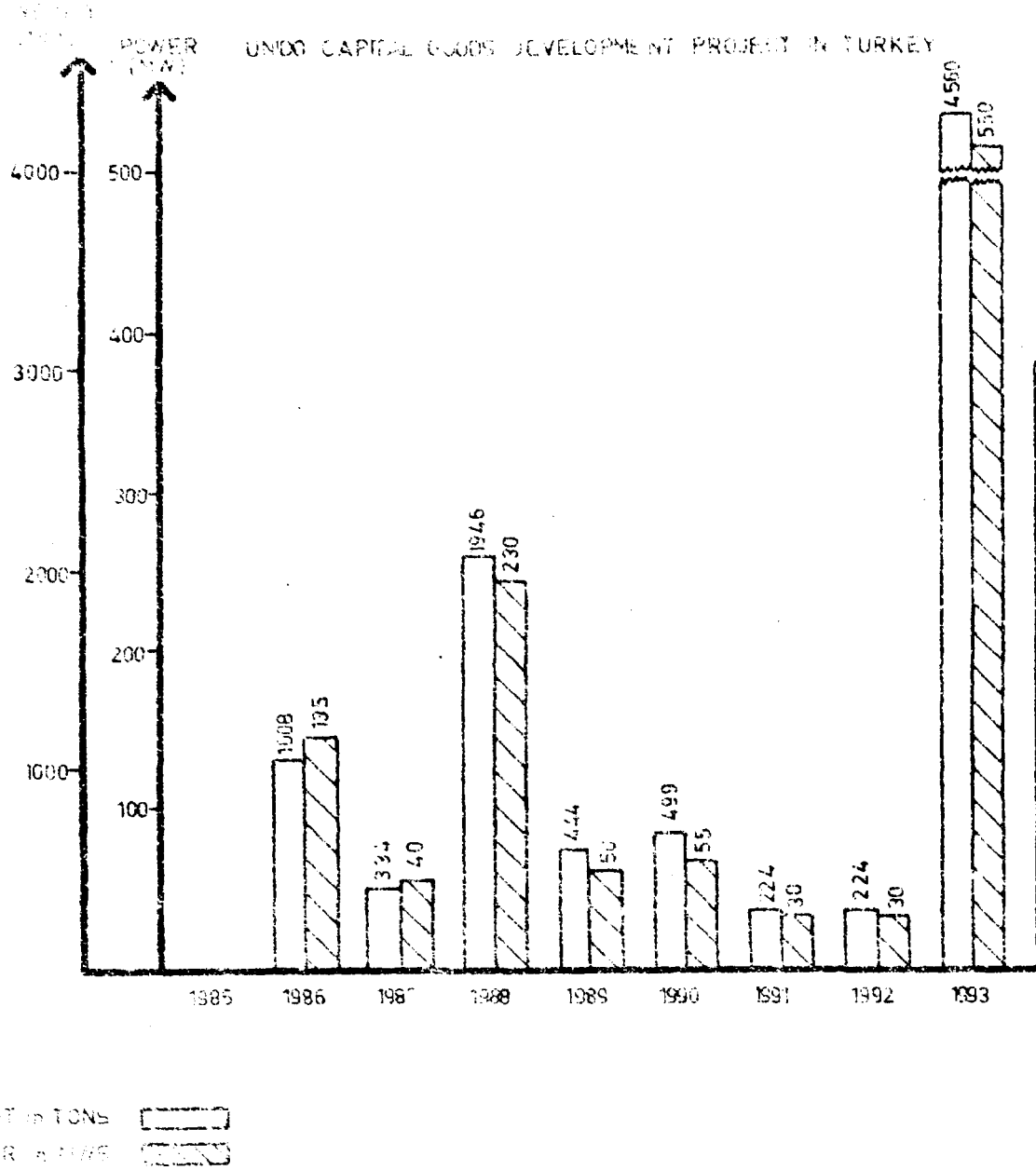
Hydraulic generator demand

(Wt. in tonnes, Power in MWs)

	Average demand/year			Capacity		
	Weight	Power	Units	Weight	Power	Units
A- 0-20 MW	1642MW	198	19	1500	150	9
B- 20-150 MW	5059MW	714	12	7000 *	1139 *	14 *
C- 150-300 MW	2166MW	520	2	* *	* *	* *

* These figures are the proposed capacity of TEMSAN for 20-300 MW Hydraulic generators. It is recommended that manufacture of hydraulic generators upto 150 MW only may be taken up.

* * It is also recommended that TEMSAN should make a revised study on its original feasibility report to manufacture 150-300 MW hydraulic generators.


POWER (MW)
UNIDO CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY
4000
3000
2000
1000
500
400
300
200
100
1008
135
334
40
1946
230
444
50
499
55
224
30
224
30
4560
550
1985
1986
1987
1988
1989
1990
1991
1992
1993
WEIGHT IN TONS
POWER IN MW

Graph 1.1

HYDRAULIC GENERATOR DEMAND of TEK (0-20 MW)

5. FACTORY 3

5.1. STEAM TURBINES

5.1.1. TEMSAN is planning to manufacture steam turbines together with high capacity water turbines in the same factory at Diyarbakir. So far there has been no investment.

5.1.2. Proposed capacity for steam turbines is 1000 MW p.a. (4units, 2288 tonnes).

5.1.3. Distribution of steam turbine demand during 1985-1994 on weight and MW basis is given in Page 17 Chart III,

5.1.4. The demand figures at around 2 units pa. evenly spread upto 1995 after which it is nil.

5.1.5. The average demand during 1985-91 is 290 MW (711 tonnes) and thereafter the demand is nil in 1992, and thereafter, 2 units each in 1993 and 1994 and 1995. Average demand during1992-1995 is 1020 tonnes, 450 MW p.a.

5.1.6. Manufacture of steam turbines for power generation is a high complexity job and it is expected that their manufacture to be fully established will take longer than 5-6 years-considering that even the factory building have not been sanctioned yet. Thereafter the level of demand is too low to make its manufacture economical. On grounds of economy at least it will be more appropriate to meet the demand by imports.

CHART III Steam turbine demand (Weight in tonnes, Power in MWs).

		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
71201-	WT	-	-	-	300	-	300	-	-	-	-	-					
11584-																	
8.72	MW	-	-	-	100	-	100	-	-	-	-	-					
.261-	WT	-	1520	380	-	-	-	-	-	-	-	-					
1 5 4																	
-5777-	MW	-	660	165	-	-	-	-	-	-	-	-					
71261	WT	-	-	-	-	-	-	-	-	1360	1360	1360					
13685																	
39 783-	MW	-	-	-	-	-	-	-	-	600	600	600					
.261	WT	495	-	-	-	495	495	990	-	-	-	-					
1794-																	
274-	MW	210	-	-	-	210	210	420	-	-	-	-					

(1985-1995)

