CHAPTER 13 RECOMMENDATIONS

13.1 General

The feasibility study has proved that the Munda Dam Multipurpose Project is feasible technically and viable economically and environmentally and is recognized as being in a state that the detailed design can commence whenever the fund becomes available. It is recommended that the field investigation and studies required for the detailed design as described below be conducted, provided that depending on the fund available, a part of the items therein could be advanced prior to full scale detailed design.

13.2 Field Investigations for Munda Dam (Full Scale)

13.2.1 Topographic Survey

A series of detailed topographic survey will be required for the detailed design of the structures and locations where no topographic survey could be done at the feasibility study stage. Those are the re-regulation weir, contractors' site installation area, the proposed quarry sites with access road routes thereto, the borrow area for concrete aggregate and earth embankment materials, all being in a scale of 1 in 1,000 or larger.

13.2.2 Geological Investigation

A detailed geological investigation will further be required for the detailed design in the future. The main purpose is the confirmation of the foundation condition at exact locations of the structures to meet the finally determined layout, the confirmation of the rock mechanical characteristics, the detailed confirmation of the quarry sites, especially about Todobo Banda quarry, and the detailed confirmation of the borrow area at West Sadar Garhi. The investigation will include but not be limited to the following items:

(1) Core drilling at dam axis, from the level of dam crest on both banks, plinth foundation for a concrete face rockfill dam, spillway chute, river bed for plinth and cofferdams and the proposed quarry sites at Todobo Banda and Sappare (approximately 1,500 m in total)

(2) Exploratory adits at Todobo Banda quarry site

(3) In-situ rock test in the existing adits at the dam site, deformation modulus and shear strength each with three test blocks

(4) Test pitting at West Sadar Garhi

(5) Laboratory tests for rock material, drilling core sample and earth embankment material

The details are shown in Appendix B.

13.2.3 Hydrological Investigation

The following hydrological investigations are recommended:

(1) Observation of the new hydrological gauging stations established at Zulam and Munda during the feasibility study stage should be commenced and continued. The stations should be maintained properly. Rainfall and discharge data, especially their hourly data, are essential for the flood analysis as well as long term runoff analysis. Sediment data should also be collected in these stations.

(2) Rainfall observation network in the Swat River basin should be improved adding rain gauges especially in the western side including Panj Kora River basin and Ambahar River basin. Target of raingauge network density is 100 km^2/gauge to 250 km^2/gauge as recommended by WMO for the mountainous area.

(3) River gauge network should be strengthened by adding at least a gauge in Panj Kora basin and a gauge in Ambahar basin.

13.3 Hydraulic Model Studies (Full Scale)

Hydraulic model studies are recommended for the selected spillway, power intake and river outlet in order to evaluate:

- Required shape of the spillway forebay
- Discharge capacity of both the gated and non-gated overflow sections
- Flow behaviors in the headworks, chute and energy dissipator
- Selection of shape and locations of aeration system within the chuteway
- Required shape of power intake in respect of bellmouth and anti-vortex device
- Required shape and length of river outlet facilities

13.4 Field Investigations for Irrigation Facilities (Full Scale)

13.4.1 Topographic Survey

A detailed topographic survey will be required for detailed planning and design for the new command area at both left and right banks at a scale of 1 in 5,000,

along the feeder tunnel and its outlet area at the right bank, the pumping station area and the locations of major structures such as river crossing, aqueducts, road culverts, superpassages at a scale of 1 in 1,000 or larger. In addition, cadastral maps over the command area should be compiled

13.4.2 Geological Investigation

A detailed geological investigation will be required for the detailed design of the feeder system at both banks. The investigation would include such items, but not limited to, as core drillings at the intake and outlet of the feeder tunnel and pump station, and seismic refraction along with the feeder tunnel.

13.5 Items of Field Investigation and Studies Prior to Full Scale Detailed Design

During and prior to arrangement of full scale fund for the Project, some of field investigation and studies may be advanced with fund available or arranged by the Government of Pakistan. Those are:

(1) Topographic survey and geological investigation over the re-regulation weir which is located 3 km downstream of the Munda dam site.

(2) Preliminary study on hydropower plant at the re-regulation weir where daily maximum head fluctuation is in an order of 15 m with regulated discharge varying from 5.5 to 65 m^3/sec on monthly average base.

(3) Preliminary study on mini hydropower plant utilizing the irrigation water for the left bank and head available in the feeder tunnel as referred to Subsection 7.3.3.

(4) Topographic survey and geological investigation for the command area at the right bank where the feeder system is by pump and development of the lift irrigation scheme may be considered even prior to implementation of the Munda dam.

13.6 Environmental Assessment

The following issues will need detailed analysis to be carried for the next phase of Environmental Assessment.

(1) An EIA for the route of the transmission lines selected for the project.

(2) Detailed studies of fish for fragmented populations and other aquatic life will be carried out. Community participation and evaluation of the economic benefits will also be carried out.

(3) Detailed plans for rescue and retrieval of archeological sites, establishment of a museum, and a plan for the promotion of tourism.

(4) A master plan will be developed for wildlife conservation, range management, social forestry, medicinal plants and erosion control.

13.7 Others

In relation to the development of new command area, the following issues shall be settled with the local administration during the detailed design stage or prior to the decision of the implementation:

(1) Issues related to the development of new command area be settled first with Indus River System Authority (IRSA).

(2) The issue on the Palai small dam scheme which is pending shall be settled and decision on resumption of its construction shall be made.

(3) The issue on the existing Tangi lift irrigation scheme shall be settled and agreement with the farmers as to what the scheme becomes a part of the new command area shall be arrived at.

(4) The issue on the existing Warsak lift irrigation scheme shall be settled so that a part of the command area be incorporated in the new command area.

(5) Formation of farmer's association shall be initiated within the new command area, together with the explanation campaign to the concerned farmers and/or residents.

(6) Field investigation shall be conducted as to the details of the existing tube wells owned by the privates within the new command area and confirmation shall be made if the owners are ready to participate in the new irrigation system.

MAIN REPORT

TABLES

Table 3.2.1 Summary of Laboratory Test Results on Earth Material

No.	Pit No.	Depth (m)	Grain size					Natural Water Contents	Atterberg Limit			Compaction test			Triaxial Test				Permeability Coefficient
			Coble	Gravel	Sand	Silt	Clay		LL	PL	PI	MMD	OMC	Sp.Gr.	CU		UU		
			(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)		(Mg/m^3)	(%)	(Mg/m^3)	C(kPa)	ø(°)	C(kPa)	ø(°)	K (cm/sec)
C01	P-8	0.15 - 3.50	5	72	11	12	0	2	25	18	7	2.11	8.5	2.67	-	-	-	-	1.65×10^{-6}
C02	P-8	3.50 - 5.00	0	0	92	8	0	2	----	NP	----	1.69	13.5	2.76	-	-	-	-	-
C03	P-9	0.10 - 0.40	0	8	15	60	17	14	33	23	10	1.68	19.0	2.66	-	-	-	-	-
C04	P-9	0.50 - 5.00	0	23	35	32	10	11	26	21	5	1.89	13.0	2.68	5	32	96	0	1.00×10^{-5}
C05	P-10	0.15 - 1.00	0	1	59	29	11	4	-----	NP	----	1.64	19.0	2.67	-	-	-	-	-
C06	P-10	1.20 - 5.00	0	0	36	58	6	5	-	-	-	1.67	16.0	2.68	18	28	125	0	2.39×10^{-5}
C07	P-10	1.20 - 5.00	0	0	28	72	0	5	-	-	-	-	-	2.68	-	-	-	-	-
C08	P-11	0.15 - 1.70	0	0	2	85	13	15	43	30	13	1.43	25.0	2.69	-	-	-	-	-
C09	P-11	1.70 - 3.00	0	0	1	79	20	10	40	28	12	1.69	19.0	2.69	20	31	50	0	-
C10	P-12	0.15 - 1.50	0	80	7	7	6	5	30	23	7	2.07	11.6	2.67	-	-	-	-	-
C11	P-12	1.60 - 5.00	0	75	20	3	2	1	----	NP	----	2.03	10.7	2.75	-	-	-	-	-
C12	P-13	0.15 - 2.00	0	62	20	13	5	4	-	-	-	2.03	10.2	2.69	-	-	-	-	-
C13	P-13	2.10 - 5.00	0	2	24	74	0	10	26	22	4	1.69	17.7	2.69	19	30	62	0	6.63×10^{-6}
C14	P-13	2.10 - 5.00	0	2	14	70	14	10	26	22	4	-	-	2.69	-	-	-	-	-
C15	P-14	0.15 - 1.60	0	1	30	55	14	18	27	22	5	1.81	13.5	2.68	-	-	-	-	-
C16	P-14	1.70 - 2.50	0	3	61	33	3	19	-----	NP	----	1.95	11.0	2.70	-	-	-	-	-
C17	P-15	0.15 - 3.00	0	4	46	50	0	6	30	24	6	1.83	14.3	2.67	24	29	44	0	3.43×10^{-6}
C18	P-15	0.15 - 3.00	0	4	42	40	14	6	30	24	6	-	-	2.67	-	-	-	-	-

Dispersion Test: P-10 (1.20 - 5.00m) Non dispersive, P-13 (2.10 - 5.00m) Non dispersive, P-15 (0.15 - 3.00m) Non dispersive

Note. NP = Non Plastic

Table 3.2.2 Summary of Laboratory Test Results on Sand and Gravel

No.	Pit No.	Depth (m)	Grain size			Specific gravity		Absorption		Sodium sulphate soundness (%)	Clay lump & friable particles (%)	Los Angeles abrasion		Alkali-silica reactivity (m.moles/lit.)	
			Cobble	Gravel	Sand	C. Agg.	F. Agg.	C. Agg.	F. Agg.			(% of water)	(Uniformity of water)	Sc	Rc
			(%)	(%)	(%)	(Mg/m3)	(Mg/m3)	(Mg/m3)	(Mg/m3)						
S01	P-1	0.15 - 1.50	20.6	62.5	16.9	2.89	2.90	0.31	1.68	0.19	0.21	6.0	0.19	21.15	80.0
S02	P-2	0.15 - 1.50	-	-	-	2.78	2.90	0.46	1.49	-	0.20	-	-	24.31	90.0
S03	P-3	0.35 - 1.50	28.4	44.2	27.4	2.77	2.89	0.30	1.55	0.31	0.19	5.0	0.19	12.32	40.0
S04	P-5	0.15 - 1.25	19.1	65.9	15.0	2.77	2.88	0.52	1.21	0.77	0.19	5.0	0.15	17.65	72.5
S05	P-5	1.25 - 1.50	-	-	30.0	-	2.88	-	1.21	-	-	-	-	-	-
S06	P-7	0.15 - 5.00	31.5	44.5	24.0	2.68	2.53	2.34	4.93	-	6.61	-	-	18.15	105.0

Table 3.2.3 Summary of Laboratory Test Results on Rock Material

No.	Hole No.	Depth (m)	Bulk density (Mg/m^3)	Water absorption (%)	Unconfined compressive strength (Mpa)	Internal friction angle (°)	Cohesion (MPa)
R01	M98-1	8.63 - 8.90	2.633	2.34	11.52	-	-
R02	M98-2	44.48 - 44.91	2.778	0.37	11.52	-	-
R03	M98-3	16.00 - 16.27	2.844	0.46	13.40	-	-
R04	M98-4	14.67 - 14.82	2.943	0.13	10.37	-	-
R05	M98-6	9.46 - 9.73	2.794	0.19	12.10	-	-
R06	M98-7	3.36 - 3.69	2.989	0.41	14.40	-	-
R07	M98-8	15.00 - 15.67	2.977	0.10	50.72	-	-
R08	M98-9	9.40 - 9.66	2.935	0.16	19.02	-	-
R09	M98-10	5.50 - 5.70	2.833	0.47	40.34	-	-
R10	M98-11	8.38 - 8.62	2.895	0.39	19.02	-	-
R11	QS-1	4.40 - 4.65	2.664	0.06	39.18	-	-
R12	QS-1	10.32 - 10.73	2.667	0.03	32.33	-	-
R13	QS-1	20.23 - 20.52	2.678	0.21	31.35	-	-
R14	QS-1	27.72 - 28.00	2.678	0.07	32.13	-	-
R15	QS-1	37.15 - 37.43	2.687	0.00	35.07	-	-
R16	QT-3	3.70 - 3.85	2.751	0.42	8.50	-	-
R17	QT-3	8.35 - 8.52	2.711	0.00	66.81	-	-
R18	QT-3	13.82 - 14.00	2.634	1.50	13.78	-	-
R19	QT-3	20.60 - 20.75	2.614	0.88	22.27	-	-
R20	QT-3	47.55 - 47.70	2.701	0.08	58.33	-	-
R21	QT-2	4.86 - 5.00	2.674	0.53	69.20	-	-
R22	QT-2	19.44 - 19.60	2.720	0.10	68.93	-	-
R23	QT-2	26.40 - 26.52	2.709	0.23	167.00	-	-
R24	QT-2	44.45 - 44.58	2.711	0.17	153.78	-	-
R25	QT-2	55.70 - 55.88	2.758	0.17	84.84	-	-
R26	M98-1	8.18 - 8.48	-	-	-	32.6	3.3
R27	M98-2	47.00 - 47.48	-	-	-	25.4	11.5
R28	M98-3	16.30 - 16.93	-	-	-	33.7	5.9
R29	M98-4	14.18 - 14.51	-	-	-	35.0	3.6
R30	M98-5	15.00 - 15.67	-	-	-	41.8	10.5

Table 3.3.1 Inventory of Climatological Stations

No.	Station	Location		Elev.	River Basin	Operating Agency	Instruments	Period of Record
		Lat.	Long.	ft				
1	Karora	34D-52M	72D-46M	-	Swat	IRR(F)	1	1962-
2	Abazai	34D-23M	71D-34M	1,500	Swat	IRR(F)	1	
3	Tota Khan	34D-38M	71D-49M	-	Swat	IRR(F)	1	1972-
4	Char Saddah	34D-09M	71D-45M	970	Swat	PRO(F)	1	
5	Utmanzai	34D-10M	71D-45M	942	Swat	IRR(F)	1	
6	Kulangi	34D-39M	71D-47M	2,200		IRR(F)	1	
7	Amandara	34D-37M	71D-59M	2,152	Swat	IRR(F)	1	
8	Chakdara	34D-39M	72D-02M	2,220	Swat	PMS	1,4,5,7	1940-
9	Saidu Sharif	34D-45M	72D-22M	3,200	Swat	SWHP PMS	1,2,4,5,6,7	1962- 1966-
10	Charbagh	34D-45M	72D-27M	3,400	Swat	IRR(F)	1	
11	Kalako	35D-03M	72D-28M	-	Swat	IRR(F)	1	
12	Kalam	35D-32M	72D-35M	7,500	Swat	SWHP	1,2,4,5,6	1962-
13	Malakand	34D-34M	71D-55M	3,000	Kalpan	IRR(F)	1	1866-
14	Peshawar	34D-00M	71D-31M	1,180	Kabul	FOR	1,2,4,5,6,7 10,11,12,13	1866 1966
15	Peshawar P.A.F	34D-01M	71D-35M	1,177	Bara	PMS	1,3,4,5,7,8,9	1966

Source: Inventory of stream gauging and climatological stations SWHP-WAPDA.

