

STATE OF INDUSTRY REPORT

2007

National Electric Power Regulatory Authority



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The information contained in this Report is updated upto June, 2006.

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FOREWORD

Section 42 (b) of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997) requires the Authority to submit a report on the state of electric power services in the country to the Council of Common Interest (CCI) and to the Federal government for every financial year. To prepare this report, the Authority collects, assembles and analyses relevant data and statistical information about electric power services in the country.

This report is also intended for a wide audience including the electric power industry and the general public, as well. The primary objective of this report is to provide a statistical review of country electric power industry's firm data, collected by the Authority for the most recent year. This report provides the information regarding electric power industry capability, generation, fuels share in electric power generation, retail sales of electricity, provincial and sector wise consumption of electricity etc. It also provides forecasts, expansion plans and trends in the relevant sectors.

Net electric power generation during the year 2005-06 by electric power industry totalled 92889 GWh, up 9.67% from 2004-05 of 84697 GWh. During the period of this report, thermal generation topped with 57826 GWh or 62.25% of the total generation mix of the country. Generation from hydel facilities totalled 30855 GWh or 33.21% while nuclear generation amounts to 4208 GWh or 4.53% of the total generation of the country. Demand for the electricity was strong from both the residential and commercial sector. In view of the limited availability of electric power from hydel and nuclear resources the country has to rely more on its thermal generation capacity.

The State of Industry Report 2007 presents a summary of electric power industry statistics at the national as well as the provincial level. It is expected that the publication will provide industry decision makers, government policy makers, analysts and the general public with historical and future data that may be used in understanding Pakistan's electricity market.

The sales of electric power rose in all consumer sectors with the largest volume in residential sector. Factors affecting the year to year change in sales include an increase in the number of retail customers, warmer-than-normal weather and strong economic growth in the country.

COUNTRY BACKGROUND

Introduction:

With a density of more than 198 people per square kilometer, Pakistan is the world's sixth most populous and second largest economy in South Asia. Pakistan's total population is about 158.17 million which is growing at a rate of 1.8 percent annually. The total area of Pakistan is 796,095 square kilometers and the country is divided into four provinces, federally administrated tribal areas and liberated portion of the disputed region of Jammu and Kashmir.

Economic Overview:

The Government's positive economic and international political policies during the last few years have yielded handsome dividends in the shape of macro-economic stability of the country. Foreign currency reserves have crossed US\$15 billion, value of rupee has stabilized, CBR revenues are on the target, increase in per capita income has been witnessed and country has achieved GDP growth rate of over 6.5 percent. Moreover, the investors' interest in privatisation policy has enhanced and government has been able to privatise few large ticket companies like Pakistan Telecommunication, National Refinery, Habib Bank, United Bank, Allied Bank, KESC etc. and has so far realized US\$5.3 billion for 58 privatised transactions during the period 1999-2006.

Pakistan is still a mixed economy with decreasing role of public sector and has consistently shown positive economic growth rate. With an economic growth around 7.0 percent in 2006-07, the economy of Pakistan is one of the fastest growing economies in the Asian region. Pakistan is the third fastest growing major economy after China and India in Asia. The economy of the country is mainly based on agriculture, manufacturing and services. The main economic indicators of Pakistan are given in the following Table:

POPULATION	Millions	158.17
GNP	Billion US \$	148.28
PER CAPITA GNP	US \$/Yr/Person	925
GDP GROWTH RATE (Av 2004-07)	%	7.52
PER CAPITA FINAL ENERGY CONSUMPTION	Kg o.e	224
PER CAPITA ELECTRICITY CONSUMPTION	kWh/Yr/Person	427

Economic outlook for Pakistan is positive. The accumulation of foreign exchange reserves have played a pivotal role in stabilizing the exchange rate, with Pakistani Rupee stabilized at around 60 Rs/US\$. During the fiscal year macroeconomic indicators show a marked improvement, namely an 11 percent increase to US\$ 925 per capita income, a rise in large scale manufacturing by 15.4 percent, increase in private sector investment of 19.3 percent and foreign exchange reserves reaching an all time high of around US\$ 16 billion. Pakistan's real GDP rate during 2005-06 was 6.6 percent. The per capita income, indicating the average standard of living, grew at an average annual rate of 14.4 percent during the last five years.

