9 WATER AND POWER

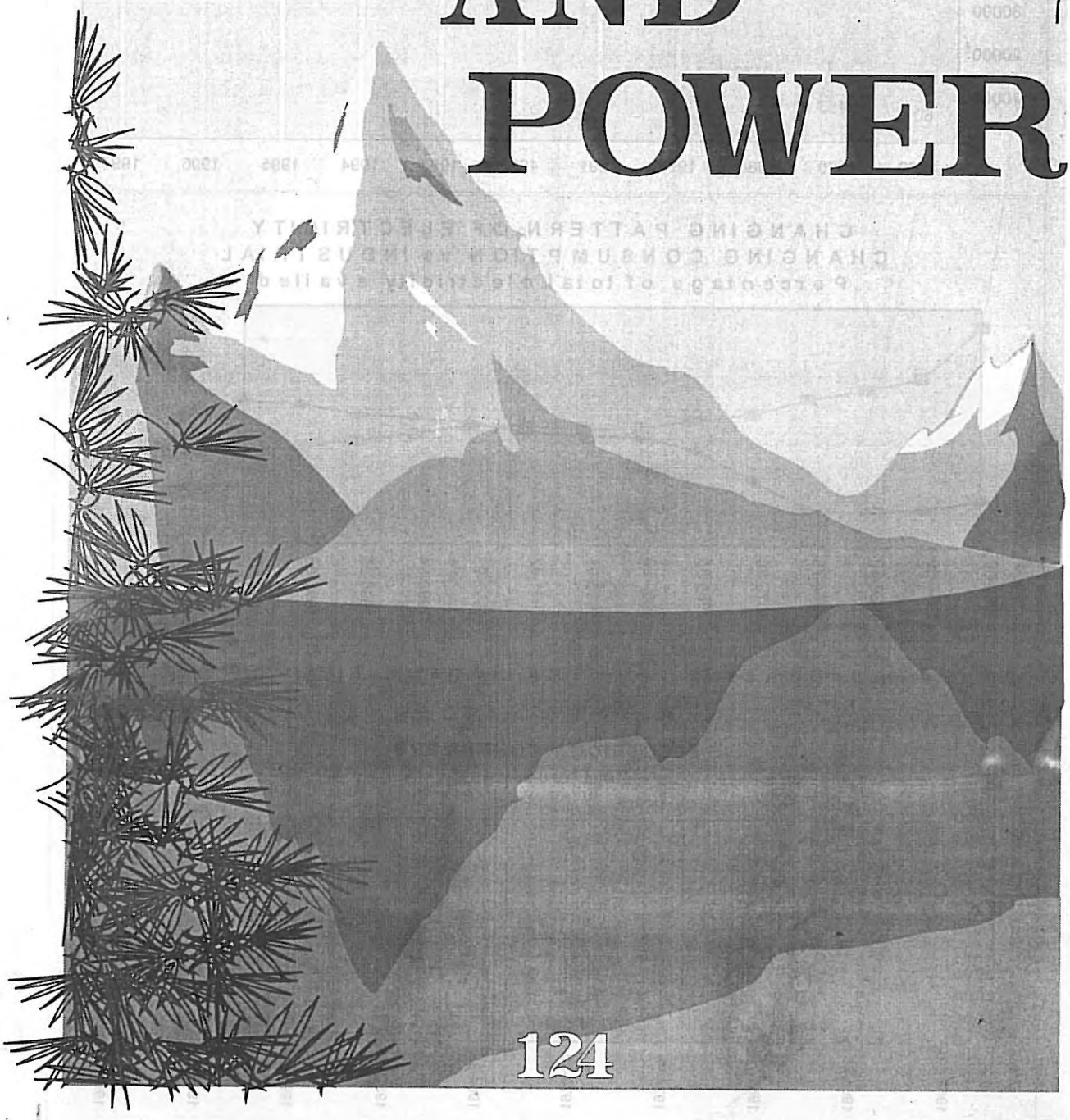
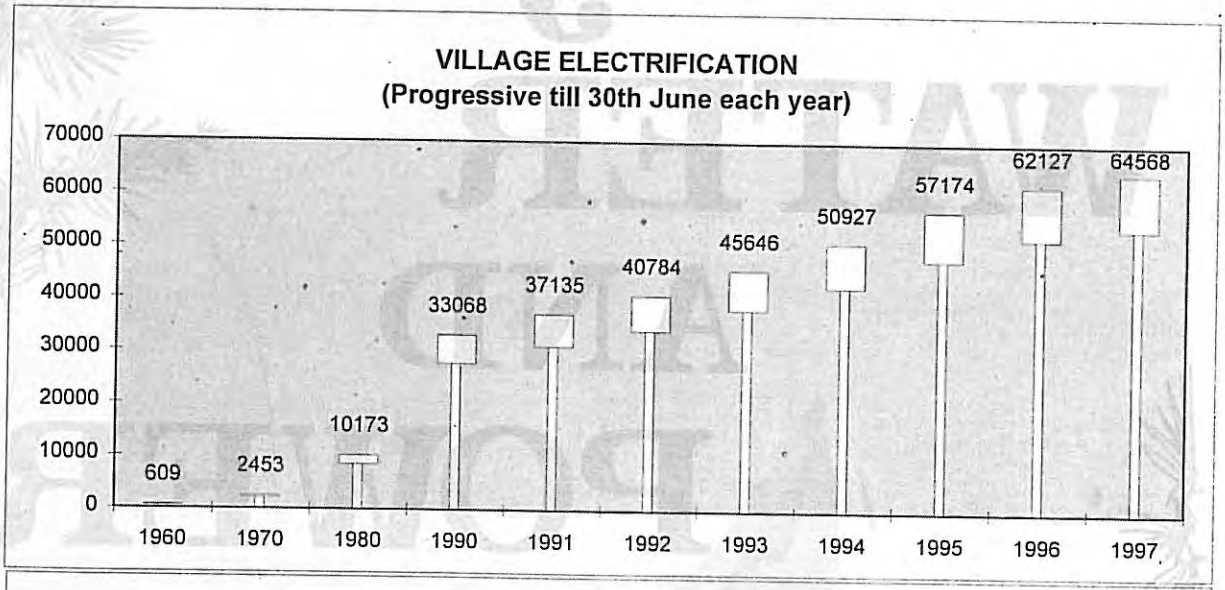
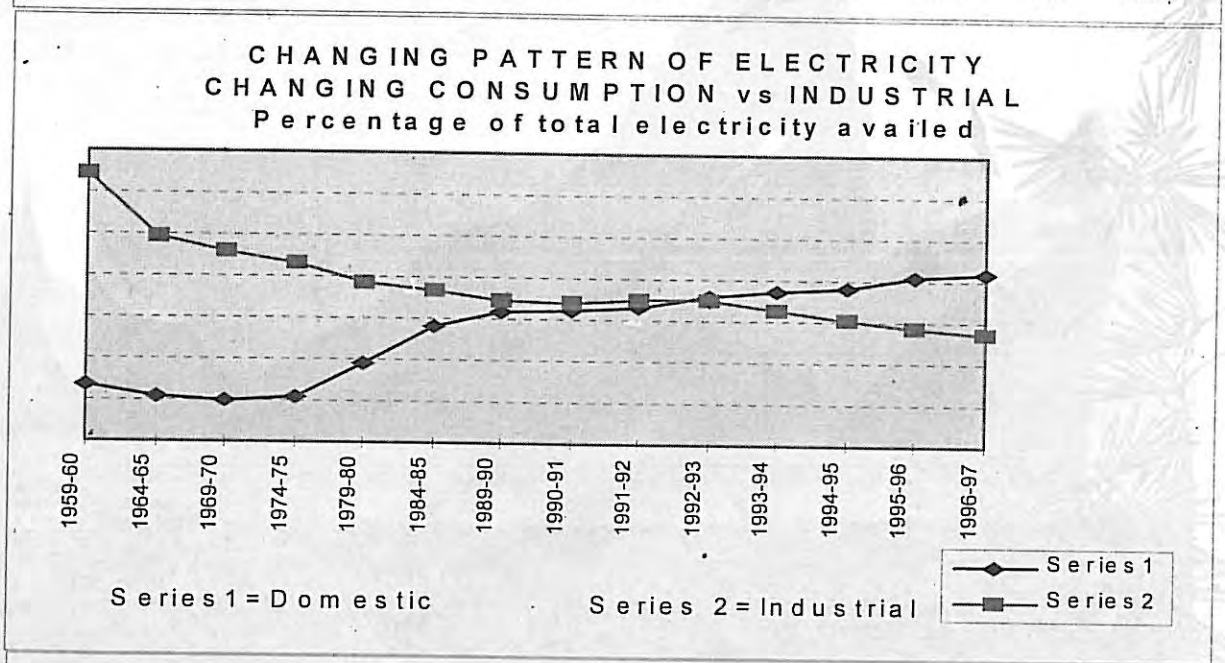
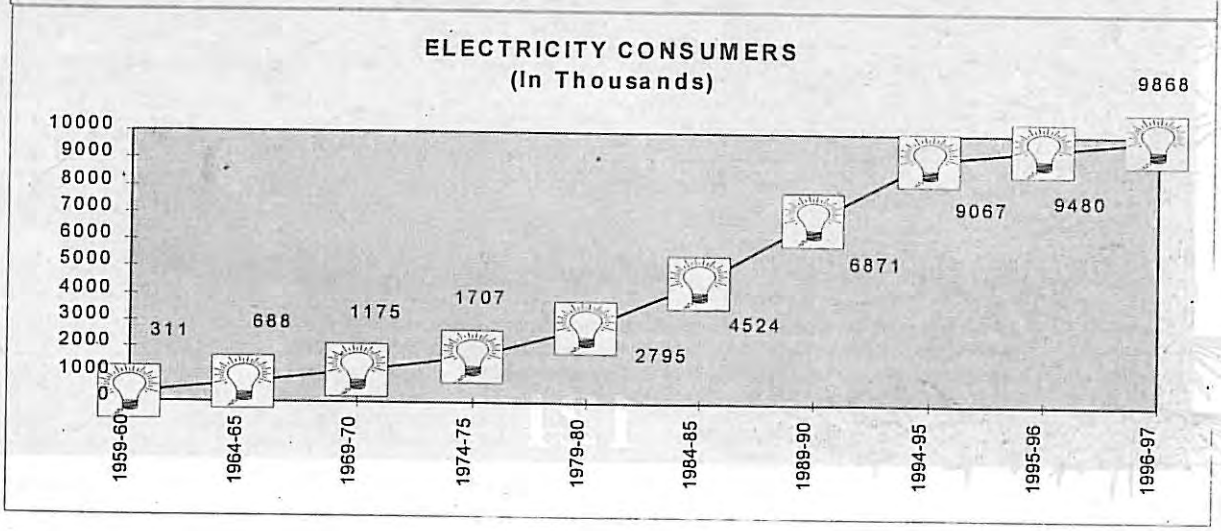


Figure 9 VILLAGE /SETTLEMENT ELECTRIFICATION, CHANGING PATTERNS OF CONSUMPTION AND NUMBER OF CONSUMERS







9

WATER AND POWER DEVELOPMENT AUTHORITY

In February 1958 Water and Power Development Authority (WAPDA) was created to undertake integrated and rapid development and maintenance of water and power resources alongwith effective control over alarming spread of soil salinity and waterlogging, flood control and internal navigation. The charter of duties assigned to this autonomous body, (amended in March 1959 to transfer the existing electricity departments to it) requires to investigate, plan and execute schemes in

- generation, transmission and distribution of power;
- irrigation, water supply and drainage;
- prevention of waterlogging and reclamation of waterlogged and saline land;
- flood control; and
- internal navigation.