Instruments Description

1: 5 inch non-recording rain gauge
2: U.S. Weighing type Recording Rain Gauge
3: Casella Natural Siphon Recording Rain Gauge
4: Dry and Wet Bulb Thermometers
5: Maximum - Minimum Thermometer
6: Evaporation Pan/Evaporation Balance
7: Anemometer
8: Pilot Baloon
9: Radiosonde
10: Sunshine instruments
11: Soil temperature recording instrument
12: Soil moisture recording instrument
13: Dew observation gauges and balance

Operating Agencies

IRR(F) - Irrigation Department NWFP
SWHP - Surface Water Hydrology Project WAPDA
PRO(F) - Provincial Authorities NWFP
PMS - Pakistan Meteorological Services
FOR - Pakistan Forest Institute Peshawar

Table 3.3.2 Inventory of Stream Gauging Stations

No.	Station	Location		Drainage Area (Sq.mile)	Operating Agency	Period Of Record
		Lat.	Long.			
1	Swat River near Kalam	35D-30M	72D-35M	780	IRR(F) SWHP	1956-62 1961-
2	Swat River at Chakdara	34D-38M	72D-02M	2,230	IRR(F) SWHP	1911- 1960-
3	Swat River at Munda	34D-20M	71D-34M	5,560	IRR(F)	1956- 1927-58
4	Kaul River at Warsak	34D-11M	71D-24M	26,000	IRR(F) PWD(F) SWHP	1897- 1949-60 1961-71
5	Khyber River at Ali Masjid	34D-01M	71D-16M	-	IRR(F)	1970-
6	Bara River at Jhansi Post	33D-52M	71D-24M	713	IRR(F) SWHP	1959-62 1961-
7	Kabul River at Nowshera	34D-01M	71D-58M	34,200	SWHP	DEC 1960-

Source: Inventory of stream gauging and climatological stations SWHP-WAPDA.

Operating Agencies
IRR(F) Irrigation Department N.W.F.P
SWHP Surface Water Hydrology Project WAPDA
PWD(F) Public Works Department N.W.F.P

Table 3.3.3 Monthly Flow Records at Kalam Station

Units: m^3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	15.2	14.8	17.5	50.9	200.3	240.8	290.1	181.9	82.3	36.8	20.5	16.1	97.3
1957	14.7	13.8	14.7	27.6	87.5	237.5	323.7	231.6	93.7	59.4	48.1	29.5	98.5
1958	14.3	11.2	15.7	61.4	136.8	278.4	438.0	246.4	157.0	54.8	26.2	19.3	121.6
1959	15.2	12.7	16.1	60.0	167.2	299.3	387.8	256.1	145.1	66.3	38.5	28.1	124.4
1960	21.6	20.4	25.8	36.6	143.7	305.0	469.7	268.0	119.9	44.2	25.2	18.4	124.9
1961	13.8	11.2	13.4	34.3	121.6	235.1	263.4	187.4	124.2	49.3	25.2	19.8	91.6
1962	16.1	14.3	14.7	31.9	73.7	187.5	211.8	147.4	68.5	32.7	20.9	13.8	69.4
1963	13.4	11.7	16.1	42.4	96.7	265.5	251.4	165.8	83.8	35.5	21.9	16.6	85.1
1964	15.2	14.8	16.1	37.6	111.0	234.6	286.0	189.7	92.3	35.5	23.3	23.5	90.0
1965	12.9	11.1	13.9	36.9	129.8	335.3	318.3	184.3	88.6	38.3	22.9	16.2	100.7
1966	13.6	13.7	19.5	40.7	100.9	282.2	225.9	185.8	92.6	35.6	21.9	16.5	87.4
1967	13.8	11.9	12.7	31.7	95.1	251.7	337.7	190.1	94.3	32.2	21.2	16.6	92.4
1968	14.5	13.0	15.3	40.6	101.8	246.4	280.3	179.1	75.8	34.5	21.2	17.3	86.6
1969	14.0	13.5	22.7	52.3	105.4	270.8	367.1	251.8	76.2	38.2	25.8	19.2	104.7
1970	15.7	13.6	14.7	46.7	124.3	231.2	196.9	181.6	108.0	39.8	24.0	18.1	84.5
1971	14.9	13.4	17.8	54.1	142.2	241.0	174.7	154.5	62.3	28.0	18.8	14.6	78.0
1972	13.0	11.4	15.1	45.2	125.2	317.0	282.0	181.0	95.4	34.7	21.2	16.0	96.4
1973	12.9	11.2	13.7	58.0	154.3	311.5	269.6	211.2	107.3	40.5	21.2	16.0	102.3
1974	12.9	11.9	19.2	54.9	96.0	194.8	217.5	144.7	59.7	30.6	19.7	15.5	73.1
1975	12.7	12.1	12.6	43.3	182.3	268.9	249.7	223.4	87.8	36.6	26.3	18.8	97.9
1976	14.6	13.1	14.3	27.4	144.8	248.0	305.0	171.6	81.2	38.0	22.7	16.5	91.4
1977	13.8	13.2	17.9	48.0	106.9	213.6	218.8	145.9	64.1	31.5	20.5	16.1	75.9
1978	14.1	12.9	13.4	41.7	136.3	260.1	257.2	136.8	52.1	31.0	21.5	18.2	82.9
1979	14.0	12.5	13.1	54.7	94.3	249.2	293.5	144.7	63.2	28.5	20.7	15.2	83.6
1980	16.6	13.1	13.4	43.7	133.5	256.6	215.1	128.9	63.4	32.3	23.3	17.9	79.8
1981	16.7	15.6	18.1	62.0	186.1	232.8	259.0	141.4	57.6	30.0	20.5	16.9	88.1
1982	14.5	13.5	13.5	36.0	94.8	138.8	150.8	142.6	45.2	26.8	21.5	18.7	59.7
1983	16.1	14.6	15.4	30.1	105.4	193.9	209.6	167.5	79.9	34.4	25.4	20.0	76.0
1984	16.2	13.1	16.8	41.4	125.2	320.9	207.0	180.3	80.3	29.7	20.1	16.3	88.9
1985	14.4	13.0	14.5	34.9	92.1	186.1	214.5	157.5	64.4	33.9	21.6	17.2	72.0
1986	14.8	12.8	15.8	47.0	113.5	217.6	294.9	173.0	62.4	35.4	21.9	16.4	85.5
1987	15.6	15.4	18.2	52.9	127.8	233.7	271.1	196.6	96.4	39.4	26.3	19.2	92.7
1988	18.6	16.8	18.2	73.1	183.7	258.5	266.5	151.8	66.9	32.3	20.6	17.0	93.7
1989	14.7	13.0	15.4	27.5	99.4	263.0	226.9	157.0	77.5	33.5	22.8	18.0	80.7
1990	15.3	14.4	19.6	38.3	213.4	252.9	248.7	162.3	96.3	36.0	22.5	16.3	94.7
1991	14.9	15.8	19.8	47.1	114.1	300.3	369.1	234.5	115.8	42.3	25.6	20.8	110.0
1992	16.8	15.1	17.3	35.0	139.0	292.8	293.6	186.6	81.8	31.7	22.4	19.3	95.9
1993	15.8	14.7	19.5	31.7	124.9	250.6	263.8	174.4	88.3	34.3	22.8	20.4	88.4
1994	17.0	16.2	19.0	42.2	139.4	288.0	335.7	200.7	91.9	35.7	25.1	19.2	102.5
1995	15.4	13.6	15.5	42.1	118.9	262.4	337.1	198.8	71.8	38.0	23.0	17.9	96.2
1996	16.7	13.5	14.7	42.1	120.3	268.7	289.8	185.0	75.1	34.3	22.4	20.1	91.9
1997	21.6	14.3	15.7	39.4	122.4	257.2	288.9	182.7	87.5	NA	NA	NA	NA
Average	15.2	13.6	16.3	43.5	126.9	254.3	277.6	182.9	85.2	36.9	23.6	18.2	91.7

Table 3.3.4 Monthly Flow Records at Chakdara Station

Units: m^3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	36.8	42.3	65.9	192.3	432.9	406.9	478.9	279.5	139.9	54.8	37.1	38.2	183.8
1957	36.4	39.8	55.3	104.7	188.8	401.2	534.2	335.7	159.4	88.4	86.6	70.0	175.0
1958	35.5	32.6	59.9	232.2	295.7	470.6	722.6	379.5	267.0	81.5	46.6	46.1	222.5
1959	37.3	37.2	60.8	226.5	361.1	505.9	639.7	394.2	247.0	99.0	70.0	67.2	228.8
1960	53.4	59.7	97.2	139.0	310.4	527.3	775.1	412.6	203.7	65.9	45.2	44.2	227.8
1961	38.7	40.3	59.9	157.5	273.1	422.1	429.7	269.9	197.5	77.8	50.0	40.5	171.4
1962	34.5	35.2	52.0	117.1	166.2	275.5	343.1	236.7	116.6	56.2	43.8	39.6	126.4
1963	30.9	28.0	93.5	186.5	322.8	440.7	378.6	248.7	114.7	55.7	51.9	35.9	165.7
1964	39.1	44.9	81.5	169.4	233.0	356.9	492.8	319.6	147.0	61.7	35.7	44.7	168.9
1965	38.7	62.6	80.6	263.3	370.3	568.3	526.4	294.3	125.1	66.5	50.0	38.5	207.0
1966	33.2	46.6	107.5	234.0	298.5	508.7	404.8	301.3	168.1	79.0	46.6	35.8	188.7
1967	31.9	51.0	85.2	175.3	234.3	525.4	523.5	282.4	142.8	71.5	44.4	46.9	184.6
1968	40.3	40.6	80.5	169.9	260.7	551.5	545.4	348.7	102.6	61.6	48.3	55.0	192.1
1969	40.6	55.7	139.5	197.9	282.2	478.6	567.8	395.6	136.8	91.2	58.8	40.9	207.1
1970	36.7	35.3	65.2	147.4	254.0	387.8	292.3	264.9	214.5	78.4	42.0	33.6	154.4
1971	28.0	28.8	51.7	162.7	288.4	386.9	320.6	267.2	102.7	47.9	34.0	28.6	145.6
1972	30.1	42.5	98.6	169.0	307.7	527.9	452.6	298.6	150.1	66.9	53.6	45.4	186.9
1973	43.7	57.7	109.5	211.2	340.9	514.1	459.6	401.6	173.9	70.8	39.0	37.1	204.9
1974	34.0	40.7	78.7	156.3	197.4	329.2	335.3	218.7	88.3	54.2	34.3	34.3	133.5
1975	28.6	35.6	81.5	209.5	354.0	466.0	438.6	416.3	168.0	69.1	48.3	47.2	196.9
1976	46.7	58.7	87.6	233.9	318.3	398.2	450.3	332.2	148.7	70.3	43.8	36.7	185.4
1977	44.2	41.4	59.9	168.4	227.8	387.8	417.6	225.6	111.1	78.9	52.1	42.4	154.8
1978	38.1	37.0	122.6	193.8	320.2	451.8	452.1	312.1	110.9	63.8	56.3	40.3	183.2
1979	34.8	41.4	76.4	209.6	233.1	379.8	426.3	258.5	134.7	58.0	45.3	37.3	161.3
1980	37.6	50.2	131.7	217.4	308.6	444.6	359.1	232.7	114.6	69.9	54.9	44.3	172.1
1981	39.0	49.6	120.5	299.8	402.5	339.0	407.6	241.2	105.3	62.8	42.9	31.0	178.4
1982	32.4	34.6	68.3	144.3	208.4	231.2	223.7	250.7	73.9	60.4	72.3	53.8	121.2
1983	43.8	48.5	114.3	171.6	269.5	317.6	301.0	316.1	162.4	67.0	49.2	46.9	159.0
1984	43.8	44.5	67.8	132.3	249.9	501.9	312.0	283.1	151.5	57.5	51.5	45.6	161.8
1985	43.4	39.8	53.7	116.5	184.9	272.7	329.9	224.9	92.9	61.3	30.7	37.9	124.0
1986	38.1	48.5	106.9	197.0	238.3	301.1	431.1	320.2	91.0	59.2	41.8	45.6	159.9
1987	24.4	36.3	132.9	199.6	248.7	367.6	421.9	261.5	133.0	138.3	66.2	48.1	173.2
1988	35.9	44.8	127.4	229.2	334.5	389.9	477.3	268.6	105.9	56.1	35.9	35.4	178.4
1989	43.8	36.6	59.3	107.9	281.8	395.8	347.6	255.8	110.2	67.3	55.2	65.2	152.2
1990	46.4	73.2	180.7	275.7	459.3	396.9	365.6	282.6	167.6	97.9	69.7	63.5	206.6
1991	75.1	131.3	221.9	369.7	373.7	604.0	523.4	335.5	196.4	84.0	52.2	45.4	251.1
1992	34.9	42.9	110.0	201.9	334.2	494.9	466.2	308.4	147.7	65.0	44.0	36.4	190.5
1993	32.3	34.5	89.6	211.6	310.2	420.2	398.0	285.3	136.3	61.1	48.7	61.7	174.1
1994	46.0	57.9	106.5	203.8	352.0	508.5	588.9	421.4	163.4	95.7	68.0	62.9	222.9
1995	49.1	54.6	180.6	268.3	262.7	426.9	605.3	403.6	115.6	75.7	49.7	44.8	211.4
1996	32.8	45.3	94.4	175.0	280.5	312.8	410.7	348.6	118.0	61.3	46.1	45.1	164.2
1997	36.2	48.4	98.3	188.8	291.2	373.1	414.8	334.4	123.4	NA	NA	NA	NA
Average	38.7	46.6	95.6	193.8	292.0	423.0	447.4	306.4	142.4	71.0	49.8	44.9	180.2