Structural Reforms:

Structural reforms aim at adapting institutional frameworks or creating new ones and regulations necessary for markets to work properly. Since some markets are prone to market failure or inefficiencies, therefore, there is a role for the government and regulator to oversee in order to ensure proper functioning of the markets.

Pakistan has been implementing wide-ranging structural reforms in almost every sector of the economy to improve supply-side response by removing impediments to private sector development, removing irritants to improve investment climate and the allocation of resources.

Pakistan is targeting a GDP growth rate of 6 to 8 percent in the next five years. However, to sustain such a growth momentum more 'growth-critical' reforms would be required.

Investment Climate:

Foreign Direct Investment (FDI) has emerged as a major source of private external flows in Pakistan as well as contributing to the growth of domestic fixed capital. Nearly 80 percent of FDI was targeted to four main sectors namely IT/Telecom Sector, banking and financial services, energy, beverages and tobacco sector.

As the privatisation-led inflows boosted the total foreign investment figure to a high level of US\$3.872 billion in 2005-06, Pakistan hopes to attract huge FDI for infrastructure development in the coming years, particularly in power, oil and gas, telecom and transport sectors.

In the power sector the Private Power and Infrastructure Board (PPIB) is providing one window facility for attracting foreign and local investment to develop power projects. Similarly, Alternative Energy Development Board (AEDB) is involved in promoting renewable energy projects in Pakistan.

Energy Overview:

Energy is the lifeline of economic development and adequate energy to industry is necessary for driving economic growth and creating employment opportunities.

In recent years, rising oil consumption in Pakistan has led to rising oil imports. In addition, the lack of refining capacity leaves Pakistan heavily dependent on petroleum product imports. Natural gas accounts for the largest share of Pakistan's energy use, amounting to about 39.3 percent of total energy consumption. Pakistan at present uses all of its domestic natural gas production, but without higher production Pakistan will be forced to become a natural gas importer. As a result, Pakistan is exploring several pipeline and LNG import options to meet the expected growth in natural gas demand. Pakistan's electricity demand is rising rapidly and the government estimates that the electricity generation capacity of the country needs to grow by 50 percent by 2010 in order to meet expected demand.