WORKFORCE, MANAGERS AND THE AUTHORITY

During past 39 years, Wapda has created a large and competent workforce, about 138,000 strong, consisting of professionals and specialists, engineers and technicians of various disciplines, scientists, economists, administrators and accounts for planning, building and managingprojects in the field of water and power development. The Power Wing, being the developer and custodian of the largest and most significant utility service in the country, claims more than eighty per cent of the total workforce, followed by Water Wing and Common Services. Wapda's hydel and thermal power stations gave a collective output of 50887 MKWH of electricity in 1996-97 including 10740 units, imported from Independent Power Projects(IPP).

WATER DEVELOPMENT

Having been chartered in 1959 to develop and manage Pakistan's water resources for irrigation, drainage, prevention of waterlogging and salinity, and reclamation of affected land for increased productivity, Wapda assumed the charge of building dams, barrages and canals for creating water reservoirs and diversion facilities for irrigation purposes, and combating the alarming menance of waterlogging and salinity through Salinity Control and Reclamation Projects (SCARPs). On signing of Indus Basin Treaty in 1960 the organisation was entrusted the task of building historic Indus Basin Project (IBP). During 38 years of its operations the Water Wing of Wapda has planned and built sixteen IBP components including two dams at Tarbela and Mangla, five barrages, one gated syphon and eight inter-river link canals, in addition to four dams (Rawal, Tanda, Hub, Khanpur), one barrage Guddu) and one lift irrigation scheme (Chablat Kas). Salient features of the completed tasks are given below in Box 9.1 and Box 9.2.

BOX 9.1 SALIENT FEATURES OF MAJOR PROJECTS UNDERTAKEN BY WAPDA

Project	Cost(Rs. Mil.)	Technical Dta	Objectives
Chablat Kas Lift Irrigation Scheme completed in 1961	0.4	Pumping Water from Chablat Kas near Hasan Abdal involving lift of about 90 feet.	Provision of irrigation facilities for 1400 acres.
Rawal Dam completed in 1962	21.2	Type: Stone masonry gravity dam. Height:113.5 ft Length: 700 ft Live storage capacity 4300 acre ft.	Provision of 20 million gallons per day of potable water to Rawalpindi/Islamabad and irrigation of small area.
Guddu Barrage completed in 1965	474.8	Type: Gate controlled with navigation lock. Width: 64 spans of 60 feet each. Maximum discharge capacity 1.2 million cusecs.	Controlled irrigation supplies (including for 2.9 million acres in Jacobabad, Larkana and Sukkur districts of Sindh and Nasirabad district of Balochistan.
Tanda Dam completed in 1965	66.8	Type: Earthfill dam. Height:115 ft. Length: 2,340 ft. Outlet capacity: 2000 cusecs.	Irrigation of about 32000 acres in Kohat Valley
Karachi Irrigation Project (Hub Dam) completed in 1983	1022.60	Earthfill dam. Hight: 151 ft. Length: 21360 ft. Reservoir capacity: 10600 acre feet Spillway capacity: 458000 cusecs.	Irrigation of 21000 acres in Lasbela and 1000 acres in Karachi district. Drinking water supply of 89 MGD for karachi and 15 MGD for industries in Balochistan.
Khanpur Dam completed in 1984	1385.0	Type: Earth-cum-rockfill Hieght:167 ft. Length: 1547 ft. Reservoir capacity: 106000 acre ft. Spillway capacity: 166000 cusecs.	Irrigation of 36470 acres in Attock, Rawalpindi and Abbottabad district and supply of 131 MGD of water to Islamabad, Rawalpindi, POF Wah and Industries around Taxila.