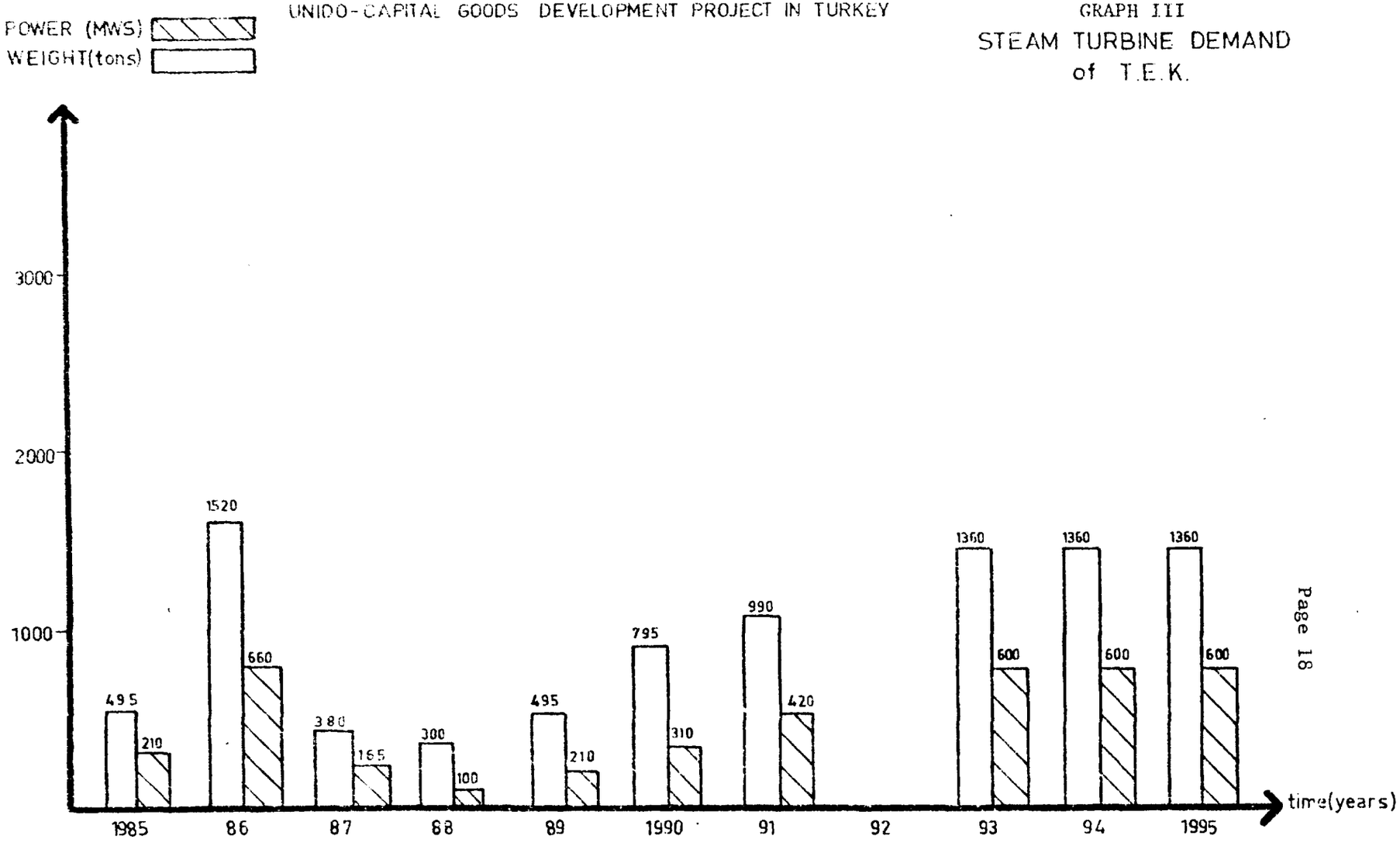
DEMAND/CAPACITY BALANCE

	Average Demand/yr.			Proposed capacity of TEMSAN		
	WT in tonnes	Power in MWs	Units	WT in tonnes	Power in MWs	Units
Steam Turbines	823	352	2	2288	1000	4

UNIDO-CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

GRAPH III

STEAM TURBINE DEMAND
of T.E.K.



5.2. HIGH CAPACITY WATER TURBINES

5.2.1. As mentioned above so far there has been no investment for manufacture of these turbines,

5.2.2. The average annual demand for 20-150MW water turbines during 1985-1988 is 714MW pa.(12 units, 3201 tonnes). In addition there is an annual avaerage demand of 520MW(2 units, 883 tonnes) for higher capacity (upto 300MW) water turbines. Details of this demand are given in Chart I and Graph IV, V in Page 20 and 21.

5.2.3. TEMSAN porpose to set up an annual capacity of 1139 MW (14 units, 2686 tonnes) for water turbines in the range 20-175MW. There is no capacity for these in the private sector.

5.2.4. It is recommended that this capacity should be set up urgently for manufacture of turbines upto 150MW capacity.

5.2.5. It is recommended that DSI should coordinate its future demand for water turbines in this range with TEMSAN's production programme.

5.2.6. A techno-economic appraisal may however be conducted to establish the economic viability of their manufacture with special consideration of additional equipment that may be necessary for them.

6. FACTORY 4

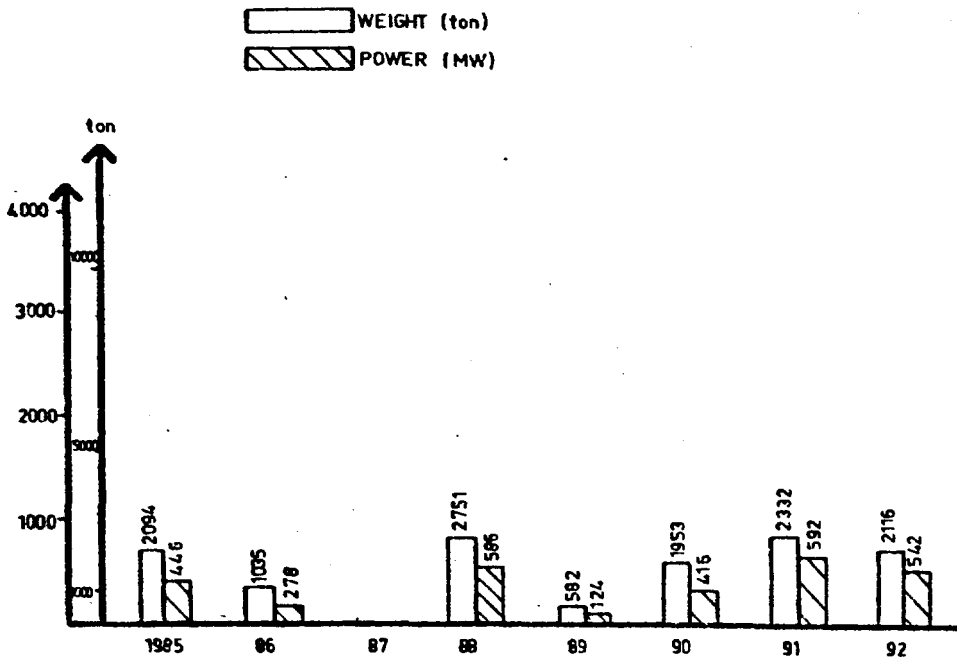
6.1. HIGH CAPACITY HYDRAULIC GENERATORS

Higher capacity hydraulic generators are proposed to be manufactured in a combined hydraulic, steam generator and motor factory in Diyarbakir.

6.1.1. There has been no investment so far on this factory.

6.1.2. The average annual demand for 20-150MW hydraulic generators during 1985-1998 is 714MW(12 units,5059 tonnes where demand for 150-300MW hydraulic generators at the same period is 520MW(2166 tonnes,2 units)-Details of demand figures are given in Chart II in page 13 and in Graph VI and VII in page 22 and 23.