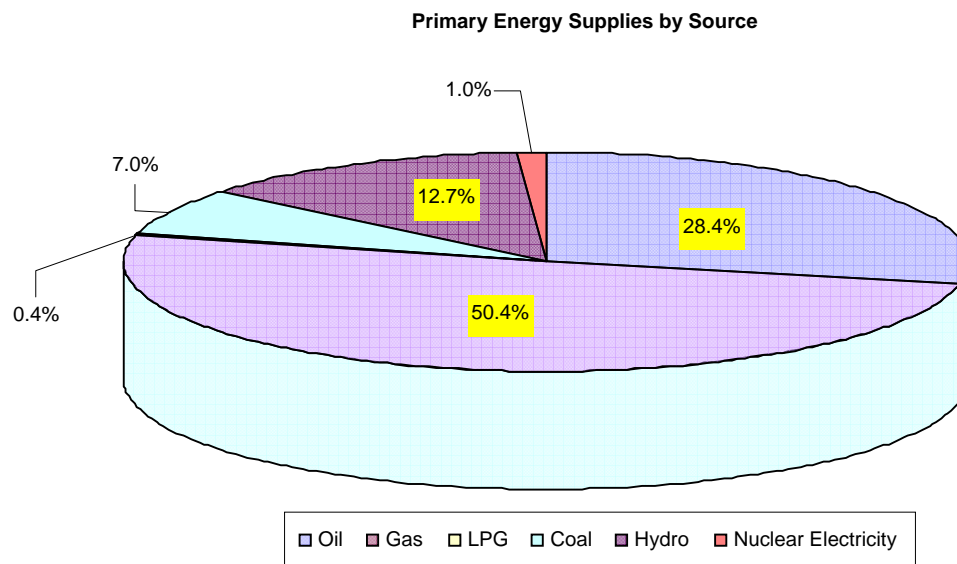
Primary Energy Supplies

The primary commercial energy supplies increased by 4.2 percent during the year; (increased to 57.9 MTOE in 2005-06 from 55.5 MTOE in year 2004-05). The share of natural gas in primary energy supplies during 2005-06 reached upto 50.4 percent followed by oil 28.4 percent, hydro electricity 12.7 percent, coal 7.0 percent, nuclear electricity 1.0 percent and LPG 0.4 percent. Table 1 shows the Primary Energy supplies position of the country during year 2005-06.

TABLE 1
Primary Energy Supplies by Source

Year	Unit	Oil	Gas	LPG	Coal	Hydro	Nuclear Electricity	Total
2005-06	Million TOE	16.4	29.2	0.2	4.0	7.4	0.6	57.8
	Percent Share	28.4	50.4	0.4	7.0	12.7	1.0	100

Source: Pakistan Energy Year Book 2006



Comparing the data of 2005-06 with 2004-05, it is noted that the total energy needs of the country rose by 4.1% and increased to 57.8 MTOE from 55.5 MTOE. The share of gas and hydro in the primary energy supplies of the country during 2005-06 was increased by 0.1% and 1.7% respectively, while the share of oil, coal and nuclear energy in the primary energy supplies decreased by 1%, 0.6% and 0.2% respectively.

The increased share of gas, LPG, hydro and decreased share of oil in the energy supplies of the country is a healthy sign for our economy however decreased share of coal and nuclear energy needs to be reviewed by the concerned quarters.

Energy Consumption

During the year 2005-06, the power sector was the largest consumer of gas (40.2 percent), followed by industrial sector (22.8 percent), fertilizer (16.2 percent), household sector (14 percent), commercial sector (2.4 percent) and cement (1.3 percent). During the same period, the power sector was the second highest consumer of petroleum products (28.8 percent) after transport sector (55.8 percent). Gas consumption in power sector decreased during 2005-06 and was recorded as 9.97 MTOE as compared to 10.30 MTOE during 2004-05.

The use of coal in the power sector decreased from a level of 348,052 tonnes in 1999-00 to 149,334 tonnes in 2005-06. In view of a big shortfall in electricity in the coming years, maximum utilization of coal will be the most appropriate option for power generation and Pakistan needs to acquire expertise and technology to efficiently deal with problems associated with mining and coal fired thermal power stations.

The crude oil and petroleum products import for the year 2005-06, amounted to about 8.6 million tonnes and 6 million tonnes, with payments worth US\$3,802.8 million and US\$2,848.62 million, respectively.

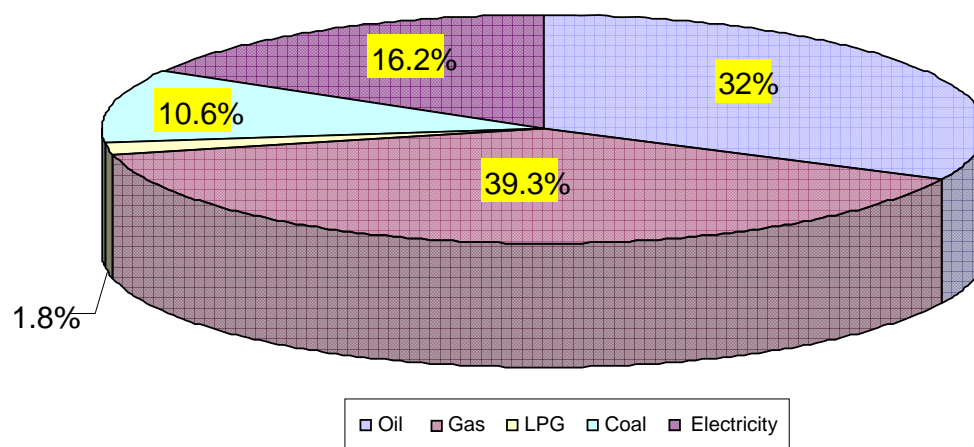
A structural shift is taking place in energy consumption in Pakistan since 2000-01. The consumption of petroleum products has been declining except in 2004-05, the consumption of other components of energy has been rising. The average consumption of petroleum products has, in fact, registered a decline of 3.42 percent per annum during period 2000-01 to 2005-06. Moreover, the consumption of oil in the cement industry, as well as in the electricity generation, has declined substantially as the former has shifted to gas and coal, while gas is increasingly being used to generate electricity. On the other hand, consumption of gas, electricity and coal has grown at average rates of 11.85 percent, 7.82 percent and 18.14 percent, respectively. Table 2 shows the final energy consumption position during 2005-06.