Table 3.3.5 Monthly Flow Records at Nowshera Station

Units: m3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	225	185	391	1,110	1,752	1,557	2,094	585	376	376	243	163	755
1957	185	164	248	720	1,189	1,894	2,229	428	274	274	290	268	680
1958	237	192	390	1,122	1,047	1,837	2,532	741	305	305	209	265	765
1959	254	273	501	950	1,496	2,242	2,716	1,288	538	538	437	366	967
1960	315	304	615	1,337	2,090	2,750	3,446	772	289	289	237	221	1,055
1961	307	315	264	963	1,440	2,141	2,243	881	343	343	321	282	820
1962	264	211	194	699	913	1,577	1,606	529	221	221	210	236	573
1963	190	166	350	747	1,902	2,422	1,989	543	257	257	255	269	779
1964	296	276	408	1,303	1,445	1,812	2,270	626	270	270	230	266	789
1965	268	334	398	1,671	2,629	3,529	3,227	1,452	539	309	318	298	1,248
1966	285	295	685	1,376	1,683	3,056	2,219	1,475	730	322	258	245	1,053
1967	234	241	507	1,011	1,584	2,509	2,654	1,638	731	354	316	375	1,013
1968	389	306	561	1,052	1,583	3,070	2,850	1,925	536	317	305	313	1,101
1969	287	272	594	1,135	1,254	2,327	2,503	1,697	551	347	295	239	958
1970	270	203	298	684	1,132	1,453	1,178	1,168	858	265	209	203	660
1971	200	173	199	522	1,121	1,547	1,140	1,254	526	193	193	175	604
1972	176	247	374	937	1,775	2,832	2,115	1,240	640	289	257	245	927
1973	262	306	484	1,521	2,172	2,860	2,444	1,586	900	365	251	223	1,115
1974	209	207	307	696	946	1,490	1,523	952	434	252	158	151	611
1975	156	158	272	934	1,483	2,013	1,723	2,284	685	269	230	255	872
1976	280	318	357	1,095	1,443	1,764	1,667	1,499	658	310	244	229	822
1977	348	270	263	850	872	1,553	1,816	1,236	587	376	276	246	724
1978	281	211	659	972	1,502	2,044	2,377	1,620	655	370	348	235	940
1979	306	314	399	1,138	1,240	1,985	2,234	1,416	515	306	303	206	864
1980	270	254	406	1,025	1,541	2,056	1,598	1,144	555	221	245	196	793
1981	255	274	446	1,208	1,953	1,674	1,928	1,103	487	258	247	212	837
1982	220	203	277	557	949	1,125	1,022	1,264	340	217	246	219	553
1983	190	190	358	1,031	1,752	1,630	1,720	1,962	867	313	214	245	873
1984	244	295	320	688	1,147	2,278	1,536	1,858	819	227	254	257	827
1985	274	200	163	457	678	1,001	1,476	1,168	469	293	196	232	551
1986	260	259	453	934	1,223	1,561	2,090	1,500	489	310	295	396	814
1987	276	255	793	1,109	1,158	1,671	1,584	1,059	662	461	261	209	792
1988	240	217	492	1,015	1,618	1,792	2,038	1,437	542	268	207	233	842
1989	305	185	284	615	1,167	1,738	1,479	1,134	527	259	208	198	675
1990	268	360	664	814	2,019	1,649	1,582	1,349	735	351	257	260	859
1991	326	319	856	1,775	2,126	3,058	2,779	1,671	975	465	315	278	1,245
1992	306	261	475	1,805	1,827	2,093	2,242	1,496	821	333	647	276	1,049
1993	260	559	507	1,192	1,472	1,896	1,809	1,354	663	292	279	263	879
1994	255	226	392	836	1,334	1,940	2,485	1,641	661	369	313	289	895
1995	284	258	510	1,184	1,484	2,147	2,497	1,538	605	358	227	230	943
1996	232	355	597	923	1,300	2,059	1,960	1,393	762	339	269	261	871
1997	261	279	636	988	1,293	1,826	1,943	1,342	799	NA	NA	NA	NA
Average	261	259	437	1,017	1,470	2,035	2,061	1,292	576	313	270	249	858

Table 3.3.6 Average Monthly and Annual Rainfall for the Period 1961-1997

Units: mm

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Abazai	22.5	43.4	91.3	44.1	11.0	8.4	95.8	95.0	28.8	20.6	19.4	27.3	489
Amandara	46.7	78.2	92.1	54.9	27.3	16.3	69.1	111.7	31.3	27.0	16.6	26.6	628
Charbagh	70.5	93.3	135.9	105.1	52.7	50.7	150.7	127.5	60.8	45.2	25.7	65.5	965
Kalam	76.2	130.1	185.6	180.6	94.2	24.6	35.0	38.2	36.0	46.8	42.6	55.7	873
Malakand	51.9	92.4	101.1	69.4	21.9	25.3	101.4	179.0	43.5	20.4	26.3	36.8	756
Kulangi	45.8	166.0	214.8	143.0	78.2	24.3	101.3	165.3	81.7	56.3	22.3	94.0	1,089
Mardan	29.0	49.9	70.4	41.6	20.2	22.4	116.2	169.4	34.5	16.0	15.0	26.8	602
Peshawar	24.9	41.7	56.4	48.9	17.7	31.3	39.3	51.2	17.8	15.5	13.3	16.9	387
Saidu Sharif	38.0	102.1	131.6	107.5	61.5	25.8	121.3	115.4	40.9	39.4	21.2	42.2	769
Utmanzai	24.3	48.4	81.2	47.5	12.1	9.8	82.8	121.0	21.9	10.8	10.8	15.2	479
Average	43.0	84.5	116.1	84.3	39.7	23.9	91.3	117.4	39.7	29.8	21.3	40.7	704

Table 3.3.7 Monthly Pan Evaporation Data at Peshawar 1966-97

Units: mm

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1986	40.6	78.5	137.5	141.1	229.1	270.4	205.6	172.0	156.7	116.6	62.3	37.9	1,648
1987	44.4	67.8	163.7	148.3	132.3	209.4	225.1	223.7	162.2	111.5	69.3	46.1	1,604
1988	53.2	73.1	147.7	121.2	188.3	224.6	202.9	134.7	139.8	119.0	63.2	44.7	1,512
1989	66.3	67.7	83.9	164.1	222.9	266.2	246.0	179.8	158.9	105.9	60.4	41.9	1,664
1990	36.6	65.2	100.0	131.4	245.5	217.8	235.2	141.0	157.7	98.2	51.9	31.5	1,512
1991	48.9	79.0	150.8	167.3	175.9	196.3	211.2	208.4	129.2	98.9	48.8	33.4	1,548
1992	37.1	72.6	131.1	101.2	147.2	231.6	241.5	179.6	136.1	92.6	44.2	36.8	1,452
1993	37.6	71.0	153.3	123.5	222.6	200.0	235.7	198.0	150.0	101.1	44.0	38.4	1,575
1994	38.7	49.7	94.1	153.3	105.9	226.6	231.5	142.3	131.5	98.9	49.6	47.6	1,370
1995	51.4	82.5	156.9	112.2	189.3	268.2	224.9	191.4	196.6	119.6	58.5	50.5	1,702
1996	57.8	81.7	102.6	121.1	169.4	283.4	224.4	133.4	189.8	117.0	54.4	30.9	1,566
1997	30.1	65.8	83.4	156.4	166.5	185.5	172.8	278.0	126.2	214.3	40.9	50.8	1,571
Av. 1986-97	45.2	71.2	125.4	136.7	182.9	231.7	221.4	181.9	152.9	116.1	54.0	40.9	1,560
	1.9	2.6	3.7	5.8	9.6	11.9	9.5	7.3	6.8	5.1	2.8	1.6	69
Av. 1966-85	48.3	66.0	94.0	147.3	243.8	302.3	241.3	185.4	172.7	129.5	71.1	40.6	1,742
Av. 1966-97	47.1	68.0	105.8	143.4	221.0	275.8	233.8	184.1	165.3	124.5	64.7	40.7	1,674

Source : ref. 4 and Mean Monthly Data at Forest Institute, Peshawar

Table 3.3.8 Present and Future Water Use in Swat River Basin

(Unit : m^3/sec)

Irrigation Scheme		Canal Capacity	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Nipkikhel	Present	2.403	1.330	1.358	1.585	2.179	2.406	2.406	2.406	2.179	2.264	1.924	1.557	1.472
	Future	4.245	2.349	2.406	2.802	3.849	4.245	4.245	4.245	3.849	3.990	3.396	2.745	2.604
	Add.	1.842	1.019	1.047	1.217	1.670	1.840	1.840	1.840	1.670	1.726	1.472	1.189	1.132
Fatehpur	Present	0.425	0.226	0.255	0.283	0.396	0.425	0.425	0.425	0.396	0.396	0.340	0.283	0.255
	Future	0.934	0.509	0.566	0.623	0.877	0.934	0.934	0.934	0.877	0.877	0.736	0.623	0.566
	Add.	0.509	0.283	0.311	0.340	0.481	0.509	0.509	0.509	0.481	0.481	0.396	0.340	0.311
Badwan Kharif	Present	0.566	0.311	0.311	0.368	0.509	0.566	0.566	0.566	0.509	0.538	0.453	0.368	0.340
	Future	0.566	0.311	0.311	0.368	0.509	0.566	0.566	0.566	0.509	0.538	0.453	0.368	0.340
	Add.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Darora Jaghabanj	Present	0.255	0.000	0.000	0.000	0.226	0.255	0.255	0.255	0.226	0.226	0.000	0.000	0.000
	Future	0.849	0.000	0.000	0.000	0.764	0.849	0.849	0.849	0.764	0.792	0.000	0.000	0.000
	Add.	0.594	0.000	0.000	0.000	0.538	0.594	0.594	0.594	0.538	0.566	0.000	0.000	0.000
Ganidigar	Present	2.264	1.245	1.245	1.472	2.038	2.264	2.264	2.264	2.038	2.151	1.811	1.472	1.358
	Future	2.264	1.245	1.245	1.472	2.038	2.264	2.264	2.264	2.038	2.151	1.811	1.472	1.358
	Add.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Balambat	Present	1.443	0.283	0.821	0.962	1.302	1.443	1.443	1.443	1.302	1.358	1.160	0.934	0.877
	Future	3.113	0.623	1.783	2.066	2.802	3.113	3.113	3.113	2.802	2.943	2.490	2.009	1.896
	Add.	1.670	0.340	0.962	1.104	1.500	1.670	1.670	1.670	1.500	1.585	1.330	1.075	1.019
Gopalam	Present	4.273	0.000	0.000	0.000	3.877	4.273	4.273	4.273	3.877	4.019	0.000	0.000	0.000
	Future	6.792	0.000	0.000	0.000	6.169	6.792	6.792	6.792	6.169	6.396	0.000	0.000	0.000
	Add.	2.519	0.000	0.000	0.000	2.292	2.519	2.519	2.519	2.292	2.377	0.000	0.000	0.000
Others (upper Swat)	Present	-	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660
	Future	-	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660	5.660
	Add.	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Upper Swat Canal	Present	50.940	21.168	26.376	35.403	50.940	50.940	50.940	47.629	50.940	50.940	50.940	29.517	21.593
	Future	92.994	21.168	26.376	35.403	68.939	84.334	92.994	47.629	51.365	85.353	59.741	29.517	21.593
	Add.	42.054	0.000	0.000	0.000	17.999	33.394	42.054	0.000	0.425	34.413	8.801	0.000	0.000