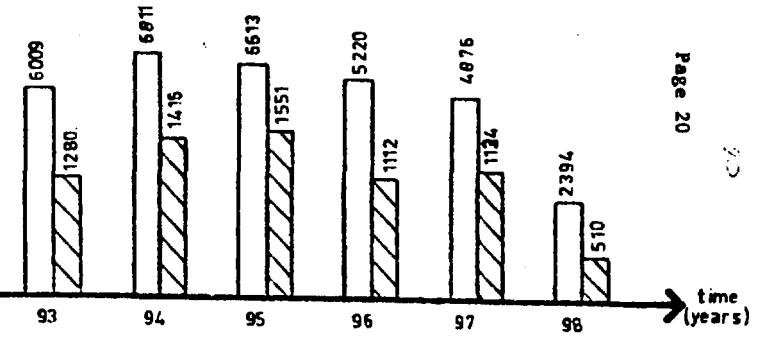
UNIDO-CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY



GRAPH IV

WATER TURBINE DEMAND

(20-150 MW)



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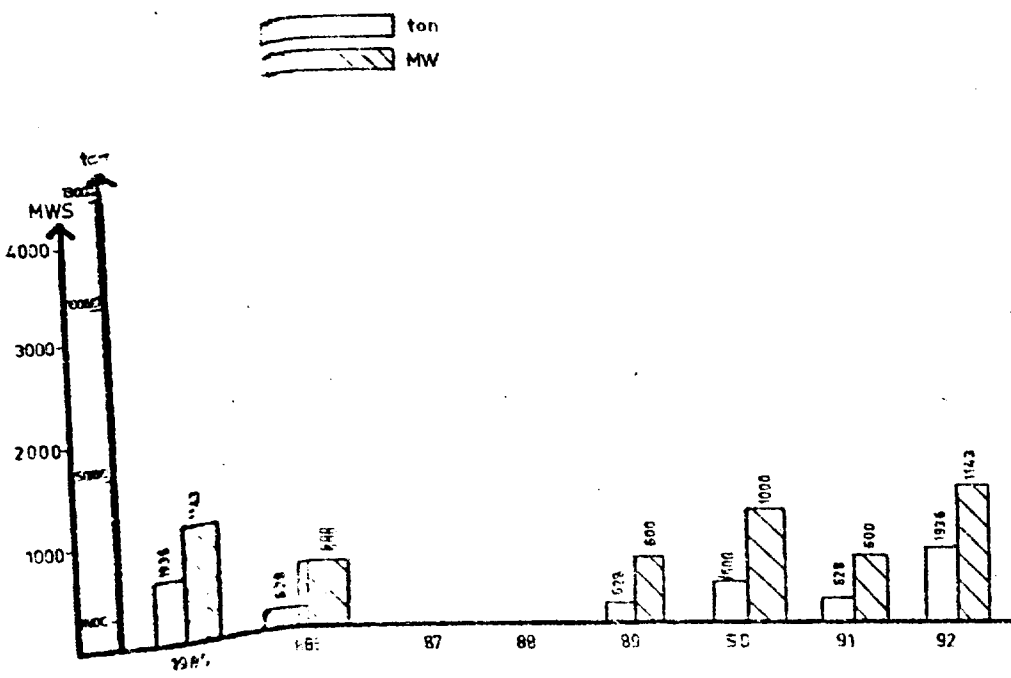
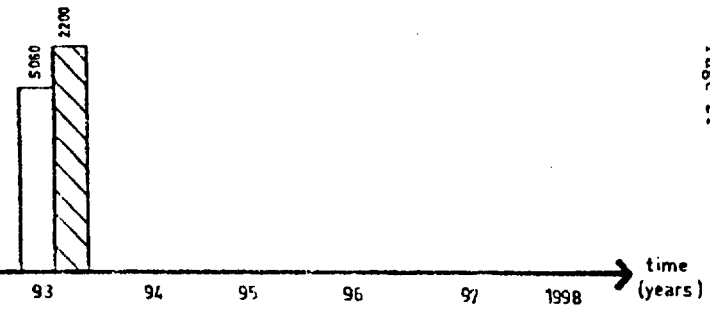


GRAPH V

WATER TURBINE DEMAND
(150-300 MW)



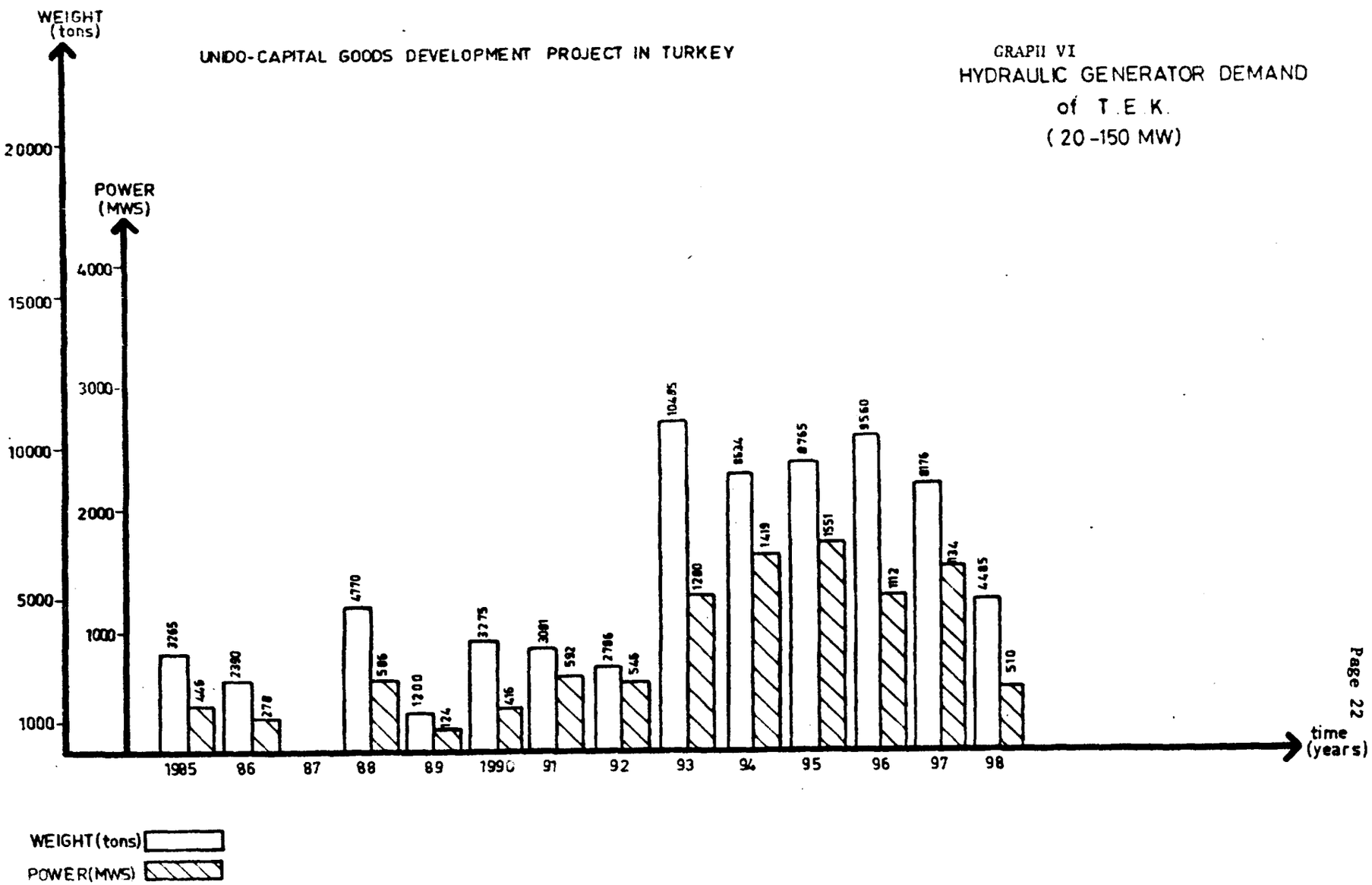
UNIDO-CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

