

ANNEXES

Annex Table 1

**Projected Sales of Electricity without Conservation (kWH) in Swat District,
1987/88 to 1992/93**

Sector	i-elast ¹	p-elast ²	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR(Plan) ³	Share 1992/93
Domestic Connection										
Urban Domestic Connections			9857	11040	12365	13848	15510	17371	12.00	
Rural Domestic Connections			41079	46008	51529	57713	64639	72395	12.00	
Total Domestic Connections			50936	57048	63894	71561	80149	89767	12.00	
g-rate %				12.0	12.0	12.0	12.0	12.0		
Domestic kWh/HH/yr	1.67	0.20	1048	1085	1125	1167	1211	1256	3.70	
g-rate %				3.63	3.67	3.70	3.73	3.77		
DOMESTIC TOTAL (MWH)			53356	61929	71904	83512	97025	112761	16.14	71.5
g-rate %				16.07	16.11	16.14	16.18	16.22		
Industrial	1.38	-0.29	29475	29910	30351	30799	31254	31715	1.48	20.1
Agriculture 1.58	-0.20	3352	3562	3784	4021	4272	4539	6.25	2.9	
Comm/Bulk/Pub. light	1.47	-0.41	6656	7037	7439	7864	8314	8790	5.72	5.6
TOTAL ELECTRICITY (MWH)			92839	102437	113478	126196	140864	157804	11.19	100.0
g-rate %				10.34	10.78	11.21	11.62	12.03		

WAPDA TARIFF INCREASE FOR PLAN PERIOD

	Real % (After taking out Inflationary Effects)						
	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94
Domestic	3.77	3.77	3.77	3.77	3.77	3.77	3.77
Industrial	9.43	9.43	9.43	9.43	9.43	9.43	9.43
Agriculture	3.77	3.77	3.77	3.77	3.77	3.77	3.77
Others	9.43	9.43	9.43	9.43	9.43	9.43	9.43
Average	6.60	5.66	5.66	5.66	5.66	5.66	5.66
	Nominals % (After taking in Inflationary Effects)						
	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94
Domestic	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Industrial	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Agriculture	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Other	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Average	13.00	12.00	12.00	12.00	12.00	12.00	12.00
Inflation	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Source: WAPDA

Note:

¹ income elasticity² price elasticity³ annual compound growth rate

Annex Table 2

**Projected Sales of Electricity with Conservation (MWH) in Swat District,
1987/88 to 1992/93**

Sector		1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR (Plan)	Share 1992/93
TECHNOLOGICAL CONSERVATION (MWH)									
Domestic	(MWH)	0	100	110	110	130			
Industrial	(MWH)	0	100	100	120	140	170		
Agriculture	(MWH)	0	20	40	40	60	80		
Others	(MWH)	0	25	50	70	80	110		
Total	(MWH)	0	245	310	340	390	490		
g-rate	%		26.53	9.68	14.71	25.64			
TECHNOLOGICAL CONSERVATION (%)									
Domestic	(%)	0	0.16	0.15	0.13	0.11	0.12		
Industrial	(%)	0	0.33	0.36	0.39	0.45	0.54		
Agriculture	(%)	0	0.56	1.06	0.39	1.40	1.76		
Others	(%)	0	0.36	0.67	0.89	0.96	1.25		
Total	(%)	0	0.24	0.27	0.27	0.28	0.31		
SALES OF ELECTRICITY WITH CONSERVATION									
Domestic	(MWH)	53356	61829	71794	83402	96915	112631	16.12	71.6
Industrial	(MWH)	29475	29810	30241	30679	31114	31545	1.37	20.1
Agriculture	(MWH)	3352	3542	3744	3981	4212	4459	5.87	2.8
Others	(MWH)	6656	7012	7389	7794	8234	8680	5.45	5.5
Total	(MWH)	92839	102192	113168	125856	140474	157314	11.12	100.0
g-rate	%	10.07	10.74	11.21	11.62	11.99			