Table 3.3.9 Estimated Monthly Flow at Munda Dam Site (Present Condition)

Units: m^3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	28.0	38.1	51.8	284.4	623.1	557.4	680.3	372.1	129.5	38.8	15.8	21.8	236.8
1957	21.7	22.2	43.7	131.8	236.8	546.8	760.7	468.1	156.6	104.0	88.3	62.4	220.3
1958	16.9	13.2	47.3	351.8	405.4	652.2	1052.5	528.5	306.8	87.4	24.5	32.4	293.2
1959	18.1	16.0	48.3	344.6	509.1	705.7	919.5	542.5	283.2	116.5	66.8	56.6	302.2
1960	41.7	44.7	105.2	193.4	427.6	729.9	1132.5	565.7	217.7	55.1	29.8	28.5	297.7
1961	27.3	24.1	52.8	226.7	360.2	557.0	601.3	362.1	211.7	67.4	28.9	16.3	211.3
1962	19.1	17.8	36.7	148.0	191.3	384.2	467.9	288.0	95.2	33.8	23.7	18.5	143.7
1963	13.9	11.0	96.5	269.0	356.1	609.3	542.5	321.7	109.8	37.7	33.6	25.7	202.2
1964	32.2	38.3	91.2	254.1	321.9	519.9	691.3	416.5	157.0	52.5	18.8	34.5	219.0
1965	31.4	67.0	89.7	420.2	460.9	811.5	758.3	391.2	137.3	60.2	41.9	24.8	274.5
1966	20.3	30.3	122.8	362.3	341.1	682.9	534.8	383.6	159.9	52.5	27.6	13.5	227.6
1967	14.8	42.9	89.0	248.7	274.6	650.6	757.6	384.7	138.4	40.7	19.8	28.5	224.2
1968	24.3	25.4	80.6	243.0	314.6	672.1	713.0	420.5	96.2	39.0	33.7	46.5	225.8
1969	34.5	55.8	183.3	304.5	349.8	659.9	852.1	548.6	131.0	78.7	56.0	28.6	273.6
1970	28.1	22.9	65.2	215.1	361.6	539.2	422.8	366.3	222.5	71.5	28.9	17.1	196.8
1971	32.4	15.2	32.9	223.5	406.2	542.2	408.9	326.8	84.1	28.9	19.2	15.0	178.0
1972	17.1	34.5	118.4	253.3	404.6	757.0	655.0	390.3	162.8	55.2	47.7	35.7	244.3
1973	33.1	53.2	126.3	310.3	469.4	728.6	635.2	491.2	185.9	53.6	21.5	20.3	260.7
1974	23.6	31.6	86.7	230.8	267.9	447.6	482.2	286.9	77.7	39.7	16.7	18.2	167.5
1975	14.6	23.3	91.1	325.0	541.2	647.7	603.4	528.9	166.4	59.7	39.1	38.6	256.6
1976	44.7	60.8	100.8	368.1	447.4	568.8	682.2	403.5	145.1	62.7	31.8	22.0	244.8
1977	36.5	28.1	42.1	236.6	301.8	506.1	541.3	288.8	85.8	42.7	31.0	21.5	180.2
1978	20.8	22.5	147.6	278.0	417.3	610.5	614.6	340.8	73.9	34.9	40.1	16.1	218.1
1979	16.5	29.9	73.4	309.2	277.4	543.0	633.7	301.1	103.5	29.4	27.5	21.5	197.2
1980	26.2	42.9	164.6	324.7	405.6	603.0	483.1	262.7	86.0	38.0	36.2	24.7	208.1
1981	23.1	35.9	145.0	474.4	572.9	490.9	577.5	286.5	74.0	32.6	24.1	10.7	229.0
1982	17.1	16.9	64.1	194.7	261.2	289.0	298.1	292.6	38.0	29.7	65.6	37.4	133.7
1983	39.9	44.1	143.4	258.0	340.0	437.5	445.5	386.6	153.2	54.8	40.6	38.0	198.5
1984	39.9	37.7	69.3	188.4	360.0	741.9	450.7	378.0	146.0	40.9	44.2	36.1	211.1
1985	29.1	27.2	43.8	145.3	238.8	380.4	462.9	293.7	74.6	37.3	11.4	14.8	146.6
1986	19.9	44.1	120.8	297.3	317.0	444.8	641.2	383.3	70.9	38.9	21.3	29.2	202.4
1987	9.7	24.5	172.9	307.5	363.6	527.0	617.3	382.2	151.9	116.0	68.0	40.0	231.7
1988	26.8	38.2	164.1	359.9	528.7	575.8	654.7	332.3	98.5	43.6	19.2	20.0	238.5
1989	40.0	24.9	55.8	145.2	339.0	586.2	503.6	329.3	113.9	53.8	50.3	67.0	192.4
1990	44.3	84.3	248.8	442.3	677.3	574.0	545.1	355.5	176.0	80.6	73.6	64.4	280.5
1991	91.8	178.2	314.3	608.6	435.6	794.3	820.0	483.2	219.0	79.3	45.5	35.7	342.1
1992	25.1	35.1	136.4	311.6	449.3	700.5	680.2	404.4	145.1	49.5	32.2	21.5	249.3
1993	20.8	21.5	104.0	328.7	405.9	589.1	589.5	372.4	144.8	50.3	39.7	61.5	227.4
1994	43.6	59.5	130.9	314.9	463.8	705.0	829.0	504.8	167.9	78.5	70.9	63.4	286.0
1995	48.6	54.1	248.8	429.2	358.7	609.4	843.5	489.3	111.0	66.8	41.4	34.7	277.9
1996	21.7	39.0	111.7	264.0	374.9	529.5	632.1	432.0	116.5	50.5	35.5	35.1	220.2
1997	27.3	44.0	117.9	288.3	387.0	561.2	634.2	418.7	134.7	NA	NA	NA	NA
Average	28.7	38.6	109.1	290.8	389.2	589.8	639.3	393.0	139.5	55.7	37.4	31.7	228.6

Table 3.3.10 Monthly Estimated Flow at Munda Dam Site (Future Condition)

Units: m^3/sec

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1956	26.2	27.2	53.6	247.6	575.7	500.6	663.6	351.4	81.8	34.9	14.7	23.4	216.7
1957	25.5	23.0	36.8	92.6	188.0	492.0	749.1	453.9	108.8	75.0	94.3	73.7	201.0
1958	23.9	17.9	44.1	318.3	357.5	597.8	1039.9	504.2	258.1	63.0	30.0	35.8	274.2
1959	27.0	18.9	45.6	308.2	461.7	651.8	912.0	526.9	230.2	93.0	67.5	69.3	284.3
1960	53.7	55.2	103.4	153.2	381.1	675.5	1120.9	555.2	170.4	42.9	27.7	32.9	281.0
1961	29.3	23.9	44.1	186.1	313.2	505.0	591.5	351.1	171.1	52.2	35.4	27.1	194.2
1962	22.4	15.6	31.7	114.5	146.2	331.3	459.0	277.4	49.3	28.5	25.4	25.6	127.2
1963	16.3	15.0	97.6	237.5	307.5	558.3	536.6	308.9	65.8	32.6	38.4	19.8	186.2
1964	30.0	31.3	78.5	207.2	263.6	454.2	669.2	390.5	98.4	31.2	19.0	33.6	192.2
1965	29.3	60.0	77.0	373.3	402.6	745.9	736.2	365.2	78.8	34.2	35.4	23.9	246.8
1966	20.2	34.0	119.8	321.5	296.3	632.0	524.9	372.1	113.5	33.2	30.0	19.6	209.8
1967	18.0	41.3	84.4	217.6	236.4	605.8	758.4	363.6	97.8	22.7	26.4	37.1	209.1
1968	31.9	24.3	76.9	208.0	268.7	619.2	703.0	398.9	48.0	29.7	32.7	50.0	207.6
1969	32.4	48.8	170.7	257.6	291.6	594.2	830.0	522.6	72.4	46.2	49.5	27.7	245.3
1970	26.0	15.9	52.6	168.2	303.3	473.6	400.6	340.3	164.0	39.0	22.4	16.2	168.5
1971	17.3	15.5	31.1	195.3	361.5	485.5	394.7	308.6	32.2	23.7	18.0	14.0	158.1
1972	15.0	27.5	105.7	206.4	346.4	691.3	632.9	364.3	104.3	28.8	41.3	34.8	216.5
1973	37.5	52.1	123.0	281.1	423.4	673.7	622.7	477.2	134.8	34.1	17.6	21.6	241.6
1974	21.4	24.6	74.0	183.9	209.6	382.0	460.1	260.9	29.8	25.9	18.2	17.3	142.3
1975	12.5	16.3	78.5	278.1	483.0	582.1	581.2	502.9	107.9	27.2	32.6	37.7	228.3
1976	42.6	53.8	88.2	321.2	389.2	503.2	660.1	377.5	86.5	30.2	25.3	21.1	216.6
1977	38.5	25.7	44.2	205.4	252.4	451.1	525.9	267.4	40.2	27.2	38.7	30.0	162.2
1978	28.3	18.6	143.8	250.2	375.5	559.9	601.1	319.9	26.1	24.2	45.5	26.7	201.7
1979	22.9	25.6	70.4	278.2	234.2	490.6	626.8	290.1	55.7	21.9	27.8	22.0	180.5
1980	27.4	40.0	158.4	292.1	361.7	549.9	475.6	251.8	41.9	21.5	43.4	33.0	191.4
1981	29.7	38.9	140.6	438.0	527.1	438.1	568.8	273.4	28.6	23.0	24.0	12.0	211.8
1982	18.8	14.6	57.6	162.7	215.9	234.8	289.1	281.8	17.1	18.9	71.3	48.1	119.2
1983	37.8	37.2	130.7	211.0	281.8	371.8	423.4	360.6	94.7	28.3	34.1	37.1	170.7
1984	37.8	30.7	56.7	141.4	301.7	676.3	428.6	352.0	87.5	23.8	37.8	35.2	184.1
1985	37.0	23.0	34.3	113.5	193.2	327.2	452.0	281.2	33.8	29.0	16.0	23.0	130.3
1986	28.3	37.2	118.9	256.0	272.2	389.5	632.3	370.3	32.1	31.7	22.2	35.2	185.5
1987	15.0	17.5	160.2	260.5	305.4	461.3	595.1	356.2	93.4	83.5	61.6	39.1	204.1
1988	24.7	31.2	151.4	312.9	470.4	510.2	632.6	306.3	40.0	27.9	19.2	19.1	212.2
1989	37.8	17.9	43.2	98.3	280.8	520.6	481.5	303.3	55.3	21.3	43.8	66.1	164.2
1990	42.2	77.3	236.2	395.4	619.1	508.4	523.0	329.5	117.5	48.1	67.1	63.4	252.3
1991	89.7	171.2	301.7	561.7	377.4	728.6	797.9	457.2	160.4	46.7	39.0	34.8	313.9
1992	22.9	28.1	123.8	264.7	391.1	634.9	658.1	378.4	86.6	24.9	25.8	20.6	221.7
1993	18.6	14.5	91.3	281.8	347.6	523.4	567.4	346.4	86.3	29.6	33.2	60.6	200.1
1994	41.4	52.5	118.3	268.0	405.5	639.3	806.8	478.8	109.4	46.0	64.4	62.5	257.7
1995	46.5	47.1	236.1	382.3	300.5	543.7	821.3	463.3	52.5	34.3	35.0	33.8	249.7
1996	19.5	32.0	99.0	217.1	316.7	463.9	610.0	406.0	58.0	29.6	29.1	34.2	192.9
1997	25.2	37.0	105.3	241.4	328.7	495.6	612.0	392.7	76.2	NA	NA	NA	NA
Average	29.7	34.8	100.9	250.2	337.3	530.3	623.2	372.4	88.0	35.8	36.1	34.1	206.2

Table 3.3.11 Annual Water Yield and Suspended Sediment Records (1/2)