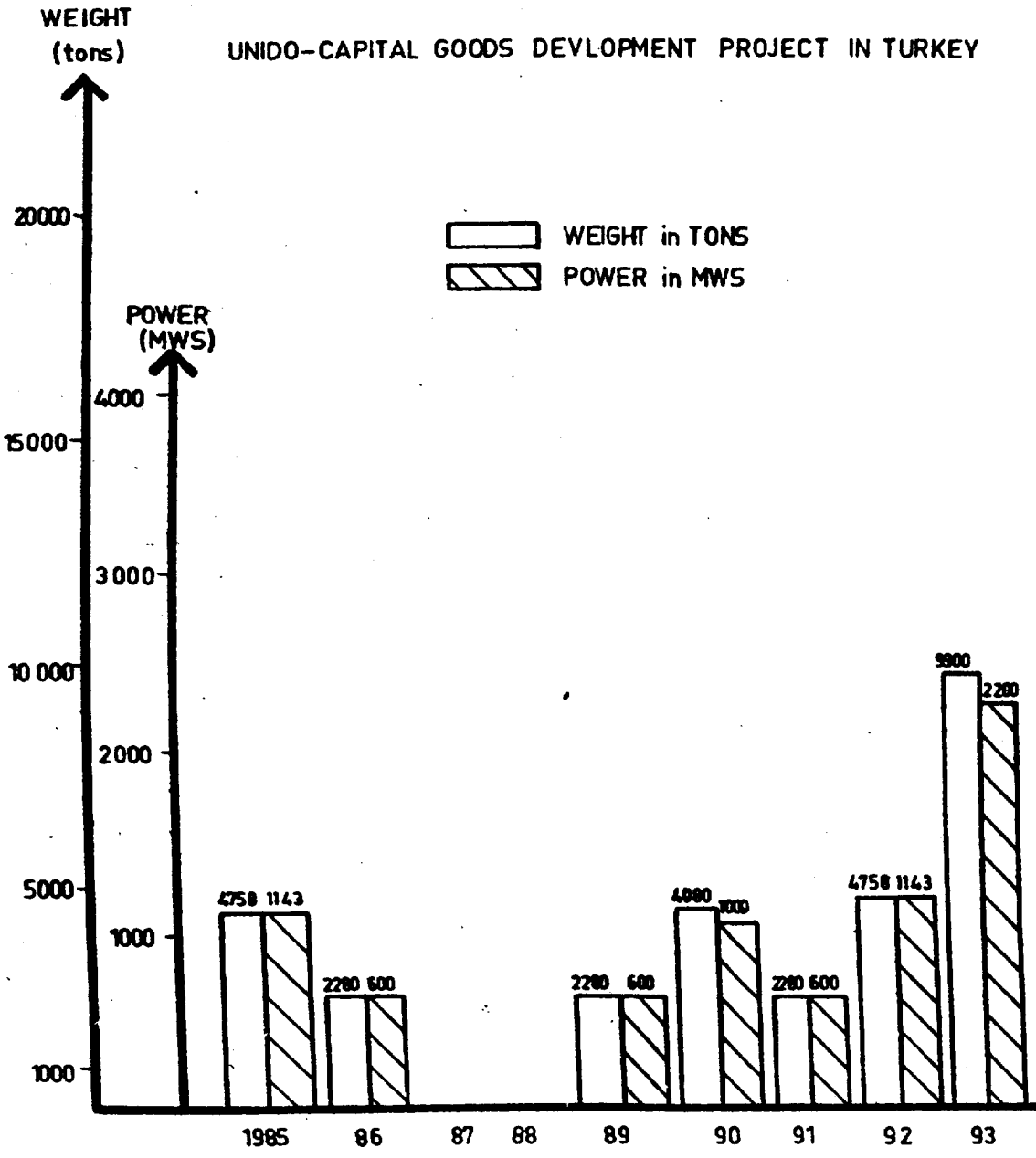
GRAPH VI

HYDRAULIC GENERATOR DEMAND

of T.E.K.

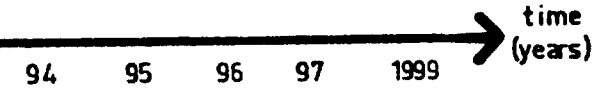
(20-150 MW)




WEIGHT
(tons)
UNIDO-CAPITAL GOODS DEVLOPMENT PROJECT IN TURKEY
WEIGHT in TONS
POWER in MWS
POWER
(MWS)
20000
15000
10 000
5000
1000
4000
3000
2000
1000
4758 1143
2280 600
2280 600
4000 3000
2280 600
4758 1143
9900
2280
1985
86
87
88
89
90
91
92
93

GRAPH VII

HYDRAULIC GENERATOR DEMAND
of T.E.K.
(150-300 MW)



6.1.3. TEMSAN propose to set up an annual capacity of 1139 MW(14 units, 7000 tonnes) for hydraulic generators in the ragne 20-300 MW.

6.1.4. It is recommended that the capacity for 20-150 MW hydraulic generators should be set up urgently.

6.1.5. It will be crucial for the Government to take a policy decision that DSI should order all their hydraulic generator needs on TEMSAN if TEMSAN takes the necessary managerial and other steps to build up its manufacture in goods time.

6.2. STEAM GENERATORS

6.2.1. TEMSAN's proposed capacity for steam generators is 1000 MWpa. (4 units, 1123 tonnes).

6.2.2. Distrubution of steam generator demand and demand/capacity balance during 1985-1994, on wieght and MW basis are given in Chart IV,

6.2.3. The demand figure is fairly even upto 1995 at 2 units per annum.

6.2.4. It is understood from TEMSAN that the basic manufacturing facilities are similar to those required for hydraulic generators. Considering that the factory building have not been constructed yet and the level of future demand is low, no special provision need be made at present for manufacture of steam generators.

7. FACTORY 5, STEAM BOILERS

7.1. TEMSAN is planning to manufacture steam boilers in a factory at Malatya.

7.2. Although on 18.8.1982 "Board for Coordination of Economical Affairs" recommended establishment of a new enterprise with participation of TEMSAN, Seker Fab.A.S. VKW (Germany) and other private sector companies, to manufacture steam boilers, this has not been realized.

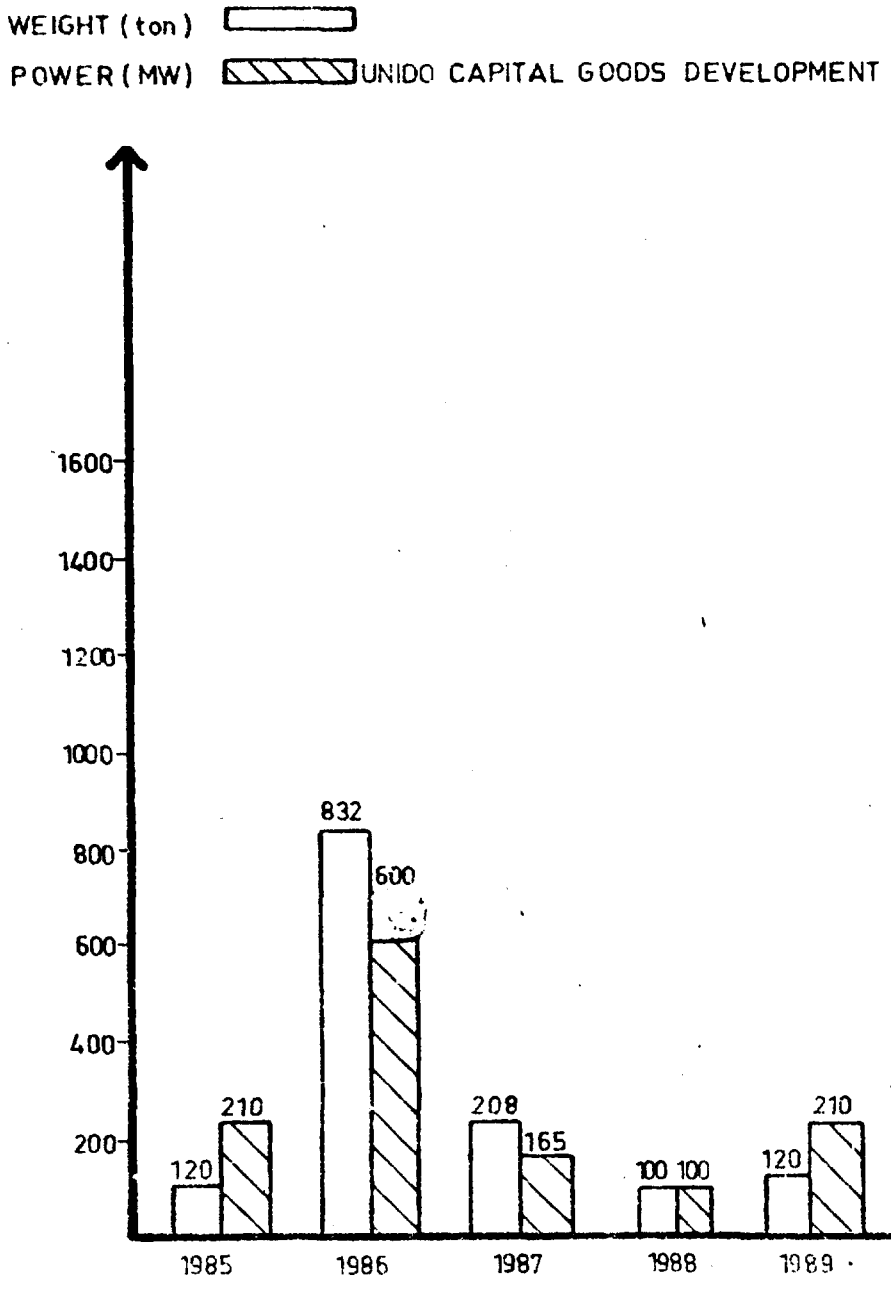
7.3. GAMA, a private sector firm, which manufactures industry type steam boilers, signed a contract with Babcock, and Wilcox from USA to manufacture power plant type boilers. Also GURIS, another private sector firm, have entered into an agreement with EWT of Germany(American-German partnership) for engineering services and technology transfer to manufacture this type of boilers.