BOX 9.2 PROJECTS COMPLETED BY WAPDA UNDER INDUS BASIN SETTLEMENT PLAN

Project	Main Technical Features	Objectives
Mangla Dam on river Jhelum (12th largest dam in the world) completed in 1967	Type: Earthfill Height: 380 feet above river bed Length: 10,300 ft. Gross Storage Cap.: 5.35 MAF Live Storage Cap.: 4.81 MAF Main Spillway Cap.: 1100000 Cusecs, Emergency Spillway Capacity: 230000 Cusecs	* Water storage for supplementing irrigation supplies * Hydropower generation 1000 MW from 10 units of 100 MW each * Incidental flood regulation.
Tarbela Dam on river Indus (The largest rock and earthfill dam in the world)	Type: Earthfill and rockfill Height: 485 feet above river bed Length: 9,000 ft. Gross Storage Cap. :11.3 MAF Live Storage Cap. : 9.4 MAF Main Spillway Cap. : 650,000 Cusecs, Emergency Spillway Capacity:840,000 cusecs Lake area: 100 sq. miles	* Water storage for supplementing / regulating irrigation supplies * Hydropower generation: -Units 1-4=700MW in 1977 -Units 5-8=700MW in 1982 -Units 9-10=700MW in 1985 -Units 11-14=1728MW in 92-93 * Repair remedialand additional works completed in 1983 * Reservoir works completed in 1977
Link Canals (08) ♦ Trimmu-Sidhnai ♦ Sidhani-Mailsi ♦ Mailsi-Bahawal ♦ Rasul-Qadirabad ♦ Qadirabad-Balloki ♦ Balloki-Suleimanki ♦ Chashma-Suleimanki ♦ Taunsa-Panjnad Link Canals Remodelled ♦ Marala-Ravi ♦ Bombanwala-Ravi-Bedian-Depalpur (BRBD) ♦ Balloki- Suleimanki-I	These link canals comprise a total of 389 miles and have 400 principal structures with discharging capacities varying between 4100 cusecs and 21700 cusecs. Besides, a total of 1,029,000 cusecs can be diverted through these link canals at full.	Completed progressively from 1965 - 1970, these canals are meant to transfer water of three westren rivers, namely Chenab, Jhelum and Indus to the canals dependent on the three easttern rivers, namely Sutlej, Beas and Ravi.
Barrages/Syphon ♦ Sidhnai on river Ravi ♦ Qadirabad on river Chenab ♦ Rasul on river Jhelum ♦ Chashma on river Indus ♦ Marala on river Chenab ♦ Mailsi Syphon on river Sutlej	These barrages and the syphon comprise a total length of over three miles (16,926 feet) with combined design capacity of 4.38 cusecs to facilitate aggregate diversion of 102,900 cusecs in to the link canals.	Completed progressively from 1964 - 1971, these barrages are aimed to provide river control for divertiing water from three weastern rivers to the three eastern rivers.

The operation against the onslaught of waterlogging and salinity consists of 57 completed scarps and drainage projects and a number of on-going schemes launched by Wapda to reclaim millions of acres of land lost to soil salinity and prevent its further spread.

Wapda's water Wing operates through the following divisions.

- Dams and Coordination Division
- Planning Division
- Tarbela Dam
- Ghazi Barotha Hydropower Project
- Kalabagh/Hydroelectric Projects
- Water Division(Central)
- Water Division(North)
- Water Division (South)
- Water Division (West)

INDUS BASIN SETTLEMENT PLAN

This historic plan was conceived, and the ensuing Indus Basin Treaty signed by India and Pakistan, after decade long parleys under aegis of World Bank to end the water dispute between two nations arising out of the former closing flow of river water to the lower riparian Pakistan and drying out its vast irrigation network. The settlement plan allocated water of eastern rivers Sutlej, Beas and Ravi to India and the western rivers Chenab, Jhelum and Indus to Pakistan. In order to provide water Pakistan's irrigation network is the largest manmade system in the world. Wapda was made executing agency for construction of sixteen IBP components all of which were completed within a decade of signing of the Treaty except Tarbela which was commissioned in 1975. The replacement system came as a boon for agriculture in years to come sustaining Pakistan's agriculture economy and providing low cost hydel energy from Tarbela and Mangla.

Wapda handed over all the IBP components to provincial departments except Tarbela and Mangla dams, Chashma barrage and Chashma-Jhelum Link Canal which have since been maintained and operated by Wapda. One of the largest earthfill dams in the world, Mangla dam is built across river Jhelum, about 60 miles south-east of Islamabad. Built under the historic Indus Basin Settlement Plan the world's largest earth and rock-filled dam has greatly enhanced the agricultural and industrial potential of Pakistan. It is now a major support to the country's economy

LAND RECLAMATION

In order to arrest further spread of waterlogging and salinity, mainly because of incessant operation of world's largest man-made canal system and unscientific irrigation of farm land over the past two centuries, the task of combating the devastating soil disease and reclamation of affected land was entrusted to Wapda soon after its creation in 1959.

Total achievement in the land reclamation sector is the completion of fifty seven projects since 1963 when first Scarp was completed by Wapda. Together, the 57 Salinity Control And Reclamation Projects (SCARP) and drainage projects have covered about 20 million acres of affected land through installation of vertical and horizontal drainage systems to stabilize under-ground watertable and surface drainage of affluent, and implementation of land management measures like "On-Farm Water Management" (OFWM), construction of water channels and introduction of other prescribed farm practices.

Other eighteen development projects are under execution with the water wing of Wapda through water divisions, covering a gross area of over eight million acres. The water divisions are responsible for planning, project preparation,

detailed design and implementation of surface and subsurface drainage and allied structural components for the canal irrigated areas.

Wapda's five reservoirs (Chashma, Hub, Khanpur, Mangla, Tarbela) produced 3400 metric tons of fish as by-product earning sizeable revenue, promoted the sport of angling by issuing over 19330 licenses and provided employment to many. Development of fisheries in reservoirs is drawing Wapda's special attention to supplement scarce proteinous food in the country.

POWER DEVELOPMENT

On 14th August 1947, power generation capacity, inherited by Pakistan, was only 60 MW with 142 MKWH of electricity production Upto 1959, i.e., pre wapda period, it rose to 119 MW only. The charter of duties assigned to Wapda after its creation requires the organisation to investigate, plan, execute, operate and maintain projects in the power sector covering generation, transmission and distribution of electrical energy in the country (except Karachi). During 38 years operation since 1959 up to 1997, Wapda has developed the sector to respectable level by enhancing the installed generating capacity of the system from 119 MW to 11,566 MW or 97 times, with length of transmission and distribution lines to 45 times and number of electricity consumers in various sectors by 32 times. The organisation has achieved notable success in benefitting the rural areas estimated to be inhabited by over 70 percent of country's population, by providing the utility to 64568 villages at the end of year 1996-97 which is 106 times of 609 villages enjoying the facility in 1959. As a result of this development the important economic indicator of per capita power consumption has increased tremendously (over 22 times) despite explosive population rise. Achievements in various formations of Wapda's power wing are summarised below.