River Station	Year	Water Yield			Suspended sediment			Sed/Dis Ratio		Observed Conc.	
		Total Flow $10^6 m^3$	Max. Flow m^3/s	Min. Flow m^3/s	Million Tons	$10^3 m^3$	m^3/km^2	By Wt kg/m^3	By Vel mm %	Max PPM	Min PPM
Swat near Kalam	1961	2,903	314	10	0.31	344	170.48	0.11	0.1186	210	12
C.A = 2,020 km^2	1962	2,202	405	14	0.19	209	103.50	0.09	0.0950	607	6
	1963	2,681	473	11	0.25	283	140.04	0.09	0.1055	2,020	10
	1964	2,841	521	12	0.31	344	170.48	0.11	0.1212	299	19
	1965	3,186	464	10	0.39	431	213.10	0.12	0.1351	320	10
	1966	2,780	425	12	0.22	246	121.77	0.08	0.0885	198	10
	1967	2,927	422	8	0.27	308	152.21	0.09	0.1050	134	10
	1968	2,755	439	12	0.22	246	121.77	0.08	0.0893	204	7
	1969	3,321	456	12	0.32	258	127.86	0.10	0.0778	245	10
	1970	2,669	371	12	0.20	221	109.59	0.07	0.0829	315	9
	1971	2,472	351	12	0.18	197	97.42	0.07	0.0796	188	10
	1972	3,050	473	10	0.19	209	103.50	0.06	0.0685	112	21
	1973	3,235	388	10	0.23	246	121.77	0.07	0.0760	137	10
	1974	2,312	337	12	0.12	135	66.97	0.05	0.0585	1,180	3
	1975	3,100	464	11	0.25	283	140.04	0.08	0.0913	92	6
	1976	2,903	393	13	0.22	241	119.33	0.07	0.0831	363	3
	1977	2,399	342	12	0.15	171	84.63	0.06	0.0713	322	3
	1978	2,632	597	18	0.55	606	300.16	0.21	0.2304	3,430	13
	1979	2,645	470	10	0.23	256	126.64	0.09	0.0967	204	6
	1980	2,522	393	11	0.31	346	171.09	0.12	0.1371	477	5
	1981	2,792	408	14	0.40	448	221.62	0.14	0.1604	176	7
	1982	1,894	233	12	0.15	164	80.98	0.08	0.0864	211	7
	1983	2,411	368	12	0.27	280	138.82	0.11	0.1163	191	6
	1984	2,804	413	12	0.40	412	203.96	0.14	0.1469	2,580	18
	1985	2,312	308	12	0.23	237	117.51	0.10	0.1027	265	15
	1986	2,706	430	11	0.40	411	203.36	0.15	0.1518	297	17
	1987	2,940	342	14	0.41	416	205.79	0.14	0.1414	345	14
	1988	2,964	376	14	0.42	426	210.66	0.14	0.1436	1,310	18
	1989	2,546	328	12	0.40	410	202.75	0.16	0.1609	590	16
	1990	3,001	422	13	0.40	413	204.57	0.13	0.1377	332	13
Mean		2,743			0.29	308	152.21	0.10	0.1121		
Swat at Chakdara.	1961	5,412	744	32	1.36	1,624	281.11	0.25	0.3000	872	5
C.A = 5,776 km^2	1962	3,998	942	29	0.91	1,082	187.41	0.23	0.2708	647	6
	1963	5,240	608	20	1.31	1,562	270.46	0.25	0.2981	1,210	14
	1964	5,264	945	31	1.37	1,636	283.24	0.26	0.3107	1,280	5
	1965	6,531	809	29	1.03	1,242	215.09	0.16	0.1902	1,430	2
	1966	5,953	1,002	29	1.00	1,193	206.57	0.17	0.2004	1,560	5
	1967	5,843	900	26	1.06	1,267	219.35	0.18	0.2168	355	6
	1968	6,076	925	30	0.83	984	170.37	0.14	0.1619	1,700	4
	1969	6,556	985	34	0.97	1,169	202.31	0.15	0.1782	994	11
	1970	4,846	674	29	0.63	750	129.91	0.13	0.1548	7,130	13
	1971	4,600	572	23	0.62	738	127.78	0.13	0.1604	173	10
	1972	5,904	818	26	0.51	603	104.35	0.09	0.1021	135	32
	1973	6,470	611	34	1.25	1,501	259.81	0.19	0.2319	3,750	10
	1974	4,219	583	30	0.27	320	55.37	0.06	0.0758	216	7
	1975	6,224	906	26	1.35	1,624	281.11	0.22	0.2609	2,400	7
	1976	5,855	685	31	0.80	962	166.54	0.14	0.1643	959	3
	1977	4,895	1,208	31	1.26	1,513	261.94	0.26	0.3090	8,400	5
	1978	5,793	942	33	1.96	2,349	406.76	0.34	0.4055	1,380	19
	1979	5,092	611	29	0.79	945	163.55	0.15	0.1855	157	3
	1980	5,437	1,282	31	1.55	1,857	321.57	0.29	0.3416	5,990	26
	1981	5,646	897	29	0.83	999	172.92	0.15	0.1769	472	7
	1982	3,838	642	28	0.36	435	75.39	0.09	0.1135	242	8
	1983	5,031	883	36	0.25	48	8.31	0.05	0.0095	91	6
	1984	5,105	951	32	0.92	1,097	189.96	0.18	0.2149	1,800	31
	1985	5,781	1,330	24	0.76	909	157.38	0.13	0.1572	1,080	23
	1986	5,055	659	27	1.09	1,216	210.62	0.22	0.2406	1,190	31
	1987	5,486	679	20	1.03	1,156	200.18	0.19	0.2108	1,220	10
	1988	5,646	1,602	28	5.47	6,113	1,058.42	0.97	1.0828	1,270	14
	1989	4,809	744	32	1.56	1,747	302.40	0.32	0.3632	1,920	11
	1990	6,519	778	39	2.88	3,223	557.96	0.44	0.4943	605	19
Mean		5,375				1,402	242.78	0.00	0.2609		

Table 3.3.11 Annual Water Yield and Suspended Sediment Records (2/2)

River Station	Year	Water Yield			Suspended sediment			Sed/Dis Ratio		Observed Conc.	
		Total Flow $10^6 m^3$	Max. Flow m^3/s	Min. Flow m^3/s	Million Tons	$10^3 m^3$	m^3/km^2	By Wt kg/m^3	By Vel mm %	Max PPM	Min PPM
Kabul at Nowshera	1961	28,659	3,141	136	29.03	30,627	345.76	1.01	1.0687	1,770	72
C.A = 88,578 km^2	1962	20,664	3,255	142	17.24	18,204	205.51	0.83	0.8810	2,110	31
	1963	27,306	4,075	140	26.67	28,167	317.99	0.98	1.0315	2,540	9
	1964	27,429	3,849	170	26.76	28,290	319.38	0.98	1.0314	9,100	42
	1965	39,360	6,311	179	51.89	54,735	617.93	1.32	1.3906	5,230	42
	1966	33,210	4,585	179	34.84	36,777	415.19	1.05	1.1074	3,880	34
	1967	31,980	5,037	163	32.75	34,563	390.20	1.02	1.0808	3,740	26
	1968	34,932	4,047	187	53.16	56,088	633.20	1.52	1.6056	3,820	28
	1969	30,258	3,028	181	35.47	37,392	422.14	1.17	1.2358	6,030	44
	1970	20,787	1,981	126	15.15	15,990	180.52	0.73	0.7692	2,210	55
	1971	19,065	2,323	145	14.33	15,129	170.80	0.75	0.7935	6,220	36
	1972	29,274	3,934	132	40.55	42,804	483.24	1.39	1.4622	6,600	70
	1973	35,178	3,622	190	56.70	59,778	674.86	1.61	1.6993	4,380	51
	1974	19,311	2,541	112	25.58	26,937	304.10	1.32	1.3949	4,570	6
	1975	27,675	4,839	118	39.19	41,328	466.57	1.42	1.4933	3,150	33
	1976	25,953	577	199	36.74	38,745	437.41	1.42	1.4929	3,790	19
	1977	22,878	2,972	197	27.13	28,659	323.55	1.19	1.2527	3,970	81
	1978	29,520	4,754	156	47.54	50,184	566.55	1.61	1.7000	7,520	25
	1979	27,306	2,972	136	23.50	24,846	280.50	0.86	0.9099	6,200	26
	1980	24,969	2,972	134	55.97	59,040	666.53	2.24	2.3645	15,000	35
	1981	26,445	3,339	173	64.59	68,142	769.29	2.44	2.5767	5,980	33
	1982	17,466	2,216	98	29.12	30,750	347.15	1.67	1.7606	6,220	7
	1983	27,675	2,915	198	50.08	50,307	567.94	1.81	1.8178	3,880	21
	1984	26,076	3,226	159	60.51	60,885	687.36	2.32	2.3349	6,950	80
	1985	17,466	2,858	99	19.78	19,926	224.95	1.13	1.1408	3,830	67
	1986	25,707	3,056	154	33.66	33,825	381.87	1.31	1.3158	4,620	83
	1987	24,969	2,649	169	26.04	26,199	295.77	1.04	1.0493	3,880	78
	1988	26,691	3,453	174	66.23	66,543	751.24	2.48	2.4931	9,050	76
	1989	21,279	2,473	121	21.59	21,771	245.78	1.01	1.0231	5,610	81
	1990	27,183	3,311	190	35.20	35,424	399.92	1.29	1.3032	4,910	47
Mean		26,691			36.56	38,130	430.47	1.37	1.4286		
Kabul at Warsak	1961	22,386	2,377	87	9.80	10,332	153.43	0.44	0.4615	2,900	19
C.A = 67,340 km^2	1962	15,498	1,916	103	3.54	3,727	55.34	0.23	0.2405	743	10
	1963	20,787	3,028	91	16.06	16,974	252.06	0.77	0.8166	2,240	9
	1964	19,926	2,567	122	13.25	14,022	208.23	0.66	0.7037	19,200	13
	1965	29,274	4,273	125	39.83	42,066	624.68	1.36	1.4370	3,070	19
	1966	23,616	3,283	172	18.23	19,188	284.94	0.77	0.8125	2,350	24
	1967	22,386	3,679	152	16.69	17,589	261.20	0.75	0.7857	2,090	7
	1968	24,969	3,028	186	21.77	23,001	341.57	0.87	0.9212	6,910	9
	1969	21,033	2,270	171	12.70	13,407	199.09	0.60	0.6374	13,000	33
	1970	16,482	1,562	139	5.90	6,273	93.15	0.36	0.3806	10,600	33
Mean		21,648			15.79	16,605	246.58	0.73	0.7670		

Table 4.2.1 Schedule of Electricity Tariffs Effective from 1 April, 1999 (WAPDA)

Tariff Category/ Particulars	Fixed Charge (Rs/kW/Mon)	Energy Charge (Pa/kWh)	F.A.S. (Pa/kWh)	Additional Surcharge (Pa/kWh)
GENERAL SUPPLY TARIFF (A-1)				
Up to 50 units		54	7	73
For Consumption above 50units				
For First 100 units		68	7	89
For Next 200 units (101-300)		77	15	180
For Next 700 units (301-1000)		110	75	288
For Next 3000 units (1001-4000)		147	75	385
Above 4000 units		147	75	436
Flat Rate for FATA (Rs. Per Consumer/Mon.)	90			537
Minimum Monthly Charges:	a) for Single-phase Consumer: Rs 45/-			
	b) for Three-phase Cons.: Rs 100/- plus Rs 25/kW for load in excess of 10kW			
GENERAL SUPPLY TARIFF (A-2)				
For First 100 units		217	75	346
Above 100 units		241	75	356
Minimum Monthly Charges:	a) for Single-phase Consumer: Rs 150/-			
	b) for Three-phase Cons.: Rs 300/- plus Rs 30/kW for load in excess of 10kW			
INDUSTRIAL SUPPLY TARIFFS				
B1 Up to 40 kW		119	75	246
There shall be minimum charge of Rs. 70/kW for first 20kW & Rs.90/kW for load 20-40kW				
B2 41-500 kW	200	68	75	220
B2 TOD (Off-peak)	200	58	75	205
B2 TOD (Peak)	200	136	75	276
B3 Up to 5000 kW (Normal)	290	67	75	144
B3 TOD (Off-peak)	290	53	75	103
B3 TOD (Peak)	290	135	75	169
B4 For All Loads (Normal)	280	62	75	133
B4 TOD (Off-peak)	280	49	75	96
B4 TOD (Peak)	280	125	75	167
Bulk SUPPLY TARIFF				
C-1(a) 400 volts (Licencees/ Non-Licencees)		83	75	252
C-1(b) 400 volts (Other Consumers)	220	68	75	251
C-2(a) 11/33 kV (Licencees/ Non-Licencees)		69	75	238
For Government of A J&K		69	75	165
C-2(b) POF WAH		95	75	274
C-2(c) 11/33 kV (Other Consumers)	216	65	75	248
C-3 66/132/220 kV	214	63	75	224
TEMPORARY/ COGEN./ P.LIGHT TARIFFS				
E-1-(i) Domestic Supply		170	75	299
E-1-(ii) Commercial Supply		319	75	446
E-2-(i) Industrial Supply		174	75	303
E-2-(ii)a Bulk Supply to Licensee/Non-Licensee (400 V)		135	75	315
E-2-(ii)b Bulk Supply to Licensee/Non-Licensee (11 kV)		123	75	303
E-2-(iii) Bulk Supply to Other Consumers		144	75	323
G-1-(i) Public Lighting of Provincial Govts		Unit Charge as per Tariff A-1		
G-1-(ii) Public Lighting Other Than G-1-(i)		152	75	449
H-1 Residential Colonies of Industries		104	75	302
H-2 Residential Colonies of Industries		105	75	304
I Railway Traction		61	75	250
J-1 Co-Generation Tariff (sale by WAPDA)		133	75	270
J-2(a) Cogen. Tariff (Purchase by WAPDA) Dec-July		103		
J-2(b) Cogen. Tariff (Purchase by WAPDA) Aug-Nov		78		
AGRICULTURAL TARIFF (D)				
1 Scarp		85	75	213
2-(i) Punjab and Sindh	82	49	75	140
2-(ii) NWFP and Baluchistan	72	34	75	115
FLAT RATE TARIFF (D-1)				
	Fixed Charges Rs/HP/Month			Addl. Surcharge Rs/HP/Month
1) Punjab and Sindh	147			373
2) NWFP & Baluchistan and Distts. of Mianwali, Bahwalpur & Tharparkar	122			316

Note: "Surcharge" at a rate of 10.4% is also leviable on "Supply Charges" which include Fixed Charges, Energy Charge, F.A.S. and Low Power Factor Penalty.