TABLE 2

Final Energy Consumption by Source

Year	Unit	Oil	Gas	LPG	Coal	Electricity	Total
2005-06	Million TOE	10.9	13.3	0.6	3.6	5.50	33.9
	Percent Share	32.0	39.3	1.8	10.6	16.2	100

Source: Pakistan Energy Year Book 2006

Final Energy Consumption by Source

Comparing the data of 2005-06 with 2004-05, it is noted that the total final energy consumption in Pakistan rose by 5.6% and increased to 33.9 MTOE from 32.1 MTOE. The share of oil in final energy consumption is reduced by 4.5% whereas share of gas, coal and electricity in final energy consumption is increased by 3.1%, 0.3% and 0.6% respectively.

Keeping in view of the dwindling fuel availability viz-a-viz depleting natural gas resources and large coal reserves in the country, the decreased share of coal in final energy consumption needs to be reviewed by the concerned agencies.

Energy Reserve, Production and Projected Demand

Whilst production levels may still be insufficient, our country is undoubtedly rich in oil potential. So far about 883 million barrels of crude oil reserves have been discovered, of which 558.9 million barrels have already been produced. Prognostic potential of total endowment of hydrocarbons has been estimated as 27 billion barrels of oil and 282 trillion cubic feet of gas in Pakistan. Until recently, over 620 exploratory wells have been drilled by various national and international exploration and production companies, resulting in over 177 oil and gas discoveries.

Indigenous production of crude oil during the year 2005-06 was 65,577 barrels per day which showed negative growth and decreased by 0.76 percent (from 66,079 barrels per day, in 2004-05, to 65,577 barrels per day in 2005-06). At the same time, natural gas production increased by 4.09 percent (from 3,685 in year 2004-05 to 3,836 in year 2005-06 million cubic feet per day).

Keeping in view energy demand of the country, the government is making great efforts to attract local and foreign investors. As a result of the financial and structural reforms in the country, the energy sector has already become one of the most attractive sectors in the country.

It is expected that the energy supply position will get better after the implementation of plans for pipeline projects from Iran. Similar pipelines are also being negotiated with Qatar and Turkmenistan. These energy

development projects in the country would help to battle future energy shortage in the country and pave way for enhanced economic activities, reduction of poverty and bring Pakistan's backward areas at par with the developed ones. The short-term, medium-term and long-term energy demand (projected) of the country is shown in Table 3.

TABLE 3
Energy Demand Projections by Fuel

	Short Term		Medium Term				Long Term	
	2010		2015		2020		2030	
Total MTOE	79.4	Percent	120.17	Percent	177.34	Percent	361.31	Percent
Oil	20.69	26	32.51	27	45.47	26	66.84	18
Gas	38.99	49	52.98	44	77.85	44	162.58	45
Coal	7.16	9	14.45	12	24.77	14	68.65	19
Hydro	11.03	14	16.40	14	21.44	12	38.93	11
Renewable	0.84	1	1.60	1	3.00	2	9.20	3
Nuclear	0.69	1	2.23	2	4.81	3	15.11	4

Source: Medium Term Development Framework

Table 3 shows forecast of the demand for different fuels with respect to short, medium and long term development. The statistics suggest that contribution of energy from oil, gas and hydel is going to decrease whereas share of coal, nuclear and renewable is going to increase.