Source: WAPDA

Annex Table 3

**Per Capita Electricity Consumption, Population Served and Total Supply of Electricity
in Swat District, 1987/88 to 1992/93**

Indicators		1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR(Plan)
POPULATION	('000)	1495.73	1545.09	1595.77	1647.79	1701.18	1755.95	3.26
G-RATE	%	3.30	3.28	3.26	3.24	3.22		
Households @ 8.0766	('000)	185	191	198	204	211	217	3.26
Persons per HH		3.30	3.28	3.26	3.24	3.22		
Sales Per Capita	MWH	92839	102192	113168	125856	140474	157314	11.12
Consumption Per Year	kWH	62	66	71	76	83	90	7.62
g-rate	%			6.56	7.22	7.70	8.11	8.49
Domestic Connections		50936	57048	63894	71561	80149	89767	12.00
Population Served @ 8.0766 per HH		411390	460756	516047	577973	647330	725009	12.00
Population Served	%	27.50	29.82	32.34	35.08	38.05	41.29	8.46
Population Not Served		1084341	1084334	1079722	1069818	1053850	1030948	-1.00
Population Not Served	%	72.50	70.18	67.66	64.92	61.95	58.71	-4.13
SUPPLY OF ELECTRICITY								
Sales	MWH	92839	102192	113168	125856	140474	157314	11.12
National Grid	MWH	89072	97550	107649	119461	133203	149167	10.86
Increase y1-y0	MWH		8477	10100	11812	13743	15964	
Surplus/Deficit	MWH	-3767	-4643	-5519	-6395	-7271	-8147	16.68
Small Hydel+Solar + Biogas	kW (Power)	860	860	1060	1260	1460	1660	14.06
Capacity Added Locally	kW (Power)	0	200	200	200	200	200	
Small Hydel+Solar	MWH	3767	4643	5519	6395	7271	8147	16.68
Net Surplus/Deficit	MWH	0	0	0	0	0	0	at 50% capacity

Source: WAPDA, PCAT, and SHYDO

Demand for LPG (Cylinder Gas) in Swat District, 1987/88 to 1992/93

Sector	i-elast	p-elast	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR(Plan)	
Domestic Connections	1.5	-0.15	9260	10000	10800	11655	12598	13605	8.00	1 cylinder = 11.5 kg.
g-rate				8.00	8.00	8.00	8.00	8.00		
Domestic use per HH/month	cylinder/month	1.00	1.35	1.39	1.44	1.48	1.53	8.89		
Domestic per HH/year	Tons/Year	0.14	0.15 3.09	0.15 3.12	0.16 3.15	0.16 3.18	0.17 3.21	3.15		
Domestic Total	Tons/Year	1311	1460 11.34	1626 11.37	1811 11.40	2018 11.44	2250 11.47	11.40		
Restaurants and others	1.60 Tons/Year	-0.20	210	230	251	275	301	329	9.39	
Total LPG	Tons/Year		1521	1589	1877	2086	2319	2579	11.13	
Total LPG	TOE/Year		1634	1882	2091	2324	2583	2872	11.13	
Price increase for plan period										REAL %
LPG			5.66	5.66	5.66	5.66	5.66	5.66	0.00	
										NOMINALS %
LPG			12.00	12.00	12.00	12.00	12.00	12.00	0.00	

Demand for Superior Kerosene in Swat District, 1987/88 to 1992/93

Sector	i-elast	p-elast	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR (Plan)
Domestic Connections	1.4	-0.2	120400	130032	140435	151669	163803	176907	8.00
g-rate			8.00	8.00	8.00	8.00	8.00		
Domestic use per HH/month	lit/month		4.00	4.09	4.18	4.28	4.38	4.49	2.33
Domestic per HH/year	Tons/Year		0.0392 2.27	0.0400 2.30	0.0410 2.33	0.0419 2.35	0.0429 2.38	0.0439	2.33
Domestic Total	Tons/Year		4714 10.45	5207 10.48	5752 10.51	6357 10.54	7027 10.57	7770	10.51
Domestic Total	TOE/Year		4862	5370	5933	6557	7248	8014	10.51
Price increase for plan period									
					REAL %				
Kerosene				7.08	7.08	7.08	7.08	7.08	0.00
					NOMINALS %				
Kerosene				13.50	13.50	13.50	13.50	13.50	0.00