Table 4.3.1 Statistics at a Glance of Country (WAPDA + KESC)

Fiscal Year Ending 30th June		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Installed Capacity (MW) excl. KANUPP	Hydel	2547	2897	2897	2897	2897	2897	2897	2897	3329	3761	4725	4825	4825	4825	4825
	Thermal	2335	2580	3190	3560	3760	4160	4830	5879	5902	6129	6694	7506	8026	6645	6855
	Total	4882	5477	6087	6457	6657	7057	7727	8776	9231	9890	11419	12331	12851	11470	11680
Addition during the year (MW)			595	610	370	200	400	670	1049	464	668	1529	912	520	-1381	210
Energy Generation (GWh)*	Hydel	12822	12245	13804	15251	16689	16974	16925	18298	18647	21111	19436	22858	23206	20858	22060
	Thermal	8749	10386	11362	12960	16173	17613	20456	22388	26375	27052	31241	31820	34741	28420	24437
	Private (HUBCO+KAPCO+KEL)													161	10740	13580
	Total	21571	22631	25166	28211	32862	34587	37381	40686	45022	48163	50677	54678	58108	60018	60577
Maximum Demand (MW) (Undiversified)**		4027	4588	4805	5270	5996	6500	6803	7310	7805	8860	9489	9697	9791	10081	10554
Maximum Demand (MW) (Diversified)***		3948	4498	4711	5167	5878	6373	6670	7167	7652	8686	9303	9507	9599	9883	10347
Energy Sales (GWh)*		15740	16934	19076	21684	25144	26715	28931	31513	34296	36635	37867	40456	42648	44078	45807
No. of Consumers		4881316	5225446	5642209	6102422	6658910	7345623	7857377	8351432	8845100	8291984	9843365	10367886	10768265	11205948	11651822
* Export by KESC to WAPDA excluded & included Import from KESC		37	674	471	191	116	32	264	41	463	517	351	208	298	91	161

** Addition of Computed Demand of WAPDA & KESC

*** Undiversified Demand has been divided by 1.02 factor

Source: WAPDA Power Systems Statistics

Table 4.3.2 Statistics at a Glance (WAPDA)

Fiscal Year Ending 30th June		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Installed Capacity (MW)	Hydel	2547	2897	2897	2897	2897	2897	2897	2897	3329	3761	4725	4825	4825	4825	4825
	Thermal	1407	1442	2052	2452	2652	3052	3512	4156	4164	4391	4956	5768	6288	5120	5120
	Private (Thermal)														3044	3771
	Total	3954	4339	4949	5349	5549	5949	6409	7053	7493	8152	9681	10593	11113	12989	13716
Addition during the year (MW)			385	610	400	200	400	460	644	449	702	1529	912	520	1876	727
Energy Generation (GWh)	Hydel	12822	12245	13804	15251	16689	16974	16925	18298	18647	21111	19436	22858	23206	20858	14868
	Thermal	5230	6532	7251	8379	10762	11924	14502	16137	19419	19680	22960	23268	25653	19184	17619
	Private (HUBCO+KAPCO+KEL)													161	10740	13580
	Total	18052	18777	21055	23630	27451	28898	31427	34435	38066	40791	42396	46126	49020	50782	53259
Maximum Demand (MW)		3295	3791	3933	4325	5031	5440	5680	6090	6532	7522	8067	8252	8278	8552	8825
Energy Sales (GWh)		12762	13756	15504	17745	20702	21982	24121	26585	29267	31272	32131	35032	36925	38529	39422
No. of Consumers		4231550	4523995	4877057	5278686	5779623	6419167	6870679	7260721	7736241	8175750	8592042	9067284	9481731	9868612	10217072
Villages Electrified		17564	19269	21846	25251	27691	29992	33088	37135	40784	45644	50927	57170	62127	64568	65951
Length of Transmission lines (km) 500, 220, 132 & 66 kV		22980	23676	25613	27193	27898	28331	29251	30633	31084	31619	33074	38531	40307	41125	41652
No. of Grid Stations in Service 500, 220, 132 & 66 kV		231	252	274	292	300	316	329	346	355	365	377	388	593	598	601
Transformation Capacity (MVA)		11233	11835	12653	16431	17305	19011	20101	21528	23212	25783	26639	27048	31761	32795	33675
Average Sales Price (Paisa/kWh) (S.O.P)		53.16	52.92	57.57	55.41	59.93	67.86	75.02	82.17	87.25	86.94	84.30	84.28	86.42	90.17	95.39
Average Sale Price incl: FAS+Addl. Surcharge (Paisa/kWh)		64.36	65.36	75.85	70.92	84.22	96.26	107.83	116.51	126.81	126.15	140.76	162.58	208.70	232.99	271.5
T&D Losses (%)		27.09	24.59	24.45	23.19	22.93	22.22	21.27	20.30	20.68	21.03	21.59	21.45	21.51	21.72	23.97
Auxiliary (%)		2.22	2.15	1.91	1.72	1.65	1.71	1.98	2.49	2.44	2.31	2.62	2.60	2.92	2.41	2.01
System Losses (%) incl:consumption in auxiliary		29.31	26.74	26.36	24.91	24.58	23.93	23.25	22.79	23.12	23.34	24.21	24.05	24.43	24.13	25.98

* REPCO 9 MW Retired

** Hyderabad 43 MW Retired

Source: WAPDA Power Systems Statistics

Table 4.3.3 Statistics at a Glance (KESC)

Fiscal Year Ending 30th June	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Installed Capacity (MW) excl. KANUPP	928	1138	1138	1108	1108	1108	1318	1723	1738	1738	1738	1738	1738	1525	1735
Addition during the year (MW)		210	0	-30	0	0	210	405	15	0	0	0	0	-213	210
Energy Generation (GWh)	3556	4528	4582	4772	5527	5721	6218	6292	7419	7889	8632	8760	9386	9327	7318
Maximum Demand (MW) (Undiversified)	732	797	872	945	965	1060	1123	1220	1273	1338	1422	1445	1513	1529	1729
Energy Sales (GWh)	3015	3852	4043	4130	4558	4765	5074	4969	5492	5880	6087	5632	6021	5640	6385
No. of Consumers	649766	701451	765152	823736	879287	926456	986698	1090711	1108859	116234	1251323	1300602	1286534	1337336	1434750
Average Sale Price	96.70	94.24	94.18	93.22	105.24	113.50	125.14	144.44	156.38	165.59	190.21	220.67	205.67	280.09	342.15
System Losses (%) incl:consumption in auxiliary	24.76	22.23	21.87	23.59	23.48	24.23	25.62	21.03	25.97	25.47	29.48	35.71	35.85	39.53	41.09

* Includes purchase from KANUPP, Pak Steel & WAPDA 535 GWh
** Includes purchase from KANUPP, Pak Steel & WAPDA 1462 GWh
** Includes purchase from KANUPP, Pak Steel & WAPDA 1329 GWh
** Includes purchase from KANUPP, Pak Steel & WAPDA 1869 GWh
*** Retired 213 MW

Source: WAPDA Power Systems Statistics

Table 4.3.4 Energy Generated, Energy Sold, Consumed in Auxiliaries and System Losses of WAPDA

Fiscal Year Ending 30th June	Units Generated (GWh)	Consumption in Auxiliaries of Power Stations		Units sent out (GWh) (2-3)	Units sold (GWh)	System Losses		System Losses & Consumption in Auxiliaries	
		Total (GWh)	Percentage (3/2x100)			Total (5-6)	Percentage (7/2x100)	Total (GWh) (5-6)	Percentage (9/2x100)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1961	987	36	3.65	951	746	205	20.77	241	24.42
1962	1,284	45	3.50	1,239	929	310	24.14	355	27.65
1963	1,680	51	3.04	1,629	1,224	405	24.11	456	27.14
1964	2,111	90	4.26	2,021	1,561	460	21.79	550	26.05
1965	2,465	125	5.07	2,340	1,822	518	21.01	643	26.09
1966	2,909	156	5.36	2,753	2,089	664	22.83	820	28.19
1967	3,016	169	5.60	2,847	2,097	750	24.87	919	30.47
1968	3,648	186	5.10	3,462	2,486	976	26.75	1,162	31.85
1969	4,371	157	3.59	4,214	2,939	1,275	29.17	1,432	32.76
1970	5,162	179	3.47	4,983	3,600	1,383	26.79	1,562	30.26
1971	5,740	219	3.82	5,521	3,966	1,555	27.09	1,774	30.91
1972	6,029	174	2.89	5,855	4,137	1,718	28.50	1,892	31.38
1973	6,836	183	2.68	6,653	4,599	2,054	30.05	2,237	32.72
1974	7,179	218	3.04	6,961	4,742	2,219	30.91	2,437	33.95
1975	8,041	184	2.29	7,857	5,212	2,645	32.89	2,829	35.18
1976	8,276	222	2.68	8,054	5,315	2,739	33.10	2,961	35.78
1977	8,734	258	2.95	8,476	5,452	3,024	34.62	3,282	37.58
1978	10,089	221	2.19	9,868	6,490	3,378	33.48	3,599	35.67
1979	10,609	203	1.91	10,406	6,981	3,425	32.28	3,628	34.19
1980	12,124	272	2.24	11,852	8,160	3,692	30.45	3,964	32.69
1981	13,206	344	2.60	12,862	9,068	3,794	28.73	4,138	31.33
1982	14,768	390	2.64	14,378	10,288	4,090	27.70	4,480	30.34
1983	16,492	399	2.42	16,093	11,587	4,506	27.32	4,905	29.74
1984	18,052	400	2.22	17,652	12,762	4,890	27.09	5,290	29.31
1985	18,777	404	2.15	18,373	13,756	4,617	24.59	5,021	26.74
1986	21,055	402	1.91	20,653	15,504	5,149	24.45	5,551	26.36
1987	23,630	406	1.72	23,224	17,745	5,479	23.19	5,885	24.91
1988	27,451	454	1.65	26,997	20,702	6,295	22.93	6,749	24.58
1989	28,898	495	1.71	28,403	21,982	6,421	22.22	6,916	23.93
1990	31,427	623	1.98	30,804	24,121	6,683	21.27	7,306	23.25
1991	34,435	859	2.49	33,576	26,585	6,991	20.30	7,850	22.79
1992	38,066	928	2.44	37,138	29,267	7,871	20.68	8,799	23.12
1993	40,791	942	2.31	39,849	31,272	8,577	21.03	9,519	23.34
1994	42,396	1,112	2.62	41,284	32,131	9,153	21.59	10,265	24.21
1995	46,126	1,199	2.60	44,927	35,032	9,895	21.45	11,094	24.05
1996	48,895	1,429	2.92	47,430	36,925	10,505	21.51	11,934	24.43
1997	50,782	1,222	2.41	49,560	38,529	11,031	21.72	12,253	24.13
1998	53,259	1,071	2.01	52,188	39,422	12,766	23.97	12,837	25.98

Source: WAPDA Power Systems Statistics

Table 4.3.5 Energy Generated, Energy Sold, Consumed in Auxiliaries and System Losses of KESC

Fiscal Year Ending 30th June	Units Gene-rated (GWh)	Consumption in Auxiliaries of Power Stations		Units distribut-ed (GWh) (2-3) +imports	Units sold (GWh)	System Losses		System Losses & Consumption in Auxiliaries	
		Total (GWh)	Percent-age (3/ 2x100)			Total (5-6)-free p.	Percent -age (7/ 2x100)	Total (GWh) (3+7)	Percent-age (9/ 2x100)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1971*	1,511	92	6.08	1,421	1,262	158	11.10	250	16.50
1972	1,332	82	6.18	1,455	1,282	171	11.76	253	16.48
1973	1,366	89	6.48	1,690	1,498	190	11.23	278	15.65
1974	1,398	95	6.81	1,837	1,612	224	12.19	319	16.51
1975	1,442	96	6.65	1,850	1,616	231	12.48	327	16.79
1976	1,508	99	6.54	1,869	1,614	247	13.23	346	17.58
1977	1,820	125	6.85	1,997	1,681	305	15.26	429	20.24
1978	2,157	140	6.51	2,215	1,857	339	15.29	479	20.34
1979**	1,228	77	6.29	1,184	992	184	15.53	261	20.71
1980	2,764	171	6.19	2,595	2,175	404	15.56	575	20.78
1981	2,764	161	5.83	2,787	2,134	640	22.97	801	27.18
1982	2,787	161	5.77	3,069	2,485	569	18.54	730	22.60
1983	3,001	167	5.57	3,320	2,579	724	21.82	892	25.57
1984	3,556	239	6.73	3,791	3,015	758	20.01	998	24.76
1985	4,528	301	6.64	4,678	3,852	806	17.23	1,107	22.23
1986	4,582	305	6.66	4,897	4,043	833	17.01	1,138	21.87
1987	4,772	314	6.57	5,057	4,130	954	18.85	1,267	23.59
1988	5,527	340	6.15	5,607	4,558	1,056	18.84	1,396	23.48
1989	5,721	413	6.09	5,931	4,765	1,173	19.77	1,521	24.23
1990	6,218	440	6.64	6,416	5,074	1,337	20.84	1,750	25.62
1991	6,292	515	7.00	6,555	4,969	1,546	23.58	1,987	28.39
1992	7,419	520	6.94	7,480	5,492	1,945	26.00	2,460	30.76
1993	7,889	526	6.67	8,126	5,880	2,202	27.09	2,728	31.52
1994	8,632x	546	6.75	8,425	6,087	2,285	27.12	2,831	31.56
1995	8,760x	499	6.83	8,262	5,632	2,630	31.83	3,129	35.71
1996	9,386x				6,021				
1997	9,327x				5,640				
1998	7,318x				6,385				

* Calendar year ending 31st December.