ELECTRICITY SECTOR

Pakistan's electricity sector was historically served by two power entities: the Pakistan Water and Power Development Authority (WAPDA) serving most of the country, and the Karachi Electric Supply Corporation (KESC) serving the city of Karachi and its adjoining areas. KESC was established in 1913 while WAPDA was created by an Act in 1958, as an autonomous body for the development and use of water and power resources.

Since 1980s, power supply lagged behind demand resulting in major load shedding during peak demand of electricity. In the early 1990s, it was clear that with the demand growing at about 9 percent per year, the existing capacity was not sufficient to eliminate load shedding and undertake essential routine maintenance on all power generation plants in the system. Since late eighties it was observed that performance of energy sector was deteriorating severely because of the three major issues namely: Governance, Institutional Weaknesses and Tariff Structure with Subsidy.

Thus in order to meet the country's substantial power needs and improve the performance of the sector, the Government approved a Strategic Plan in 1992. The reforms led to unbundling of WAPDA's Power Wing into separate generation, transmission and distribution companies. As a part of this programme, KESC has been privatized during the year 2005 while WAPDA's power wing assets were unbundled into separate following companies, consisting of:

- Four (4) Generation Companies;
- The National Transmission and Despatch Company (NTDC); and
- Nine (9) Distribution Companies

All the corporatized entities carved out of WAPDA are owned by an overall Holding company, the Pakistan Electrical Power Company (PEPCO) established as a corporatized entity to manage various corporations during the transition to independent profit earning entities.

Future implementation of Strategic Plan includes privatisation of the nine distribution and four generation companies through international bidding to be processed by Privatisation Commission. The cases of one DISCO (FESCO) and one GENCO (JPCL) have been actively pursued for privatisation.

Historically Pakistan faced electricity deficit from 1990 to 1997. The demand and supply of electricity was balanced in 1997. From 1997, the generation capacity increased and it was expected that the demand and supply position of electricity will remain in equilibrium upto 2009. However, on account of brisk pace of economic activity and several other reasons, the supply shortage was experienced in the current year. To cope with this shortage, the Government has prepared short term and long term plans. Short term plan, inter alia, includes setting up fast track power plants, conservation of energy and load management. While under long term plans government plans to increase the share of hydel, coal and renewable energy in the total generation mix of the country. The installed capacity, energy generation, maximum demand on the system, energy sales and number of consumers for Ex-WAPDA Distribution Companies, KESC and the country during 2005-06 is presented in Table 4.

TABLE 4
Electric Power Statistics

Fiscal Year Ending 30 th June		2005	2006	2005	2006
A: INSTALLED CAPACITY			B: ENERGY GENERATED		
Thermal	GENCOS	4834	4834	22212	22519
	IPPs	6015	6005	23133	26177
	KESC	1756	1756	9304	9130
	Total Thermal	12605	12595	54649	57826
Hydel	WAPDA	6463	6463	25588	30751
	IPP	30	30	83	104
	Total Hydel	6493	6493	25671	30855
Nuclear	KANUPP	137	137	252	117
	CHASNUPP	325	325	4125	4091
	Total Nuclear	462	462	4377	4208
Total		19560	19550	84697*	92889*
KESC Area	Public Sector	137	137	326	136
	Private Sector	2018	2018	10851	10528
	Total	2155	2155	11177	10664
Ex-WAPDA Area	Public Sector	11622	11622	51925	57361
	Private Sector	5783	5773	21595	24864
	Total	17405	17395	73520	82225
C: ADDITION DURING THE YEAR (MW)					
Fiscal Year Ending 30th June		2005		2006	
Ex-WAPDA Area		38		-10	
KESC Area		0		0	
Total		38		-10	
D: MAXIMUM DEMAND (MW)					
Ex-WAPDA Area		12385		13066	
KESC Area		2197		2223	
of Country	Undiversified	14582		15289	
	Diversified	14296		14989	
E: ENERGY SALES (GWh)					
Ex-WAPDA Area		52938*		58572*	
KESC Area		8416		8416	
Total		61354		66988	