Annex Table 6

Demand for Animal Dung in Swat District, 1987/88 to 1992/93

Sector	i-elast	p-elast	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR (Plan)
Domestic Connections	1.02	-0.03	9632	9632	9632	9632	9632	9632	0.00
g-rate				0.00	0.00	0.00	0.00	0.00	
Domestic use per HH/month	kg/mo/HH		128	128	128	128	128	128	0.00
Domestic per HH/year	Tons/Year		1.54	1.54 0.00	1.54 0.00	1.54 0.00	1.54 0.00	1.54 0.00	0.00
Domestic Total	Tons/Year		14795	14795 0.00	14795 0.00	14795 0.00	14795 0.00	14795 0.00	0.00
Domestic Total g-rate	TOE/Year %		4734	4734 0.00	4734 0.00	4734 0.00	4734 0.00	4734 0.00	0.00

Demand for Fuelwood in Swat District, 1987/88 to 1992/93

Demand/Supply		i-elast	p-elast	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93ACGR (Plan)
Domestic (HH Nos) g-rate	1.25	-0.3	175933	181739 3.00	187700 3.00	193819 3.00	200099 3.00	206542 3.00	3.25
Domestic Use Per HH kg/Month			1256	1266	1276	1287	1298	1309	0.83
Domestic Per HH Tons/Year			15.072	15.19	15.31	15.44	15.57	15.71	0.83
Domestic Total g-rate	Tons/Year %		2651670	2760636 4.11	2874218 4.11	2992619 4.12	3116048 4.12	3244726 4.13	4.12
Others g-rate	Tons/Year %		4230	4249 0.45	4268 0.45	4287 0.45	4306 0.44	4325 0.44	0.45
Total Gross Wood g-rate	Tons/Year %		2655900	2764885 4.10	2878486 4.11	2996906 4.11	3120355 4.12	3249051 4.12	4.11
Volume	m ³ /Year		3160521	3290213	3425399	3566319	3713222	3866371	4.11
Optimal Production g-rate	Tons/Year %		0	0	0	0	0	0	0.00
Surplus/Deficit	Tons/Year		-2655900	-2764885	-2878486	-2996906	-3120355	-3249051	4.11
Total Adj. Wood g-rate	TOE/Year %		-969403	-1009183 4.10	-1050648 4.11	-1093871 4.11	-1138929 14.12	-1185904 4.12	4.11 Adjustment means demand after deducting the economic use of Forest wood
Substitute -----									
LPG	Tons/Year		0	0	0	0	0	0	
Energy Plantation			0	0	0	0	0	0	
Net Surplus Deficit	TOE		-969403	-1009183	-1050648	-1093871	-1138929	-1185904	4.11
Market price increase + induced price increase to promote substitution for higher value wood (currently used as firewood)									
									REAL %
Wood			8.49	8.49	8.49	8.49	8.49	8.49	0.00
									NOMINALS %
Wood			15.00	15.00	15.00	15.00	15.00	15.00	0.00

Demand for Charcoal and Coal Briquettes in Swat District, 1987/88 to 1992/93

Demand For		1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR(Plan)
Charcoal, Coal Briquettes	mounds/week	6000	6000	6000	6000	6000	6000	0.00
Total	tons/year	2880	2880	2880	2880	2880	2880	0.00
Total	TOE/yr	2218	2218	2218	2218	2218	2218	0.00
Restuarant + Others	Share 80%	2304	2304	2304	2304	2304	2304	0.00
HH	Share 20%	576	576	576	576	576	576	0.00