** Calendar year ending 30th June

x Includes purchase from KANUPP, Pak Steel and WAPDA.

1994	535 GWh
1995	1,462 GWh
1996	1,329 GWh
1997	1,869 GWh
1998	3,030 GWh

Source: KESC and WAPDA

Table 4.3.6 Sold Energy to Customer Groups
(WAPDA + KESC)

Fiscal Year	Domestic	Commercial	Industrial	Agricultural	Public Lightin	Bulk Supply	Traction	Total
1980-81	2,606	861	4,414	2,134	76	1,067	44	11,202
1981-82	3,289	1,034	5,002	2,367	103	935	42	12,772
1982-83	3,795	1,135	5,453	2,559	108	1,072	44	14,166
1983-84	4,566	1,298	5,898	2,676	103	1,198	38	15,777
1984-85	5,091	1,375	6,317	2,795	108	1,885	37	17,608
1985-86	5,875	1,526	7,296	2,900	131	1,784	36	19,548
1986-87	6,839	1,714	7,996	3,471	146	1,671	38	21,875
1987-88	7,939	1,870	8,954	4,415	168	1,874	40	25,260
1988-89	8,682	1,921	9,442	4,379	187	2,020	35	26,666
1989-90	9,402	1,964	10,333	5,027	219	2,041	38	29,024
1990-91	10,400	2,066	11,116	5,619	262	1,864	33	31,360
1991-92	11,459	1,599	12,288	5,848	310	2,472	29	34,005
1992-93	13,205	1,722	13,030	5,621	287	2,649	27	36,541
1993-94	14,134	1,800	12,628	5,771	298	2,841	27	37,499
1994-95	15,583	1,941	12,527	6,252	325	2,922	22	39,572
1995-96	17,116	2,175	12,183	6,696	378	3,285	20	41,853
1996-97	17,738	2,241	11,979	7,086	390	3,393	18	42,845
1997-98	18,667	2,301	12,300	6,936	388	3,999	17	44,662

Source: WAPDA

Table 4.3.7 Annual Demand Pattern of the Country (WAPDA + KESC)

(For 3 years of 1995-96, 1996-97 and 1997-98)

Month		WAPDA			KESC			Country (WAPDA + KESC)		
		Peak Demand (MW)	Computed P.Demand (MW)*	Total Energy (GWh)	Peak Demand (MW)	Computed P.Demand (MW)*	Total Energy (GWh)	Peak Demand (MW)	Computed P.Demand (MW)*	Total Energy (GWh)
July	1995	8,188	8,288	4,520.84	1,358	1,366	813.81	9,478	9,586	5,334.65
Aug.	1995	7,854	7,975	4,462.53	1,366	1,378	840.22	9,152	9,284	5,302.75
Sept.	1995	8,021	8,201	4,206.33	1,365	1,402	790.67	9,318	9,533	4,997.00
Oct.	1995	7,724	7,754	3,884.60	1,407	1,407	835.78	9,061	9,091	4,720.38
Nov.	1995	7,173	7,207	3,473.91	1,364	1,364	724.22	8,469	8,503	4,198.13
Dec.	1995	7,336	7,396	3,800.50	1,227	1,227	697.69	8,502	8,562	4,498.19
Jan.	1996	7,123	7,391	3,851.79	1,227	1,227	706.83	8,289	8,557	4,558.62
Feb.	1996	7,130	7,207	3,559.06	1,182	1,182	650.38	8,253	8,330	4,209.44
March	1996	7,060	7,095	3,686.48	1,405	1,405	775.89	8,395	8,430	4,462.37
April	1996	7,295	7,600	3,915.88	1,391	1,513	818.70	8,616	9,037	4,734.58
May	1996	7,565	7,667	4,324.77	1,473	1,478	893.39	8,964	9,071	5,218.16
June	1996	8,107	8,278	4,472.03	1,473	1,513	908.91	9,506	9,715	5,380.94
				48,158.72			9456.49			57,615.21
July	1996	8,427	8,576	4,837.39	1,494	1,494	899.93	9,846	9,995	5,737.32
Aug.	1996	8,382	8,456	4,698.38	1,431	1,494	838.77	9,741	9,875	5,537.15
Sept.	1996	8,505	8,568	4,474.01	1,431	1,449	824.45	9,864	9,945	5,298.46
Oct.	1996	8,439	8,499	3,831.25	1,397	1,450	837.86	9,766	9,877	4,669.11
Nov.	1996	7,526	7,538	3,598.87	1,364	1,411	704.73	8,822	8,878	4,303.60
Dec.	1996	7,740	7,780	3,989.83	1,257	1,279	660.00	8,934	8,995	4,649.83
Jan.	1997	7,586	7,679	4,149.12	1,218	1,227	689.11	8,743	8,845	4,838.23
Feb.	1997	7,387	7,465	3,506.71	1,278	1,346	618.90	8,601	8,744	4,125.61
March	1997	7,545	7,586	3,784.87	1,369	1,393	768.83	8,846	8,909	4,553.70
April	1997	7,311	7,541	3,846.52	1,445	1,493	796.48	8,684	8,959	4,643.00
May	1997	8,218	8,381	4,393.86	1,479	1,529	917.17	9,623	9,834	5,311.03
June	1997	8,220	8,772	4,649.12	1,494	1,525	916.69	9,639	10,221	5,565.81
				49,759.93			9,472.92			59,232.85
July	1997	8,638	9,053	5,104.39	1,510	1,560	991.42	10,073	10,535	6,095.81
Aug.	1997	8,757	9,156	4,916.16	1,486	1,583	937.99	10,169	10,660	5,854.15
Sept.	1997	8,573	8,792	4,723.08	1,516	1,558	911.60	10,013	10,272	5,634.68
Oct.	1997	7,791	8,060	3,756.50	1,585	1,586	881.81	9,297	9,567	4,638.31
Nov.	1997	7,322	7,590	3,648.26	1,444	1,444	751.15	8,694	8,962	4,399.41
Dec.	1997	7,862	8,041	4,161.10	1,343	1,343	706.49	9,138	9,317	4,867.59
Jan.	1998	7,887	8,053	4,421.00	1,270	1,273	758.27	9,094	9,262	5,179.27
Feb.	1998	7,582	7,741	3,559.20	1,358	1,398	657.53	8,872	9,069	4,216.73
March	1998	7,623	7,742	3,960.70	1,555	1,555	830.87	9,100	9,219	4,791.57
April	1998	8,302	8,396	4,163.07	1,658	1,664	931.44	9,877	9,977	5,094.51
May	1998	8,891	9,071	4,860.20	1,712	1,723	1,039.20	10,517	10,708	5,899.40
June	1998	9,033	9,209	5,122.74	1,685	1,692	1,040.91	10,634	10,816	6,163.65
				52,396.40			10,438.68			62,835.08
July	1998	9,053	9,274	5,275		1,727	1,097		10,915	6,372

* Computed peak demand is the estimated demand on the condition of no demand restriction.

** The computed peak demand and total energy are assumed figures.

*** The Karachi figures for July 1998 are assumed figures.

Source: WAPDA and KESC

Table 4.3.8 Load Forecast (Country)

(Without Captive Power)

Based on Normal Growth Assumption of Energy Consumption

Year	Energy Sales (GWh)	Growth Rate (%)	Losses			Energy Generated (GWh)	Load Factor (%)	Peak Demand (MW)
			T & D (%)	Auxiliary (%)	Total (%)			
1997-98	45,035	4.24	25.79	2.75	28.54	63,024	69.8	10,308
1998-99	47,737	6.00	24.54	2.68	27.22	65,595	68.9	10,872
1999-00	51,078	7.00	23.17	2.66	25.83	68,867	68.3	11,515
2000-01	55,165	8.00	21.81	2.65	24.46	73,026	67.7	12,319
2001-02	59,578	8.00	20.48	2.63	23.11	77,482	67.1	13,186
2002-03	64,344	8.00	19.16	2.61	21.77	82,253	66.5	14,122
G.R(1998-03)	7.4%					5.5%		6.5%
2003-04	70,135	9.00	18.60	2.61	21.21	89,011	66.2	15,348
2004-05	76,447	9.00	18.02	2.61	20.63	96,313	66.0	16,670
2005-06	83,327	9.00	17.44	2.60	20.05	104,221	65.8	18,087
2006-07	90,827	9.00	16.87	2.60	19.47	112,786	65.6	19,625
2007-08	99,001	9.00	16.30	2.60	18.89	122,062	65.4	21,296
G.R(2003-08)	9.0%					8.2%		8.6%
2008-09	107,911	9.00	15.72	2.59	18.32	132,108	65.3	23,111
2009-10	117,624	9.00	15.58	2.59	18.17	143,734	65.1	25,214
2010-11	128,210	9.00	15.44	2.58	18.02	156,389	64.9	27,509
2011-12	139,749	9.00	15.30	2.57	17.88	170,166	64.8	29,975
2012-13	152,326	9.00	15.17	2.57	17.73	185,163	64.8	32,618
G.R(2008-13)	9.0%					8.7%		8.9%
2013-14	166,035	9.00	15.15	2.57	17.72	201,783	64.8	35,547
2014-15	180,978	9.00	15.15	2.57	17.72	219,943	64.8	38,746
2015-16	197,266	9.00	15.15	2.57	17.72	239,738	64.8	42,233
2016-17	215,020	9.00	15.15	2.57	17.72	261,315	64.8	46,034
2017-18	234,372	9.00	15.15	2.57	17.72	284,833	64.8	50,177
G.R(2013-18)	9.0%					9.0%		9.0%
Av. G.R. (1997-2018)	8.4%					7.8%		8.0%

Source: WAPDA

Table 4.3.9 Load Forecast (Country)

(Without Captive Power)

Based on Low Growth Assumption of Energy Consumption

Year	Energy Sales (GWh)	Growth Rate (%)	Losses			Energy Generated (GWh)	Load Factor (%)	Peak Demand (MW)
			T & D (%)	Auxiliary (%)	Total (%)			
1997-98	45,034	---	25.73	2.81	28.54	63,024	69.8	10,308
1998-99	47,311	5.1	24.53	2.62	27.15	64,940	68.8	10,773
1999-00	50,110	5.9	23.16	2.60	25.76	67,495	68.2	11,296
2000-01	53,075	5.9	21.81	2.58	24.39	70,198	67.6	11,852
2001-02	56,216	5.9	20.49	2.56	23.05	73,056	67.0	12,443
2002-03	59,542	5.9	19.19	2.54	21.73	76,072	66.4	13,071
G.R(1998-03)	5.74%					3.84%		4.86%
2003-04	63,579	6.8	18.18	2.54	20.72	80,196	66.2	13,831
2004-05	67,892	6.8	17.20	2.53	19.73	84,577	65.9	14,642
2005-06	72,500	6.8	16.19	2.52	18.72	89,194	65.8	15,483
2006-07	77,422	6.8	16.05	2.51	18.56	95,068	65.6	16,548
2007-08	82,680	6.8	15.92	2.50	18.42	101,343	65.4	17,689
G.R(2003-08)	6.79%					5.90%		6.24%
2008-09	89,083	7.7	15.79	2.48	18.28	109,003	65.2	19,080
2009-10	95,984	7.7	15.67	2.47	18.14	117,257	65.0	20,584
2010-11	103,424	7.8	15.56	2.46	18.02	126,152	64.8	22,209
2011-12	111,446	7.8	15.45	2.45	17.90	135,738	64.7	23,933
2012-13	120,093	7.8	15.35	2.43	17.78	146,069	64.7	25,757
G.R(2008-13)	7.75%					7.59%		7.80%
2013-14	129,559	7.9	15.34	2.43	17.77	157,557	64.7	27,784
2014-15	139,771	7.9	15.35	2.43	17.77	169,981	64.7	29,976
2015-16	150,790	7.9	15.35	2.42	17.77	183,386	64.7	32,341
2016-17	162,680	7.9	15.36	2.42	17.78	197,849	64.7	34,893
2017-18	175,508	7.9	15.36	2.42	17.78	213,456	64.7	37,647
G.R(2013-18)	7.88%					7.88%		7.89%
Av. G.R. (1997-2018)	7.04%					6.29%		6.69%

Source: WAPDA

Table 4.4.1 Generated Energy by Sources of WAPDA

(GWh)