POWER GENERATION

On June 30, 1997 the system's power generation capacity was of 11,566 MW. Total thermal capacity stood at 6741 MW after addition of 320 MW from Muzaffargarh Power Station and 137 MW Kot Addu Power Station, which was only 67 MW, pre-wapda, i.e., in 1959. The hydel capacity rested at 4,825 MW which was 52 MW in 1959. The system ratio between thermal and hydel capacity was 56.3 to 43.7 in 1959 which is 58.3 to 41.7 at present, though it was 33 to 67 in 1985. Total generation of the system in 1996-97 was 50782 MKWH which included 10740 MKWH of imported units. It was 48859 units in 1995-96 including 442 imported units.

THERMAL GENERATION

All the fourteen thermal power stations with total installed capacity of 6741 MW, cumulatively generated 19184 MKWH of electricity during 1996-97 which was 25211 units and this is due to the privatization of Kot Addu Power Station. Capacitywise detail is given below.

Table 9.1 THERMAL POWER STATIONS AND THEIR CAPACITY

Sr. No.	Power Station	Installed Capacity (MW)	Year of Completion
1	Gas Turbine Power Station Shahdara	85.0	1966-69
2	Gas Turbine Power Station Faisalabad	244.0	1975-94
3	Steam Power Station Faisalabad	132.0	1967
4	Natural Gas Power Station Multan	260.0	1960-63
5	Thermal Power Station Multan Cantt	20.0	1960-63
6	Thermal Power Station Guddu	1655.0	1974-94

7	Gas Turbine Power Station, Kotri	174.0	1970-94
8	Thermal Power Station, Sukkur	50.0	1965-67
9	Thermal Power Station, Jamshoro	880.0	1990-91
10	Thermal Power Station, Quetta	83.0	1964-84
11	Thermal Power Station, Pasni	17.0	1991
12	Thermal Power Station, Muzaffargarh	1370.0	1993-95
13	Lakhra Coal Fired Power Station	150.0	1995
14	Gas Turbine Power Station Kot Addu*	1621.0	1987-95
	Total	6741.5	

* It is privatized, included in total

Source: WAPDA

Hydel Generation

Wapda's 13 hydel power stations with total installed capacity of 4,825 MW produced 20858 MKWH of electricity during 1996-97. Capacity-wise detail is given below.

Table 9.2 HYDEL POWER STATIONS AND THEIR CAPACITY

Sr. No.	Power Station	Installed Capacity (MW)	Year Of Completion
1	Tarbala Power Station Units.1-10	1750.0	1977-93
2	Tarbala Power Station Units.11-14	1728.0	1977-93
3	Mangla Power Station	1000.0	1967-94
4	Warsak Hydel Power Station	240.0	1960-80
5	Rasul Hydel Power Station	22.0	1952
6	Dargai Hydel Power Station	20.0	1952
7	Jabban Hydel Power Station	19.6	1952
8	Nandipur Hydel Power Station	14.0	1963
9	Shadiwal Hydel Power Station	13.5	1961
10	Chichokimalian Hydel Power Station	13.2	1959
11	Kurram Ghari Hydel Power Station	4.0	1958
12	Renala Hydel Power Station	1.1	1925
13	Chitral Hydel Power Station	1.0	1984
	Total	4826.4	

Source: WAPDA

TRANSMISSION LINES AND GRID STATIONS (T&GS)

Beside maintaining and operating some 29 thousand kilometers long transmission lines and 633 grid stations(1995-96), both of varying capabilities ranging from 33 KV to 500 KV, Wapda's T&GS Organization plans, designs and constructs vast, and ever-widening, transmission network which serves as the vital link between hydel and thermal generation stations in the north and south with load centres located all over the country to form the gigantic national grid with extra high voltage (500 KV) spine to connect Peshawar in NWFP with Jamshoro in Sindh Province providing a 220 KV interlink with Karachi for mutual flow of power between Wapda and KESC.

GRID SYSTEM OPERATION (GSO)

Responsible for transmission of power from power houses to load centres through out the country through 595 grid stations and 29,855 km of transmission lines of various voltage ratings, the grid system operation consists of Lahore, Islamabad, Multan and Hyderabad regions. Crew have been trained in the fields of grid station, live line and deadline maintenance. They are also assisted by Technical Services Group.

POWER DISTRIBUTION

Serving some 10 million electricity consumers in industrial,

agricultural,commercial, domestic and other sectors, Wapda's power distribution system covers the entire country, except Karachi, through eight Area Electricity Boards(AEBs), the Lahore, Faisalabad, Gujranwala and Multan AEB's operating in the province of Punjab, and Peshawar, Hyderabad and Quetta AEB's providing the facility to the NWFP, Sindh and Balochistan provinces respectively where as Islamabad AEB is providing electricity to the Federal Capital Territory and Rawalpindi Region. During 1996-97 the organization supplied about 37 billion units of electricity and the system, consisted of over 270 thousand kilometers of high tension (11 KV) and low tension (440/220 volts) distribution lines at the end of the year 1996-97, remained under constant augmentation to match the expanding load areas and increasing consumption in various sectors.