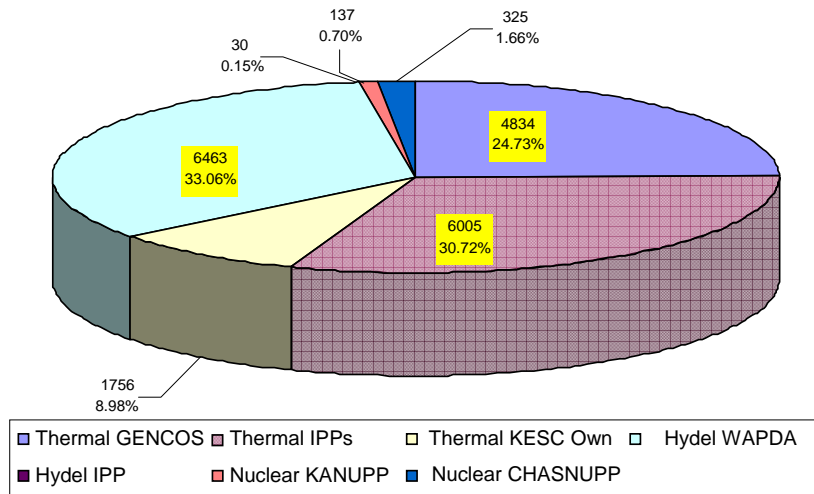
F: SYSTEM LOSSES (Percent)								
	Aux.	Trans.	Dist.	Total	Aux.	Trans.	Dist.	Total
Ex-WAPDA Area	1.99	7.444	15.28	24.71	2.21	7.10	14.79	24.10
KESC Area	7.10	NA	NA	34.23	7.5	NA	NA	34.42
G: NUMBER OF CONSUMERS (000)								
Ex-WAPDA Area	14896			15911				
KESC Area	1818			1882				
Total	16714			17793				

* After accounting for import and export of electricity

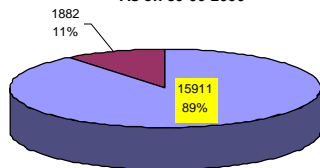
Note: After privatisation of KESC, installed capacity and energy generated from its plants are being considered in private sector.

Sources: Power System Statistics 31st Edition and KESC

Installed Capacity of the Country (MW) as on 30-06-2006

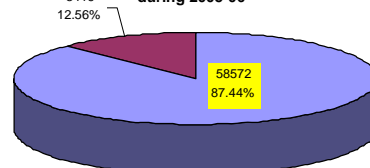


No. of Electricity Consumers (000) As on 30-06-2006



Other than KESC Area KESC Area

Electricity Sales (GWh) during 2005-06



Other than KESC Area KESC Area

Energy Generation of the Country (GWh) during 2005-06

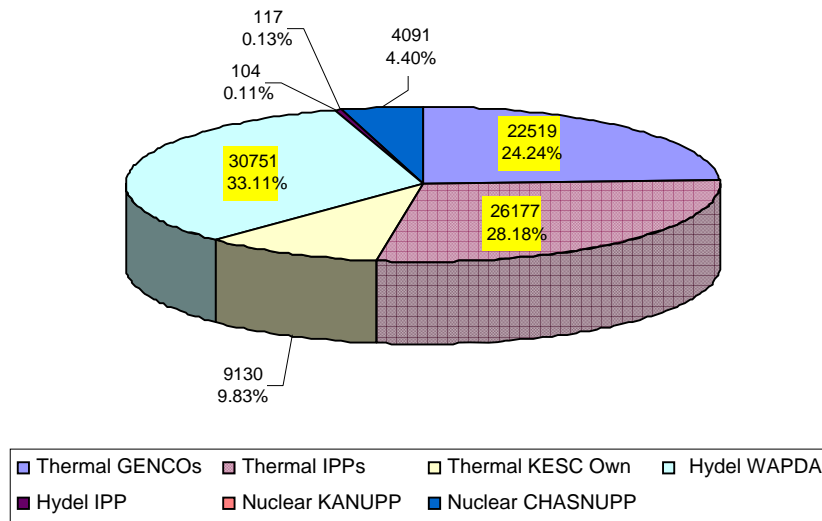


Table 4 and accompanying graphs show no addition in installed capacity during 2005-06, however a comparison of energy generation data shows that generated energy in 2005-06 increased by 9.67%, over that of 2004-05.