Fiscal Year Ending 30th June	HYDEL		THERMAL				TOTAL
	Generation :	Percentage to total :	WAPDA Generation :	Percentage to total :	Private Generation :	Percentage to total :	Generation :
1965	1362	55.3	1101	44.7			2463
1966	1425	49.0	1484	51.0			2909
1967	1530	50.7	1486	49.3			3016
1968	2482	68.0	1166	32.0			3648
1969	2792	63.9	1579	36.1			4371
1970	2915	56.5	2247	43.5			5162
1971	3449	60.1	2291	39.9			5740
1972	3679	61.0	2350	39.0			6029
1973	4355	63.7	2481	36.3			6836
1974	4141	57.7	3038	42.3			7179
1975	4359	54.2	3682	45.8			8041
1976	5436	65.7	2840	34.3			8276
1977	5183	59.3	3551	40.7			8734
1978	7466	74.0	2623	26.0			10089
1979	8353	78.7	2256	21.3			10609
1980	8718	71.9	3406	28.1			12124
1981	9046	68.5	4160	31.5			13206
1982	9526	64.5	5242	35.5			14768
1983	11366	68.9	5126	31.1			16492
1984	12822	71.0	5230	29.0			18052
1985	12245	65.2	6532	34.8			18777
1986	13804	65.6	7251	34.4			21055
1987	15251	64.5	8379	35.5			23630
1988	16689	60.8	10762	39.2			27451
1989	16974	58.7	11924	41.3			28898
1990	16925	53.9	14502	46.1			31427
1991	18298	53.1	16137	46.9			34435
1992	18647	49.0	19419	51.0			38066
1993	21111	51.8	19680	48.2			40791
1994	19436	45.8	22960	54.2			42396
1995	22858	49.6	23268	50.4			46126
1996	23206	47.5	25653	50.4			48859
1997	20858	41.1	19184	37.8	10740	21.1	50782
1998	22060	41.4	17619	33.1	13580	25.5	53259

Source: WAPDA Power Systems Statistics

Table 4.4.2 Length of Transmission Lines in Each Province

Province Voltage/ Fiscal Year Ending 30 June	Punjab					Sindh					N.W.F.P					Balochistan					Total				
	500 kV	220 kV	132 kV	66 kV	Total	500 kV	220 kV	132 kV	66 kV	Total	500 kV	220 kV	132 kV	66 kV	Total	500 kV	220 kV	132 kV	66 kV	Total	500 kV	220 kV	132 kV	66 kV	Total
1980	330	1466	6699	3171	11666	0	272	1086	395	1753	0	438	1219	265	1922	0	0	506	90	596	330	2176	9510	3921	15937
1981	539	1466	6975	3269	12249	0	272	1086	511	1869	0	438	1223	297	1958	0	0	506	154	660	539	2176	9790	4231	16736
1982	849	1471	7237	3408	12965	0	272	1086	531	1889	0	438	1256	333	2027	0	0	658	154	812	849	2181	10237	4426	17693
1983	849	1491	9134	3986	15460	0	272	1209	632	2113	0	574	1339	387	2300	0	0	807	154	961	849	2337	12489	5159	20834
1984	849	1491	9733	4112	16185	438	272	1275	632	2617	0	574	1524	387	2485	0	0	1539	154	1693	1287	2337	14071	5285	22980
1985	849	1491	9956	4131	16427	438	532	1287	672	2929	0	574	1524	529	2627	0	0	1539	154	1693	1287	2597	14306	5486	23676
1986	1170	1491	10717	4603	17981	438	542	1293	822	3095	0	574	1611	529	2714	0	0	1663	154	1817	1608	2607	15284	6108	25607
1987	1170	1701	11637	4699	19207	438	542	1293	860	3133	0	574	1839	603	3016	0	0	1677	154	1831	1608	2817	16446	6316	27187
1988	1170	1899	11834	4774	19677	438	542	1293	935	3208	0	574	1937	603	3114	0	0	1739	154	1893	1608	3015	16803	6466	27892
1989	1170	1899	11940	4794	19803	438	542	1333	977	3290	0	574	2009	683	3266	0	0	1812	154	1966	1608	3015	17094	6608	28325
1990	1488	1953	12042	4794	20277	438	570	1573	1022	3603	0	574	2044	683	3301	0	0	1835	229	2064	1926	3097	17494	6728	29245
1991	1800	2155	12376	4896	21227	438	570	1646	1022	3676	0	574	2225	683	3482	0	0	2043	229	2272	2238	3299	18290	6830	30657
1992	1800	2181	12700	4905	21586	438	570	1646	1022	3676	0	574	2269	683	3526	0	0	2061	229	2290	2238	3325	18676	6839	31078
1993	1800	2241	12840	4939	21820	438	570	1663	1022	3693	0	574	2393	683	3650	0	0	2221	229	2450	2238	3385	19117	6873	31613
1994	2242	2535	13138	5113	23028	438	570	1663	1022	3693	0	574	2393	683	3650	0	0	2468	229	2697	2680	3679	19662	7047	33068
1995	2777	2877	17119	5190	27963	595	570	1715	1022	3902	0	576	2652	723	3951	0	0	2468	241	2709	3372	4023	23954	7176	38525
1996	2777	3105	17440	5222	28544	1065	570	1739	1022	4396	117	822	2678	729	4346	0	280	2468	241	2989	3959	4777	24325	7214	40275
1997	2777	3465	17665	5222	29129	1246	570	1739	1022	4577	117	822	2678	729	4346	0	280	2552	241	3073	4140	5137	24634	7214	41125
1998	2782	3731	17699	5226	29438	1246	1088	1744	1066	5144	117	822	2678	729	4346	0	280	2588	241	3109	4145	5921	24709	7262	42037

Source: WAPDA Power Systems Statistics

Table 4.4.3 In-Service Grid Substations in NWFP

YEAR	500 kV*		220 kV**		132 kV		66 kV		Total	
	No.	Capa-city MVA	No.	Capa-city MVA	No.	Capa-city MVA	No.	Capa-city MVA	No.	Capa-city MVA
1980	0	0	0	0	18	531			18	531
1981	0	0	0	0	21	625			21	625
1982	0	0	0	0	23	638			23	638
1983	0	0	1	320	25	659			26	979
1984	0	0	1	320	23	633			24	953
1985	0	0	1	320	27	751			28	1071
1986	0	0	1	320	27	874			28	1194
1987	0	0	1	320	30	797			31	1117
1988	0	0	1	320	30	797			31	1117
1989	1	474	1	320	33	836			35	1630
1990	1	474	1	320	36	1162			38	1956
1991	1	474	1	320	37	1279			39	2073
1992	1	474	1	320	37	1463			39	2257
1993	1	474	2	800	37	1503			40	2777
1994	1	474	2	800	39	1542			42	2816
1995	1	474	2	800	42	1600			45	2874
1996	2	924	1	480	48	1828	33	451	84	3683
1997	2	924	1	480	49	1906	32	423	84	3733
1998	2	924	1	653	49	2010	32	468	84	4055

* Tarbela & Peshawar (Kohat Road)
** Mardan

Source: WAPDA Power System Statistics

Table 4.5.1 Generating Capacity Addition During 9th Five-Year Plan (1998/99 to 2002/03)

Name of Power Station/ Fiscal Year ending 3th June	9TH FIVE YEAR PLAN					
	1998	1999	2000	2001	2002	2003
A. PUBIC SECTOR						
1 Chashma Nuclear	0	0	325	325	325	325
2 Chashma Low Head Hydel	0	0	184	184	184	184
3 Ghazi Barotha Hydel 1-5	0	0	0	0	1160	1450
Subtotal (A)	0	0	509	509	1669	1959
Addition during the year	0	0	509	0	1160	290
B. PRIVATE SECTOR						
1 AES Lal Pir Ltd.	362	362	362	362	362	362
2 Southern Elec. Power Co. Ltd.	117	117	117	117	117	117
3 AES Pak Gen: Ltd.	365	365	365	365	365	365
4 Habib Ullah Energy ltd.	140	140	140	140	140	140
5 Liberty Power Project	235	235	235	235	235	235
6 Japan Power Gen. Ltd.	0	120	120	120	120	120
7 Rousch Pak Power Ltd.	0	412	412	412	412	412
8 Uch Power Project	0	586	586	586	586	586
9 Fauji Kabirwala	0	157	157	157	157	157
10 Altern Energy Ltd.	0	14	14	14	14	14
11 Eeshatech Ltd.	0	20	20	20	20	20
12 Davis Energon	0	10	10	10	10	10
13 Power Gen. System	0	116	116	116	116	116
14 Saba Power Co.	0	114	114	114	114	114
15 Northern Electric Co.	0	6	6	6	6	6
Subtotal (B)	1219	2774	2774	2774	2774	2774
Addition during the year (Thermal)	1219	1555	0	0	0	0
Total (A+B)	1219	2774	3283	3283	4443	4733
Total Addition during the year	1219	1555	509	0	1160	290

Source: WAPDA Power Systems Statistics

Table 4.5.2 Private Sector Hydropower Projects in N.W.F.P. (Studied by SHYDO)

Sr. No.	Project Name	Site / Location	Peak power (MW)	Annual energy (GWh)	Approx: cost (Mill US $)	Start of Feasibiity Study	Expected completion date	REMARKS
1	Ranolia	Kohistan	12	64	11.000	-	-	Feasibiity completed
2	Batal Khwar	Swat	8	45	11.000	-	-	Feasibiity completed
3	Shishi	Chitral	2	17	4.000	-	-	Feasibiity completed
4	Summar Gah	Kohistan	28	102	17.000	-	-	Feasibiity completed
5	Matiltan	Swat	84	345	95.000	-	-	Feasibiity completed
6	Daral Khwar	Swat	37	128	22.000	July 1993	June 1998	Feasibiity in progress
7	Duber	Kohistan	122	566	97.000	Feb. 1995	Oct. 1998	Feasibiity in progress
8	Khan Khwar	Swat	66	333	72.000	-	-	Feasibiity completed
9	Allai-IV	Mansehra	124	518	93.000	-	-	Feasibiity completed
10	Malakand-III	Swat	75	527	74.000			Pre-feasibiity completed
11	Spat Gah / Chor Nala	Kohistan				-	-	PC-II under preparation
	Stage I & II		851	3661	829.000			
12	Kanidioh System	Kohistan				-	-	PC-II under preparation
	Stage-I: Karrang		454	1635	348.000			
	Stage-II: Kaigah		549	1942	808.000			
13	Swat System	Swat				-	-	PC-II under preparation
	Swat scheme B1		429	1783	401.000			
	Swat scheme A1		105	390	113.000			
14	Kaghan System	Mansehra				-	-	PC-II under preparation
	Stage-I: Naran		219	866	720.000			
	Stage-II: Suki Kinari		652	2797	611.000			
			3817	**15719**				

Source: SHYDO

Table 4.5.3 Extension of 500/220 kV Lines

New Substation	Line Description	From Substation	To Substation	No. of SC Lines	Length of SC Lines	Year of Completion
500 kV Lines						
Rousch PH	In/Out at Rousch PH	Multan	Gatti	2	3	1998
M. Garh	In/Out at M. Garh	Guddu	Multan	2	8	1999
		M. Garh	Gatti	1	277	2000
R.Y. Khan	In/Out at R.Y. Khan	Guddu	Multan	2	56	2001
Moro		Jamshoro	Moro	1	174	2001
		Moro	R.Y. Khan	1	355	2001
		Moro	Dadu	1	35	2001
G.Barotha	In/Out at G.Barotha	Tarbela	Gatti	2	30	2001-02
	In/Out at G.Barotha	Tarbela	Gatti	2	37	2001-02
		G.Barotha	Rewat	1	108	2001-02
		G.Barotha	Rewat	1	108	2001-02
Gujranwala	In/Out at Gujranwala	Tarbela	Lahore	2	10	2001-02
		Rewat	Gujranwala	1	179	2001-02
		Gujranwala	Lahore	1	65	2001-02
	In/Out at	Lahore	Multan	2	-	2002
220 kV Lines				No. of DC Lines	Length of DC Lines	
	Circuit #2 & 3	Guddu	Sibbi	1	249	1998
	In/Out at M. Garh	Kot Addu	Multan	1	2.5	1998
		Kot Addu	Multan	1	85	1998
Samundri Rd	In/Out at Samundri Rd	Nishatabad	Multan	1	4	1998
Ibd. P. Rd.	In/Out at Ibd. P. Rd.	Tarbela	Rewat	2	5	1998
Vehari	In/Out at Vehari	Multan	Yousufula	2	5	1998
AES Pak Gen.		AES Pak Gen	M. Garh	1	20	1998
	In/Out at Burhan	Tarbela	Rewat	1	10	1998
Sialkot	In/Out at Sialkot	Ghakar	K.S. Kaku	1	25	1998
Uch PH	In/Out at Uch PH	Guddu	Sibbi	2	20	1998
		K.S. Kaku	Ravi	1	25	1998
Chashuma		Chashma	Daudkhel	1	75	1999
Shikarpur	In/Out at Shikarpur	Guddu	Sibbi	1	30	1999-00
Islamabad-U		Rewat	Islamabd-U	1	25	1999-00
		Ibd. P. Rd.	Islamabd-U	1	35	1999-00
Ludewala		Gatti	Ludewala	1	100	1999-00
Bannu		Daudhkel	Bannu	1	100	1999-00
Shahibagh		Peshawar	Shahibagh	1	20	1999-00
		Shahibagh	Mardan	1	56	1999-00
Hydelabad		Jamshoro	Hydelabad	1	30	1999-00
Bahawalpur		M. Garh	Bahawalpur	1	90	1999-00
Noshera Ind.		G. Barotha	Noshera Ind.	1	69	2001
		Shahibagh	Noshera Ind.	1	40	2001
Gujranwala	In/Out at Gujranwala	Mangla	Ghakhar	2	9	2001-02
Mianchannu	In/Out at Mianchannu	Vehari	Multan	2	20	2003
Manshehra		Manshehra	Ibd. P. Rd.	1	110	2003
Allai IV		Manshehra	Allai IV	1	90	2003
DI Khan		Kot Addu	D.I. Khan	1	140	2003
		D.I. Khan	Daudkhel	1	110	2003

Source: WAPDA