Annex Table 9

Demand for Crop Residue, Saw Dust, Bagasse etc in Swat District, 1987/88 to 1992/93

Demand/Supply	i-elastic	p-elastic	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR(Plan)
Domestic HH g-rate	1.5	-0.15	34400	34400 1.00	34400 1.00	34400 1.00	34400 1.00	34400 1.00	0.00
Domestic use per HH	kg/Month		60	56	52	48	45	42	-7.00
Domestic use per HH	Tons/Year		0.72	0.67 -7.00	0.62 -7.00	0.58 -7.00	0.54 -7.00	0.50 -7.00	-7.00
Domestic Total	Tons/Year		24768	23035	21423	19924	18529	17233	-7.00
Others Cr/Sawdust/Bagasse	Tons/Year		822	825	827	830	833	836	0.33
Total Unadj.	Tons/Year		25590	23859	22250	20754	19362	18068	-6.72
Volume	m ³ /Year		30964	28870	26923	25112	23428	21863	-6.72
Optimal Production	Tons/Year		0	0	0	0	0	0	
Surplus/Deficit	Tons/Year		-25590	-23859	-22250	-20754	-19362	-18068	-6.72
Total Adj.	TOE/Year		-7677	-7158	-6675	-6226	-5809	-5420	-6.72
Substitute Residue									Adjustment means demand after deducting the economic use of Crop
LPG	Tons/Year		0	0	0	0	0	0	
Energy Plantation			0	0	0	0	0	0	
Net Surplus Deficit	TOE		-7677	-7158	-6675	-6226	-5809	-5420	-6.72
Market Price Increase + Induced Price Increase to Promote Substitution for Higher Value Wood (Currently Used as Firewood)									
REAL %									
Saw Dust, Crop Residue, Bagasse, etc.			27.36	27.36	27.36	27.36	27.36	27.36	0.00
NOMINALS %									
Saw Dust, Crop Residue, Bagasse, etc.			35.00	35.00	35.00	35.00	35.00	35.00	0.00

Annex Table 10

Petrol/Diesel (Transportation) Demand in Swat District, 1987/88 to 1992/93

Supply	i-elast	p-elast	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR(Plan)
Sales	1.4	-0.2	27210 6.84	29072 6.84	31061 6.84	33186 6.84	35457 6.84	37883 6.84	6.84
TOE			27591 6.84	29479 6.84	31496 6.84	33651 6.84	35954 6.84	38414 6.84	6.84
Rate Increases for Plan Period									
REAL %									
Petrol/Kerosene			9.43	9.43	9.43	9.43	9.43	9.43	0.00
NOMINALS %									
Petrol/Kerosene			16.00	16.00	16.00	16.00	16.00	16.00	0.00

Annex Table 11

Energy Use in Important Industries in Swat District, 1987/88 to 1992/93

Industrial Sector		1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR (Plan)
<u>Tobacco</u>								
Wood	Mound/season/oven	200	200	200	200	200	200	0.00
Ovens	No.	350	350	350	350	350	350	0.00
Total wood in tobacco	Tons/Year	2800	2800	2800	2800	2800	2800	0.00
Total wood in tobacco	TOE/Year	697	697	697	697	697	697	0.00
<u>BRICK KILN</u>								
Wood	Maund/Day per kiln	1.1	1.1	1.1	1.1	1.1	1.1	0.00
Kilns	No.	33	34	35	36	37	38	2.86
Total wood in Brick Kiln	Tons/Year	530	546	562	578	594	610	2.86
Total wood in Brick Kiln	TOE/Year	215	221	228	234	241	247	2.86
			3.03%	2.94%	2.86%	2.78%	2.70%	
Mineral Coal	Tons/Day per kiln	5	5	5	5	5	5	0.00
Kilns	No.	33	34	35	36	37	38	2.86
Total Mineral Coal	Tons/Year	60225	62050	63875	65700	67525	69350	2.86
Total Mineral Coal	TOE/Year	26921	27736	28552	29368	30184	30999	2.86
<u>GUR (UNREFINED SUGAR) MANUFACTURING</u>								
Wood	kg/Day	100	100	100	100	100	100	0.00
Gur Units	No.	300	301	302	303	304	305	0.33
Total Wood	Tons/Year	900	903	906	909	912	915	0.33
Total Wood g-rate	TOE/year %	365	366	367	369	370	371	0.33
			0.33	0.33	0.33	0.33	0.33	
Bagasse	kg/Day	230	230	230	230	230	230	0.00
Gur Units	No.	300	301	302	303	304	305	0.33
Total Bagasse g-rate	Tons/Year %	2070	2077	2084	2091	2098	2105	0.33
			0.33	0.33	0.33	0.33	0.33	
Total Bagasse g-rate	TOE/Year %	822	825	827	830	833	836	0.33
			0.33	0.33	0.33	0.33	0.33	