The diversified maximum demand of the country during 2005-06 was recorded as 14,989MW (4.84% increase over last year) while this demand in KESC and Ex-WAPDA Area was recorded as 2,223MW (1.18% increase over last year) and 13,066MW (5.49% increased over last year) respectively.

The sale of energy in the country during 2005-06 was recorded as 66988 GWh (9.18% increase over preceding year). All the increase in the sale of energy took place in Ex-WAPDA area while in KESC area this figure remains same as of last year.

System losses in KESC and Ex-WAPDA area during 2005-06 were recorded as 34.42% (increased by 0.19% over last year) and 24.10% (a decrease of 0.61% over last year) respectively.

An addition of 64000 customers in KESC and 105,000 customers in rest of the country has increased the total number of country's electricity customers to 17,793,000.

DEMAND AND SUPPLY OF ELECTRICITY

Load Pattern and Peak Load Hours:

Most parts of the country experience severe winter and summer conditions; as a result there is a wide variation in electricity demand during the year. Furthermore, higher share of residential sector in total electricity demand make the peak demand more pronounced. During summer and sowing seasons, the inductive load in the system increases due to tubewells, air conditioners and other motor operation while in winter, resistive load increases due to heaters. The peak load hours are generally between 6 PM to 10 PM while load decreases to its minimum between midnight and 5 AM.

Peak Demand:

During 2005-06, the maximum electric power demand on the national grid (excluding export to KESC) was recorded as 13,066MW, while this demand on KESC system was recorded as 2,223MW. The diversified combined peak electricity demand of the country during 2005-06 was recorded as 14,989MW. The peak demand of Ex-WAPDA DISCOs and KESC are shown in Table 5.

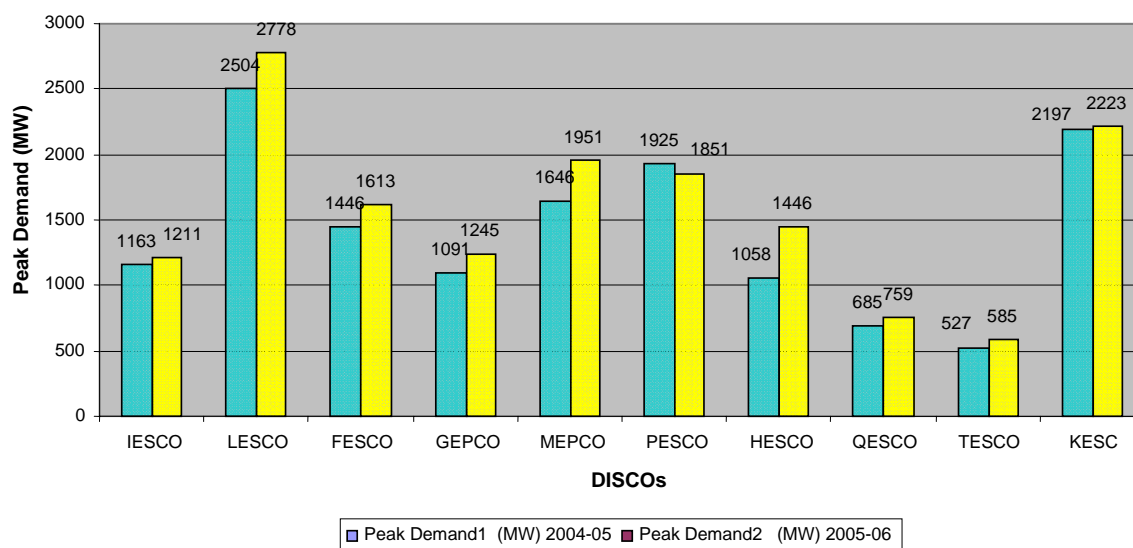
TABLE 5
Peak Demand of Distribution Companies