CHART IV - THERMAL GENERATOR DEMAND (Weight in tonnes, Power in MWs)

Item Code	UN	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
71622 00584 26682	WT	-	-	-	100		100	-	-	-	-	-	-	-	-	-	-
	MW	-	-	-	100	-	100	-	-	-	-	-	-	-	-	-	-
71622 00634 27692	WT	-	832	208	-	-	-	-	-	-	-	-	-	-	-	-	-
	MW	-	660	165	-	-	-	-	-	-	-	-	-	-	-	-	-
71622 00795 26782	WT	120	-	-	-	120	120	240	-	-	-	-	-	-	-	-	-
	MW	210	-	-	-	210	210	420	-	-	-	-	-	-	-	-	-
71622 00886 28992	WT	-	-	-	-	-	-	-	-	750	750	750	-	-	-	-	-
	MW	-	-	-	-	-	-	-	-	600	600	600	-	-	-	-	-
TOTAL	WT	120	832	208	100	120	220	240	-	750	750	750					
	MW	210	660	165	100	210	310	420	-	600	600	600					

DEMAND CAPACITY BALANCE (1985-1995)

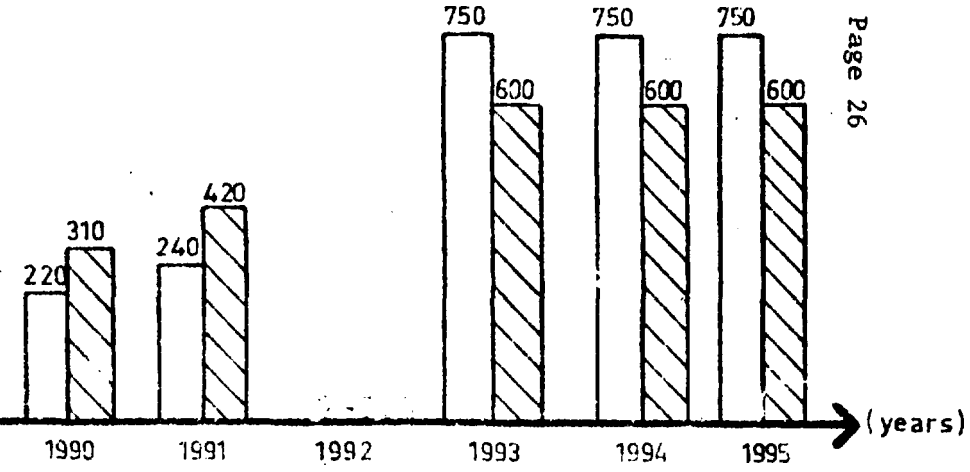
	Aver. Demand/yr.			Proposed capacity of tonnes		
	WT tonnes	Power MWs	Units	WT Tonnes	Power MWs	UNits
Thermal Generator	372	352	2	1123	1000	4


WEIGHT (ton)
POWER (MW)
UNIDO CAPITAL GOODS DEVELOPMENT
1600
1400
1200
1000
800
600
400
200
120
210
832
600
208
165
100
100
120
210
1985
1986
1987
1988
1989

PROJECT TURKEY

THERMAL GENERATOR DEMAND
Of T.E.K.

GRAPH VIII



SUN-TEK (Sungurlar+TEK) is also in this field with a Steinmuller licence. Planned capacities of these companies are given in Chart V, Page 28 .

7.4. TEMSAN's original planned capacity is 1000 MW (4 units, 40.000 tonnes). They are however now planning to reduce it to half and manufacture steam boilers with VKW licence at Diyarbakir.

7.5. The average annual demand during 1985-1995 is 352 MW (13590 tonnes) (Chart V graph IX). Average demand during 1992-95 is 8286 tonnes-450MWs.

7.6. The total planned capacity of all these units is 134.000 Tpa.(3350 MW). The proposed capacities at any one of these firms however is expected to be enough to meet the anticipated demand.

7.7. It is recommended that the Government should urgently decide, as a matter of policy which unit should take up manufacture of power generation steam boilers, carefully evaluate its product-mix (which may include other boilers and equipment requiring similar manufacturing facilities) and then give it help and assistance to reach its planned capacity in 5-6 years time. This is particularly necessary because the Turkish local demand for these power boilers is relatively low and there is a possibility of TEK finding imports to be attractive. Temsan having been brought under TEK now, are best placed to develop this capacity.

8. FACTORY 6

TEMSAN is planning to install an transmission line hardware factory at Malatya.

8.1. Proposed capacity and product-mix of this facotry, which is in planning phase at present, is given in Chapter I, para 1.3.

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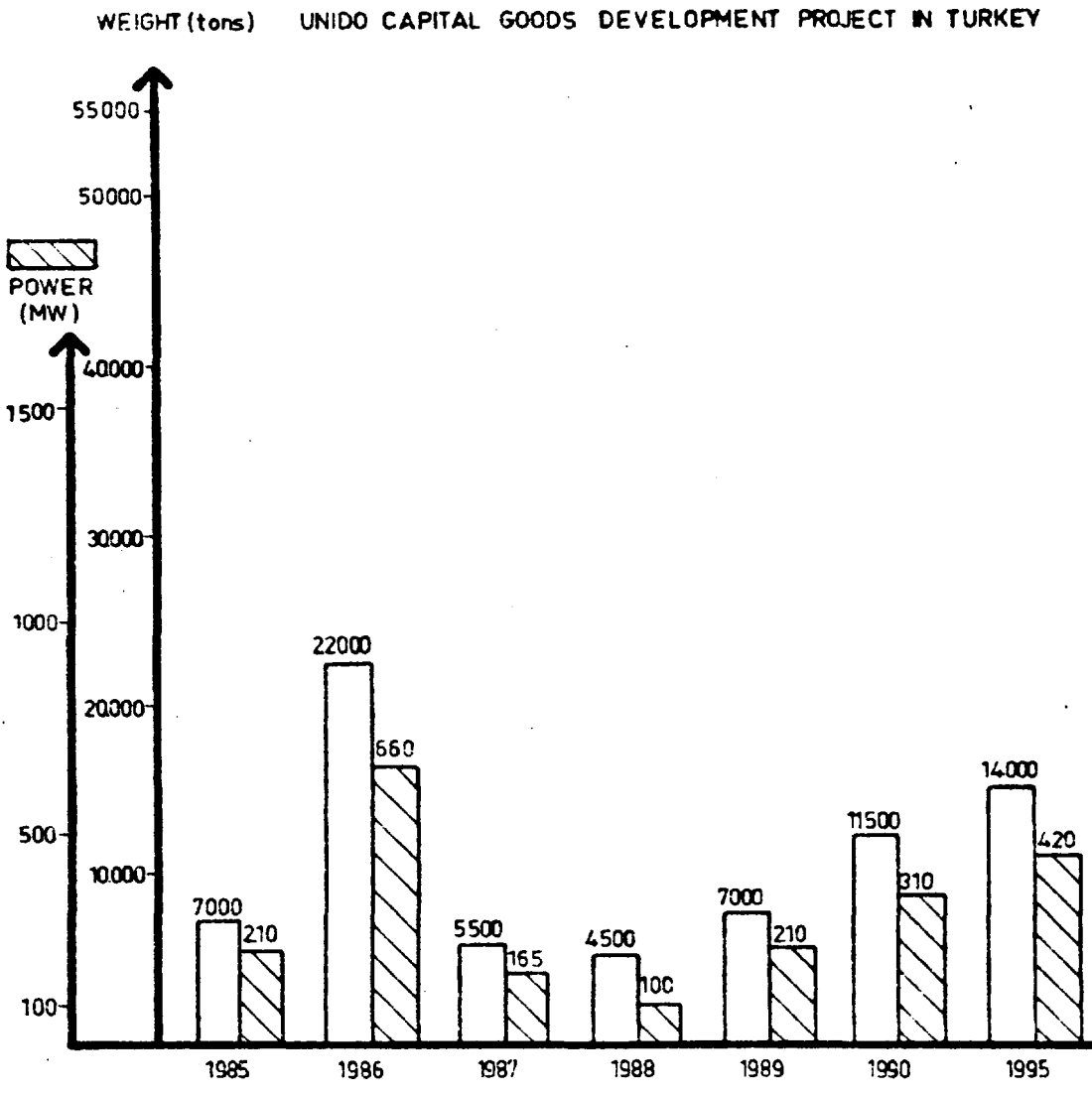
CHART V STEAM BOILER DEMAND (Weight in tonnes , Power in MWs)