CONSUMPTION PATTERN

Consumption of electricity in the domestic sector in 1996-97 registered further rise to 41.81 percent of total electricity available from 40.79 % of last year, while consumption in industrial sector in 1996-97 came down to 27.12 percent from 28.59 percent of the last year. The agricultural sector claimed 18.42 percent while commercial and other consumption outlets accounted for the balance 12.25 percent of available power with Wapda's distribution system. Sector-wise detail of percentage consumption of total available electricity in Wapda is given in table 9.6.

VILLAGE/SETTLEMENT ELECTRIFICATION

Total number of electrified villages was 64568 on 30th June, 1997 which include 34044 villages in the Province of Punjab, 13948 in Sindh, 3046 in Balochistan and 13530 villages were brought on the system in the NWFP and Federally Administered Tribal Areas (FATA). In 1959, when Wapda was created for water and power development, only 609 villages enjoyed the facility of electricity in the country. In 38 years of operations Wapda has managed to increase the number of electrified villages to 106 times.Detail is given in table 9.3.

Achievements of WAPDA since inception are highlighted below in Box 9.3.

BOX 9.3 ACHIEVEMENTS AT A GLANCE

Sr. No.	Subject	1959-60	1996-97	Increase (Times)
Power Sector				
1.	Installed Generating Capacity (MW)	119	11566	97
	Hydel	52	4826	93
	Thermal	67	6741	101
2.	Annual Energy Generation (MKWH)	780	50782	65
3.	Length of transmission lines of 500 KV, 220 KV, 132 KV, 66 KV, 33 KV capacity and distrib- ution lines of 11 KV & 440/220 volts (000KM)	7	300	43
4.	Numer of grid stations	50	633*	13
5.	Number of Consumers(000)	311.6	9868	32
6.	Number of electrified villages	609	64568	106
7.	Per Capita Electricity Consumption(Units)	14	300*	21
Water Sector				
1.	Irrigation water diversion to canal system (MAF)	80	105*	1.3
2.	Water storage capacity of Reservoirs(Million Acre Feet-MAF)	0.15	14.5	97
3.	Salinity Control and Reclamation Projects (SCARP) completed.	-	57	
4.	Scarp tubewells put into operation	-	27211	
5.	Length of drains constructed(KM)	-	21339	
6.	Waterlogged on Saline Area Reclaimed (M. Acre)	-	19.3	

* Data pertains to 1995

Source: WAPDA

Table 9.3 PROVINCE-WISE NUMBER OF VILLAGES/SETTLEMENTS ELECTRIFIED

Year	Pun-jab	NWFP	Sindh	Balo-chis-tan	Total WAPDA	Progre-ssive Total WAPDA	FATA & PATA	Progre-ssive Total FATA & PATA	Total (WAPDA + FATA & PATA)	Prog. Total (WAPDA + FATA & PATA)
Pre-Wapd	100	509	0	0	609	609	0	0	609	609
1960	167	102	0	0	269	878	0	0	269	878
1961	228	96	20	0	344	1222	0	0	344	1222
1962	212	39	17	0	268	1490	0	0	268	1490
1963	86	40	34	0	160	1650	0	0	160	1650
1964	14	54	31	0	99	1749	0	0	99	1749
1965	68	32	28	5	133	1882	0	0	133	1882
1966	91	34	27	3	155	2037	0	0	155	2037
1967	32	22	28	1	83	2120	0	0	83	2120
1968	37	10	39	1	87	2207	0	0	87	2207
1969	41	17	39	0	97	2304	0	0	97	2304
1970	83	30	36	0	149	2453	0	0	149	2453
1971	21	52	10	1	84	2537	0	0	84	2537
1972	12	44	18	0	74	2611	0	0	74	2611
1973	91	100	121	3	315	2926	0	0	315	2926
1974	310	95	115	10	530	3456	0	0	530	3456
1975	383	152	269	42	846	4302	0	0	846	4302
1976	370	87	262	34	753	5055	102	102	855	5157
1977	428	108	223	25	784	5839	70	172	854	6011
1978	850	167	371	43	1431	7270	175	347	1606	7617
1979	586	197	259	53	1095	8365	151	498	1246	8863
1980	651	192	271	55	1169	9534	137	635	1306	10169
1981	550	186	247	40	1023	10557	158	793	1181	11350
1982	925	226	297	64	1512	12069	189	982	1701	13051
1983	1399	243	303	41	1986	14055	202	1184	2188	15239
1984	1355	240	408	182	2185	16240	140	1324	2325	17564
1985	681	212	280	227	1400	17640	305	1629	1705	19269
1986	1170	363	518	281	2332	19972	245	1874	2577	21846
1987	1536	600	745	312	3193	23165	212	2086	3405	25251
1988	896	304	740	176	2116	25281	324	2410	2440	27691
1989	1090	387	593	41	2111	27392	190	2600	2301	29992
1990	1769	310	720	129	2928	30320	168	2768	3096	33088
1991	2570	511	666	104	3851	34171	196	2964	4047	37135
1992	2051	567	748	132	3498	37669	151	3115	3649	40784
1993	2753	892	933	205	4783	42452	77	3192	4860	45644
1994	2853	1099	1118	112	5182	47634	101	3293	5283	50927
1995	3223	946	1728	262	6159	53793	84	3377	6243	57170
1996	2845	621	1288	203	4957	58750	0	3377	4957	62127
1997	1517	267	398	259	2441	61191	*	3377	2441	64568
Total	34044	10153	13948	3046	61191		3377		64568	