Energy Balance Sheet for Swat District, 1987/88 to 1992/93

Energy Demand/Supply		1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	ACGR	(Plan)
Demand (Business as Usual)									
Electricity	TOE	7561	8323	9216	10250	11440	12812	11.12	
LPG	TOE	1694	1882	2091	2324	2583	2872	11.13	
Kerosene	TOE	4862	5370	5933	6557	7248	8014	10.51	
Adj. Fuelwood	TOE	969403	1009183	1050648	1093871	1138929	1185904	4.11	Adjustment means demand after deducting the economic use of Forest Wood or Crop Residue
Adj. Crop Residue	TOE	7677	7158	6675	6226	5809	5420	-6.72	
Saw Dust, Bagasse, etc									
Cow Dung	TOE	4734	4734	4734	4734	4734	4734	0.00	
Petrol/Diesel	TOE	27591	29479	31496	33651	35954	38414	6.84	
Charcoal/Coal briquettes mineral coal	TOE	29138	29954	30770	31586	32401	33217	2.65	
Total Energy Demand		1052661	1096082	1141563	1189198	1239098	1291387	4.17	
SUPPLY SCENARIO									
Grid Electricity	TOE	7254	7944	8767	9729	10848	12148	10.86	
Small Hydel	TOE	307	378	449	521	592	663	16.68	
LPG	TOE	1694	1882	2091	2324	2583	2872	11.13	
Kerosene	TOE	4862	5370	5933	6557	7248	8014	10.51	
Adj Fuelwood	TOE	969403	1009183	1050648	1093871	1138929	1185904	4.11	
Adj. Crop Residue	TOE	7677	7158	6675	6226	5809	5420	-6.72	
Saw Dust, Bagasse, etc									
Cow Dung	TOE	4734	4734	4734	4734	4734	4734	0.00	
Petrol/Diesel	TOE	27591	29479	31496	33651	35954	38414	6.84	
Charcoal/coal Briquette/ Mineral Coal	TOE	29138	29954	30770	31586	32401	33217	2.65	
Total Energy Supply	TOE	1052661	1096082	1141563	1189198	1239098	1291387	4.17	
g-rate	%		4.12	4.15	4.17	4.20	4.22		
Per Capita (Swat)	KOE	703.78	709.40	715.37	721.69	728.38	735.43	0.88	
g-rate	%		0.80	0.84	0.88	0.93	0.97		
Pakistan Per Capita	KOE	277.00	283.31	289.76	296.35	303.10	310.00	2.28	

Assessment of Felt Needs and Their Prioritisation

Priority Ranks

Felt Needs	1	2	3	4	5	6	7	8	9	10	11
Plantation Around Farms	•										
Energy Plantation on Waste/ Vacant Lands.		•									
Supply of LPG			•								
Supply of Grid Electricity				•							
Supply of Kerosene Oil					•						
Development of Solar Energy						•					
Supply of Coal							•				
Supply of Petrol/Diesel								•			
Supply of Generators									•		
Wind Mill Installation										•	
Micro/Mini-hydel											•