ITEM CODE	U,N	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
71111-00636-39312-	WT	-	-	-	4.500	-	4.500	-	-	-	-	-					
	MW	-	-	-	100	-	100	-	-	-	-	-					
71111-00736-39312-	WT	-	22.000	5.500	-	-	-	-	-	-	-	-					
	MW	-	660	165	-	-	-	-	-	-	-	-					
71111-00736-39522-	WT	7.000	-	-	-	7000	7000	14.000	-	-	-	-					
	MW	210	-	-	-	210	210	420	-	-	-	-					
71111-10847-39242-	WT	-	-	-	-	-	-	-	-	26.000	26.000	26.000					
	MW	-	-	-	-	-	-	-	-	600	600	600					
TOTAL	WT	7000	22.000	5.500	4.500	7000	11.500	14.000		26.000	26.000	26.000					
	MW	210	660	165	100	210	310	420	-	600	600	600					

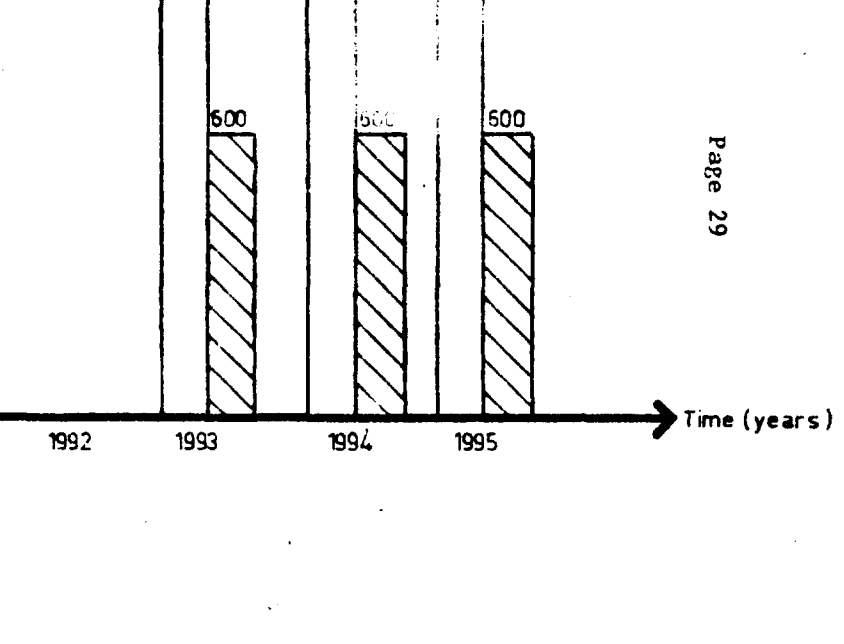
DEMAND/CAPACITY BALANCE (1985-1995)

	DEMAND	CAPACITY			
	Av.Dem./yr.	TEMSAN	CURIS	GAMA	SUNTEK
Weight in tonnes	13590	40.000	24.000	40.000	30.000
Power in MWs	352	1000	600	1000	750


WEIGHT (tons)
UNIDO CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY
55000
50000
POWER
(MW)
40000
1500
30000
1000
20000
500
10000
100
7000
210
22000
660
5500
165
4500
100
7000
210
11500
310
14000
420
1985
1986
1987
1988
1989
1990
1995

STEAM BOILER DEMAND
Of T.E.K.

GRAPH IX



8.2. Recently a merket stuiy has been done by TEK and TEMSAN and it is understood that this project has been dropped.

9. FACTORY 7 - TRANSFORMERS

9.1. As TEK's outputs of demand study were not readily available, report of the special committe, which was formed to do some preparatory work for 5th V year development plan has been taken as the basis for this report.

9.1.1. The basis of this demand study was the additional power, planned to be generated each year.

9.1.2. In the special committe study, transformer demand factors per unit of additional capacity was calculated for six types of products.

9.1.3. Turkey's transformer inventory in 1981 was evaluated and a ratio of MVA to total MW for each group of transformer and average MVA found. Percentages of 380 KV, 154 KV(66KV included), 34,5 KV transformers and lower to total are respectively 31%,48.5% and 20.5%. Thse and cosine conversion factor (1/0.83=1.2) to convert MW to transformer power MVA were used to calculate demand factors.

9.1.4. In order to get annual transformer demand on MVA basis, these factors were multiplied by additional capacity needed each year.

9.1.5. Yearly adidtional capacities given in the SCR and related demand figures are given in Chart (VI).

9.2. DEMAND/CAPACITY BALANCE

9.2.1. In TEMSAN's feasibility report, which was prepared in 1977, the capacity proposed was as follows:

50 MVA	154 KV	18 units
100 "	154 "	12 "
150 "	380 "	11 "
180 "	380 "	7 "

9.2.2. In the absence of any other basic data, it is assumed that 380KV (68,155MVA) group in SCR corresponds to 380 KV (150, 180MVA) group in TEMSAN study and 154 KV(31MVA) group in SCR corresponds to 154 KV (50, 100 MVA) group in TEMSAN study.

CHART VI

TRANSFORMER DEMAND

	Additional Capacity MVA p.a.	Generator Transformer 10.2/380KV F=0,977 Av.MVA=63		Transmission Transformer 380/154 KV F=1,35 Av.MVA=155		Generator Transformer 40-20/154KV F=0,283 Av.MVA=31		Transmission Transformer 154/34.5KV F=2,64 Av.MVA=31		Med.Volt. Power Trans. 34.5/15-10,63 F=12,12 Av.MVA=10		Dest. Transformer 34.5/0.4KV F=2,50 Av.MVA=0,21	
		MVA	Units	MVA	Units	MVA	Units	MVA	Units	MVA	Units	MVA	Units
Sp.Comm.Rep.	1308	1278	19	1756	11	370	12	3453	111	2773	277	3270	15571
SCR(TEK)*	1644	1606	24	2219	14	465	15	4340	140	3485	349	4110	19571

F= Transformer demand factor.

* Figures provided by TEK to the Special Committee.

9.2.3. Transformers below 154KV are manufactured in private sector and as the capacity in private sector is not fully utilized these transformers were not considered in TEMSAN, feasibility report.