Note = fiscal year ending 30th June

* Villages of FATA Included in NWFP

Source: WAPDA

Table 9.4 PROVINCE-WISE NUMBER OF ELECTRICITY CONSUMERS

Province/ Year	Punjab	N.W.F.P*	Sindh	Baloch-istan	Total
As on 30th June, 1959					278297
1960	175800	116552	19244**		311596
1961	200263	136747	22378**		359388
1962	249083	161917	30971**		441971
1963	337369	145602	37015**		519986
1964	384843	169570	51949**		606362
1965	435478	192542	58377	1469	687866
1966	499156	220491	79846	1982	801475
1967	552575	239429	95311	2785	890100
1968	610455	262719	118086	3420	994680
1969	663970	275804	127976	4710	1072460
1970	795427	230249	142708	6241	1174625
1971	862053	241101	160686	20384	1284224
1972	924032	261943	170967	20846	1377788
1973	996842	273561	184130	22776	1477309
1974	1056206	289519	210692	24737	1581154
1975	1153425	305134	221923	26100	1706582
1976	1269048	320861	238905	27559	1856373
1977	1404625	359440	254117	31648	2049830
1978	1549207	403432	288593	39209	2280441
1979	1719910	437713	323081	47511	2528215
1980	1887172	486622	364240	56757	2794791
1981	2270826	538372	390769	69978	3269945
1982	2503185	591291	411991	81775	3588242
1983	2732685	646673	432406	89672	3901436
1984	2975651	704038	457494	94367	4231550
1985	3184071	766768	473071	100085	4523995
1986	3440409	821950	502358	112340	4877057
1987	3740863	873887	537270	126666	5278686
1988	4115809	945385	578347	140082	5779623
1989	4594517	1040563	631807	152280	6419167
1990	4972438	1099222	642372	156647	6870679
1991	5268047	1158935	663169	170570	7260721
1992	5649209	1223790	679656	183586	7736241
1993	5984052	1300626	698182	192890	8175750
1994	6289578	1361401	736590	204473	8592042
1995	6660655	1415588	769299	221742	9067284
1996	6954402	1482611	809413	235305	9481731
1997					9868000

Note = Fiscal year ending 30th June

Source: WAPDA

* Includes FATA & PATA ** Including consumers of Balochistan Province

Table 9.5 ELECTRICITY GENERATION CAPACITY AND GENERATION (WAPDA)

	Installed Generating Capacity			Electricity Generated By Source		
Year	Hydel (MW)	Thermal (MW)	Total (MW)	Hydel (GWH)	Thermal (GWH)	Total (GWH)
Pre-Wapda	52	67	119			
1960	253	113	366	507	274	781
1961	267	197	464	645	342	987
1962	267	190	457	945	339	1284
1963	267	202	469	1176	504	1680
1964	267	332	599	1366	745	2111
1965	267	369	636	1362	1101	2463
1966	267	375	642	1425	1484	2909
1967	267	441	708	1530	1486	3016
1968	567	573	1140	2482	1166	3648
1969	667	567	1234	2792	1579	4371
1970	667	656	1323	2915	2247	5162
1971	667	650	1317	3449	2291	5740
1972	667	650	1317	3679	2350	6029
1973	667	654	1321	4355	2481	6836
1974	867	753	1620	4141	3038	7179
1975	867	873	1740	4359	3682	8041
1976	867	1068	1935	5436	2840	8276
1977	1567	1068	2635	5183	3551	8734
1978	1567	1068	2635	7466	2623	10089
1979	1567	1118	2685	8353	2256	10609
1980	1567	1118	2685	8718	3406	12124
1981	1847	1407	3254	9046	4160	13206
1982	1847	1407	3254	9526	5242	14768
1983	2547	1407	3954	11366	5126	16492
1984	2547	1407	3954	12822	5230	18052
1985	2897	1442	4339	12245	6532	18777
1986	2897	2052	4949	13804	7251	21055
1987	2897	2452	5349	15251	8379	23630
1988	2897	2652	5549	16689	10762	27451
1989	2897	3052	5949	16974	11924	28898
1990	2897	3512	6409	16925	14502	31427
1991	2897	4156	7053	18298	16137	34435
1992	3329	4164	7493	18647	19419	38066
1993	3761	4391	8152	21111	19680	40791
1994	4725	4956	9681	19436	22960	42396
1995	4825	6028	10853	22858	23268	46126
1996	4825	6288	11113	23206	25653	48859
1997	4825	6741	11566	20858	*29924	50782

* Imports from Independent Power Projects are included

Source: WAPDA

Table 9.6 PATTERN OF ELECTRICITY CONSUMPTION

(Percentage to Total sale)