9.2.4. Comparison of the results of demand studies and TEMSAN capacity is as follows:

		CAPACITY TEMSAN		DEMAND SCR(TEK)		DEMAND SCR	
		MVA	Units	MVA	Units	MVA	Units
380 KV	150 MVA	1650	11	1606	24	1278	19
	180 MVA	1260	7	2219	14	1766	11
154 KV	50 MVA	900	18	465	15	370	12
	100 MVA	1200	12	4360	140	3453	111
TOTAL		5010	48	8650	193	6857	153

9.3. RECOMMENDATIONS

9.3.1. It is recommended that TEMSAN should set up an initial capacity of 2910 MVA(18 units) of 380 KV transformers urgently as proposed with a provision to expand it to 30 units later.

9.3.2. Other transformers may be developed in the private sector. It is presumed that transformers other than 380 KV(154KV or lower) can be manufactured by TEMSAN in the same factory if the private sector does not meet the demand.

9.4. TEMSAN must update its demand study and prepare suitable plans for setting up the manufacturing capacity.

10. FACTORY 8 - CIRCUIT BREAKERS

10.1. TEK's outputs of demand study were not readily available and report of the special committee prepared about circuit breakers was studied to come to some broad conclusions.

10.1.1. In this report amount of circuit breakers and isolators per transformer is given as follows:

380 KV	23 isolators	6 circuit breakers
154 KV	11 "	4 " "

10.1.2. Such information was not worked out by special committe for middium voltage isolaters and circuit breakers.

10.1.3. In paragraph 9.2.3. 380 KV transformer demand was calculated as 30 units whereas demand for 154 KV transformers was 123 units.

10.1.4. It is concluded that demand for circuit breakers and isolaters for these KVs are as follows:

	Circuit breaker	Isolater
154 KV	492	1353
380 KV	180	690

10.2. Latest proposed capacity and product-mix of circuit breaker and isolaters factory is given in Chapter I, para 1.3.

10.2.1. Demand/capacity balance is as follows:

	Capacity					Demand	
	Circuit breakers			Isolaters		Circuit breakers	Isolater
	TEMSAN*	Iller Bankasi	Private	TEMSAN*	Priv.		
Medium Volt.(12-36KV)	1800	4200	-		37,650		
High Volt.(170KV)	160	-	-	400	750	492	1353
High Volt.(420KV)	40	-	-	100	-	180	690

* Proposed

10.2.2. Iller Bankasi have already installed (but NOT COMMISSIONED) a factory in Ankara, with Siemens collaboration and participation of medium voltage CB's. It is recommended that this may be expanded to cover 154 KV and 300 KV isolaters and circuit breakers. There is adequate capacity for HV isolators in the private sector who also have some capacity for medium voltage CB's.

11. OTHER IMPORTANT FACTORS

11.1. The crucial need for the electromechanical industry is to develop the engineering skills for design and development, manufacture and installation of comprehensive systems for Power generation, transmission and distribution. This involves and intimate contact between the users (mainly TEK) who should design the overall power systems and manufacturers who have to design and develop the machinery and plant against as a coordinated machinery and plant systems. It is recommended that TEK should prepare plans for this and allot suitable roles to TEMSAN and other agencies directly or indirectly connected with it.

11.2. The entire, manufacturing plan of TEMSAN will depend on an effective system of procuring broughts out particularly large heavy duty castings and forgings, copper sections and such other items which are expected to be manufactured and supplied by other public or private sector units to TEMSAN. It is recommended that TEMSAN prepare urgently a possible plan of action for this aspect for all units for which it has been recommended that TEMSAN should set up manufacturing capacity.

11.3. Development of manpower to design plan, manufacture, control and manage the complete TEMSAN facilities, workers, engineers and managers of different technological disciplines will perhaps be the most challenging aspect of capacity development. This needs urgent attention of the management and the Government.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

12.1. Demand projections have been generally made on the basis of TEK's projection of power generation, distribution and transmission upto 2000 proposed in 1980. This data however has not been updated for hydraulic and steam turbines and generators and boilers according to SPO.s projection in April 1983.

12.2. Wherever these projections are not available, demand forecasts made by special committees set up by SPO for the 5th Five Year Plan have been used.

12.3. Following conclusions have been reached about items in the original product-mix of TEMSAN.

PROPOSED CAPACITY OF TEMSAN	RECOMMENDATIONS
1. Small water turbines(5-20MW) 2000 tonnes, 150 MW, 9 units 2. Small hydraulic generators(5-20MW) 1500 tonnes, 150 MW, 9 units	Small hydraulic turbine and generator factories' capacity should be set up urgently, and necessary funds allocated so that all machinery and equipment are commissioned by end 1984.
3. Pumps 900 units	The project may be dropped-TEMSAN may however take up manufacture to the extent possible in the hydraulic turbine factory.
4. Motors Asynchronous Motors 510MW, 850 Units Synchronous Motors 390 MW, 700 units Direct current Motors, 135MW, 150 units	Only special heavy-duty motors for which there is no capacity in private sector should be manufactured in hydraulic generator shop without any additional investment except for balancing, testing and punching machines. In the production programme, priority, however, should be given to generators.

PROPOSED CAPACITY OF TEMSAN	RECOMMENDATIONS
5. Steam Turbines 2288 tonnes 1000 MW 4 units	This may be dropped
6. Steam Generators 1123 tonnes, 1000MW, 4 units	This may be dropped
7. High capacity water turbines (25-175MW) 2680 tonnes, 1139 MW, 14 units 8. High capacity hydraulic generators (25-3000MW) 7000 tonnes, 1139MW, 14 units	As far as the high capacity hydraulic turbines and generators are concerned, it is recommended that (i) TEK, TEMSAN and DSI should coordinate fresh projection of their future demand on the basis of latest plans for setting up new hydraulic power stations upto 2010. (ii) TEMSAN should update its feasibility study for manufacture of high capacity hydraulic turbines and generators, taking into account the capacity already set up in and the expansion of small turbine and generator factories' capacity to take up manufacture of sets upto 150MW and submit it to SPO in 1984 for modification, if necessary, of invest ment decisions. (In this study manufacturing facilities already available/planned in both public and private sector should be taken into consideration).
9. Transformers 50, 100 MWA; 154KV; 30 units 150, 180 MWA; 380 KV; 18 units	Private sector capacity will need sizable modifications/ expansions to be able to meet the demand of all ranges. (It is recommended that) the earlier studies should be immediately updated by TEMSAN taking into account the latest projection of demand and capacity.

PROPOSED CAPACITY OF TEMSAN	RECCOMMENDATIONS
X. CIRCUIT BREAKERS/ISOLATORS High voltage circuit breakers Med. " " " Med. voltage isolators	It is considered desirable for TEMSAN to take-over the already installed but not commissioned circuit breaker and isolator factory of Iller Bank in Ankara, Temsan should urgently take managerial and other steps to fully utilize this capacity expeditiously.
XI. Steam boilers 40000 tonnes, 1000 MW, 4 units	It is recommended that TEMSAN sould be responsible for design and installation of steam boilers as far as possible, they should procure parts from T. Seker Fab.A.S. and other private sector firms, manufacture some parts in Diyarbakir and assemble and test them.
XII. Transmission hardware factory 34,5; 154; 380 KV	This has been dropped by TEMSAN.

12.4. It is also recommended to TEMSAN to make a detailed 'make or buy' analysis for each factory and keeping its own manufacture minimum and procuring supplies from other Turkish sources as far as possible, without sacrificing quality.

12.5. The cricual need for the electromechanical industry is to develop the engineering skills for design and development, manufacture and installation of comprehensive systems for power generation transmission and distribution. It is recommended that TEK should design the overall power systems, and also take up the responsibility of coordination of all related agencies including TEMSAN who have to design, develop, manufacture and erect the manchinery and plant.

12.6. It is recommended that, management of TEMSAN and Government should pay urgent attention to recruitment and training of manpower to design, plan, manufacture, control and manage the complete TEMSAN facilities, including workers, engineers and managers of different technological disciplines. This is likely to be the most challenging aspect of its development.

SITC Code 711.11 - Steam and other vapour, generating boilers

Fabricated equipments

- STEAM BOILERS FOR POWER PLANTS AND USER INDUSTRIES

6-7	8		9		10		11		12		13		14		15	
Basic Machine Nomenclature	Major Specification (Capacity)		Major Spec.-1 Optional		Major Spec.-2 Optional		Type		Manufacturing characteristic -1		Manufacturing characteristic -2		Manufacturing characteristic -3		Origin	
Name	Code	Output t/h	Code	Pressure (kg/cm^2)	Code	Temperature (^oC)	Code	Description	Code	Weight (tons)	Code	Main body materials	Code	Plate thickness mm.	Code	
Natural circulation boilers	1	Upto 25	1	Upto 50	1	Upto 200	1	Bituminous coal fired	1	Upto 5	1	Mild steel upto 0.20 carbon (untested quality)	1	Upto 20	1	Turkey
Once-through boilers	2	25-50	2	50-100	2	200-300	2	Brown coal fired	2	5-10	2	Carbon steel above 0.20 C tested quality	2	20-40	2	Imported
Subcritical boilers	3	50-100	3	100-150	3	300-400	3	Lignite fired	3	10-25	3	Boiler steel	3	40-50		
Supercritical boilers	4	100-200	4	150-200	4	400-450	4	Fuel oil fired	4	25-50	4	Alloy steel	4	Over 50		
Controlled circulation boilers	5	200-300	5	200-250	5	450-500	5	Natural gas fired	5	50-100	5	High alloy steel				
Mono-tube boilers	6	300-500	6	250-300	6	500-550	6	Sulphite liquor fired	6	100-200	6	Stainless steel				
Others	7	500-1000	7	Over 300	7	Over 550	7	Combined fired	7	200-300	7	Non-ferrous materials				
	8	1000-2000					8	Waste fired	8	300-500						
	9	Over 2000					9	Others	9	Over 500	9	Others				

ANNEXURE 1

Machines

SITC Code 712.61 - Steam and other vapour units, not incorporating boilers
- STEAM TURBINE FOR POWER GENERATION AND PROCESS INDUSTRIES

6-7		8		9		10		11		12		13		14		15	
Basic Machine Nomenclature		Major Specification (Capacity)		Major Spec.-1 Optional		Major Spec.-2 Optional		Type		Manufacturing characteristic -1		Manufacturing characteristic -2		Manufacturing characteristic -3		Origin	
Code	Name	Code	Output (MW)	Code	Speed (RPM)	Code	Steam inlet pressure (kg/cm^2)	Code	Description	Code	Weight(tons)	Code	Main body material	Code	Max. Component Weight(tons)	Code	
1	Single-cylinder steam turbines	1	Upto 5	1	Upto 166.7	1	Upto 20	1	Impulse	1	Upto 5	1	Chilled iron casting	1	Upto 1	1	Turkey
11	Condensing turbines	2	5-20	2	166.7-300	2	20-50	2	Reaction	2	5-10	2	Grey iron casting	2	1-2	2	Imported
12	Back pressure turbines	3	20-50	3	300-375	3	50-100	3	Combined	3	10-25	3	Alloy iron casting	3	2-5		
13	Extraction turbines	4	50-100	4	375-500	4	100-150			4	25-50	4	Malleable iron casting	4	5-10		
14	Turbines with automatic steam extraction and back pressure	5	100-150	5	500-750	5	150-200			5	50-100	5	Spheroidal iron casting	5	10-15		
		6	150-200	6	750-1000	6	200-250			6	100-200	6	Carbon steel casting	6	15-25		
		7	200-300	7	1000-1500	7	250-300			7	200-300	7	Alloy steel casting	7	25-50		
2	Multi-cylinder steam turbines	8	300-600	8	1500-3000	8	Over 300			8	300-500	8	Non-ferrous casting	8	50-100		
21	Condensing turbines	9	Over 600	9	Over 3000			9	Others	9	Over 500	9	Steel fabrication	9	Over 100		
22	Back pressure turbines																
23	Extraction turbines																
24	Turbines with automatic steam extraction and back pressure																
3	Others																

ANNEXURE I

Machines

SITC Code 716.22 - Generators, ALTERNATING CURRENT

6-7	8	9	10	11	12	13	14	15
Basic Machine Nomenclature	Major Specification (Capacity)	Major Spec.-1 Optional	Major Spec.-2 Optional	Type	Manufacturing characteristic -1	Manufacturing characteristic -2	Manufacturing characteristic -3	Origin
Code : Name	Code Output (MW)	Code Synchronous Speed (RPM)	Code Voltage (KV)	Code Description Cooling system	Code Weight(tons)	Code Main body material	Code Max. Component Weight(tons)	Code
0 Cylindrical rotor-synchronous generators	1 Upto 5	1 Upto 166.7	1 Upto 3	1 Air	1 Upto 5	1 Chilled iron casting	1 Upto 1	1 Turkey
	2 5-20	2 166.7-300	2 3-6	2 Hydrogen	2 5-10	2 Grey iron casting	2 1-2	2 Imported
0 Salil en-pole synchronous generators	3 20-50	3 300-375	3 6-10	3 Nitrogen	3 10-25	3 Alloy iron casting	3 2-5	
	4 50-100	4 375-500	4 10-15	4 Carbon-Dioxide	4 25-50	4 Malleable iron casting	4 5-10	
0 Generators driven by diesel engines	5 100-150	5 500-750	5 15-20	5 Water	5 50-100	5 Spheroidal iron castiug	5 10-15	
	6 150-200	6 750-1000	6 20-25	6 Oil	6 100-200	6 Carbon steel casting	6 15-25	
	7 200-300	7 1000-1500	7 Over 25	7	7 200-300	7 Alloy steel casting	7 25-50	
	8 300-600	8 1500-3000		8	8 300-500	8 Non-ferrous casting	8 50-100	
	9 Over 600	9 Over 3000		9 Others	9 Over 500	9 Steel fabrication	9 Over 100	
9 Others								

ANNEXURE 1

Machines

SITC Code 718.81 - WATER TURBINES

6-7		8		9		10		11		12		13		14		15	
Basic Machine Nomenclature		Major Specification (Capacity)		Major Spec.-1 Optional		Major Spec.-2 Optional		Type		Manufacturing characteristic -1		Manufacturing characteristic -2		Manufacturing characteristic -3		Origin	
Code	Name	Code	Output (MW)	Code	Water head (m)	Code	Speed (rpm)	Code	Description	Code	Weight(tons)	Code	Main body material	Code	Max. Component Weight(tons)	Code	
00	Pelton water turbines	1	Upto 5	1	Upto 30	1	Upto 166.7	1	Vertical	1	Upto 5	1	Chilled iron casting	1	Upto 1	1	Turkey
		2	5-20	2	30-60	2	166.7-300	2	Horizontal	2	5-10	2	Grey iron casting	2	1-2	2	Imported
10	Francis water turbines	3	20-50	3	60-100	3	300-375			3	10-25	3	Alloy iron casting	3	2-5		
		4	50-100	4	100-150	4	375-500			4	25-50	4	Malleable iron casting	4	5-10		
20	Kaplan water turbines	5	100-150	5	150-210	5	500-750			5	50-100	5	Spheroidal iron casting	5	10-15		
		6	150-200	6	210-280	6	750-1000			6	100-200	6	Carbon steel casting	6	15-25		
99	Others	7	200-300	7	280-360	7	1000-1500			7	200-300	7	Alloy steel casting	7	25-50		
		8	300-600	8	360-450	8	1500-3000			8	300-500	8	Non-ferrous casting	8	50-100		
		9	Over 600	9	Over 450	9	Over 3000	9	Others	9	Over 500	9	Steel fabrication	9	Over 100		

ANNEXURE I