Year	Domestic	Commer-cial	Indus-trial	Agricul-tural	Public Lighting	Bulk Supply	Tra-ction	Total
1960	13.43	2.99	64.67	11.11	0.83	6.97	0.00	100
1961	12.87	3.08	60.46	13.67	1.07	8.85	0.00	100
1962	13.56	3.01	54.36	19.16	1.08	8.83	0.00	100
1963	11.68	2.94	51.80	25.08	1.06	7.44	0.00	100
1964	10.63	3.01	48.12	28.76	1.02	8.46	0.00	100
1965	10.76	3.02	49.56	23.27	0.93	12.46	0.00	100
1966	10.20	3.40	49.88	22.98	0.81	12.73	0.00	100
1967	11.06	3.43	52.23	18.55	0.57	14.16	0.00	100
1968	11.58	3.58	49.96	20.15	1.09	13.64	0.00	100
1969	10.48	3.16	46.31	25.59	0.54	13.92	0.00	100
1970	10.19	3.44	45 72	26.56	0.56	13.53	*	100
1971	9.78	3.68	44.28	27.03	0.56	14.67	*	100
1972	9.48	3.43	50.98	24.10	0.46	11.55	*	100
1973	9 87	3.46	48.31	25.44	0.48	12.44	*	100
1974	10.88	3.69	47.47	23.85	0.40	12.82	0.89	100
1975	10.86	3.53	43.06	29.37	0.38	11.59	1.21	100
1976	12.76	4.18	42.54	26.08	0.49	13.11	0.84	100
1977	14.31	4.51	42.09	25.68	0.53	12.09	0.79	100
1978	15.47	4.70	40.00	26.46	0.64	12.08	0.65	100
1979	17.76	4.82	39.68	23.86	1.00	12.26	0.62	100
1980	19.17	4.77	38.65	25.20	0.61	11.04	0.56	100
1981	20.49	4.91	38.40	23.44	0.63	11.65	0.48	100
1982	23.27	5.58	38.63	22.91	0.73	8.48	0.40	100
1983	24.57	5.47	38.28	21.98	0.67	8.65	0.38	100
1984	27.19	5.79	36.89	20.87	0.58	8.34	0.34	100
1985	28.26	5.79	36.79	20.22	0.57	8.10	0.27	100
1986	29.11	5.65	38.02	18.58	0.58	7.83	0.23	100
1987	30.19	5.58	36.27	19.45	0.62	7.67	0.22	100
1988	30.38	5.09	34.95	21.23	0.57	7.59	0.19	100
1989	31.57	4.86	34.47	19.82	0.58	8.54	0.16	100
1990	31.71	4.58	34.65	20.75	0.61	7.54	0.16	100
1991	32.42	4.33	34.28	21.05	0.67	7.13	0.12	100
1992	33.11	4.07	34.90	19.90	0.78	7.14	0.10	100
1993	35.88	4.17	34.89	17.89	0.62	6.46	0.09	100
1994	37.24	4.10	32.78	17.87	0.67	7.26	0.08	100
1995	38.39	4.25	30.27	17.75	0.72	8.55	0.06	100
1996	40.79	4.58	28.74	18.42	0.82	8.59	0.06	100
1997	40.47	4.56	26.26	18.22	**	10.44	0.05	100

Fiscal year ending 30th June * Separate figures are not available ** Included in Bulk supply Source: WAPDA

Table 9.7 ELECTRICITY GENERATED, SOLD AND PER CAPITA CONSUMPTION (WAPDA)

Year	Popu-lation (Mln.)	Number of con-sumers (000's)	Peak Demand (MW)	Energy		Per Capita		Average units per Consumer	
				Genera-ted (GWh)	Sold (GWh)	Gene-ration (kWh)	Consum-ption (kWh)	Gen. (kWh)	Sold (kWh)
1960	39.36	311	131	781	603	20	15	2503	1933
1961	40.84	359	171	987	746	24	18	2749	2078
1962	42.38	442	245	1285	929	30	22	2907	2102
1963	43.98	520	312	1680	1224	38	28	3231	2354
1964	45.64	606	391	2111	1561	46	34	3483	2576
1965	47.36	688	447	2485	1822	52	38	3612	2648
1966	49.15	801	517	2910	2088	59	42	3633	2607
1967	51.01	890	476	3016	2098	59	41	3389	2357
1968	52.93	995	625	3648	2486	69	47	3666	2498
1969	54.93	1072	735	4371	2939	80	53	4077	2742
1970	57.01	1174	834	5074	3600	89	63	4322	3066
1971	59.16	1284	948	5740	3966	97	67	4470	3089
1972	61.70	1378	1024	6029	4137	98	67	4375	3002
1973	63.45	1477	1148	6836	4599	108	72	4628	3113
1974	65.25	1581	1237	7179	4742	110	73	4575	3020
1975	67.10	1707	1396	8041	5212	120	78	4710	3053
1976	69.02	1856	1437	8276	5315	120	77	4459	2863
1977	70.99	2050	1620	8734	5452	123	77	4260	2660
1978	73.04	2280	1836	10089	6490	138	89	4425	2846
1979	75.13	2528	1972	10609	6981	141	93	4194	2761
1980	77.31	2795	2076	12124	8160	157	106	4337	2919
1981	79.04	3270	2473	13206	9068	167	114	4039	2773
1982	81.41	3588	2846	14768	10288	181	126	4116	2867
1983	83.85	3901	3163	16492	11587	197	138	4220	2970
1984	86.37	4231	3295	18052	12762	209	148	4266	3016
1985	88.96	4475	3791	18777	13756	211	155	4151	3041
1986	91.63	4877	3933	21055	15504	230	169	4317	3179
1987	94.38	5279	4325	23630	17745	250	188	4476	3361
1988	97.21	5780	5031	27451	20702	282	213	4749	3582
1989	100.13	6419	5440	28898	21982	289	220	4502	3425
1990	103.23	6871	5680	31427	24121	304	234	4574	3511
1991	106.43	7261	6090	34435	26585	324	250	4742	3661
1992	109.73	7736	6532	38066	29267	347	267	4921	3783
1993	113.02	8176	7522	40791	31272	361	277	4989	3825
1994	116.41	8592	8067	42354	32131	363	275	4934	3740
1995	119.74	9062	8252	46126	35032	384	293	5087	3864
1996	123.12	9481	8278	48859	36925	397	300	5153	3894
1997	123.12	9868	8552	50782	38529				

Note = Fiscal year ending 30th June

Source: WAPDA