Name of Company	Peak Demand ¹ (MW)	Peak Demand (MW)
	2004-05	2005-06
IESCO	1163	1211
LESCO	2504	2778
FESCO	1446	1613
GEPCO	1091	1245
MEPCO	1646	1951
PESCO	1925	1851
TESCO	527	585
HESCO	1058	1446
QESCO	685	759
KESC	2197	2223

¹ data from State of Industry Report 2006

Sources: NPCC /DISCOs/KESC

Peak Demand of Ex-WAPDA Distribution Companies and KESC



The peak load demand recorded during 2004-05 and 2005-06 in each Ex-WAPDA DISCO and KESC are shown in the above Table and graph. During the period, the highest increase in peak demand is observed in HESCO (388MW) followed by MEPCO (305MW), LESCO (274MW), FESCO (167MW), GEPCO (154MW), QESCO (74MW), TESCO (58MW) and IESCO (48MW). The peak demand of PESCO decreased during 2004-05 by 74MW over the same period due to formation of a separate distribution company (TESCO) which was earlier part of PESCO. Peak load demand of KESC slightly increased by 26MW.

Demand Growth:

With the exception of fiscal year 1998-99, power consumption has grown steadily in recent years. Between 1995-96 and 2005-06, total consumption increased by more than 60.44 percent from 42151 GWh to 67630 GWh. The demand of electricity will continue to rise in the years to come. Sector wise power demand projection is shown in Table 6.

TABLE 6
Sector-wise Projection of Power Demand

(MW)

Year	Domestic	Commercial	Agriculture	Industrial	Others	Total
2007-08	8127	1312	1893	7252	1159	19743
2008-09	8783	1354	1979	8181	1243	21540
2009-10	9531	1408	2079	9267	1341	23626

Source: Medium Term Development Framework

Sector wise power demand projections are given in Table 6. Highest power demand is predicted in domestic sector, increasing by 702MW (on average) per year, causing total power demand (forecast) to grow at a rate of 9.4%.

Forecast of Installed and Available Capacity:

For realistic evaluation of power supply situation during peak demand hours of year, the maximum capability of the system to generate power at that particular time should be considered instead of installed capacity. Table 7 shows available capacity against installed capacity during peak hours upto 2010.

TABLE 7
Forecast of the Installed and Available Capacity

YEAR	Ex-WAPDA Area		KESC	
	Installed Capacity (MW)	Available Capacity During Peak Demand (MW)	Installed Capacity (MW)	Available Capacity During Peak Demand (MW)
2007-2008	17583	14044	1948	1667
2008-2009	20717	16011	1978	1692
2009-2010	26094	19193	2598	2265

Source: NTDC/KESC

Projected Supply and Peak Demand Position:

Based on projected peak demand and projected generation capability during 2007-2014, the supply and demand gap has been calculated and shown in Tables 8 and 9 for Ex-WAPDA System and KESC respectively. For calculation purpose, three different growth rates have been assumed i.e. 5 percent, 7 percent and 9 percent.

TABLE 8
Projected Surplus/Deficit in Demand and Supply during Peak Hours (Ex-WAPDA Area)

Year ending 30 th June	Generation Capability (MW)	Peak Demand 9% Growth (MW)	Surplus/ (Deficit) (MW)	Peak Demand 7% Growth (MW)	Surplus/ (Deficit) (MW)	Peak Demand 5% Growth (MW)	Surplus/ (Deficit) (MW)
2006	12833	13212	(379)	13212	(379)	13212	(379)
2007	13442	14401	(959)	14137	(695)	13873	(431)
2008	14254	15697	(1443)	15126	(872)	14566	(312)
2009	16743	17110	(367)	16185	558	15295	1448
2010	18698	18650	48	17318	1380	16059	2639
2011	20705	20328	377	18531	2174	16862	3843
2012	21344	22158	(814)	19828	1516	17705	3639
2013	23256	24152	(896)	21216	2040	18591	4665
2014	24255	26326	(2071)	22701	1554	19520	4735

Source: National Transmission and Despatch Company

Projected Surplus/Deficit in Demand and Supply during Peak Hours

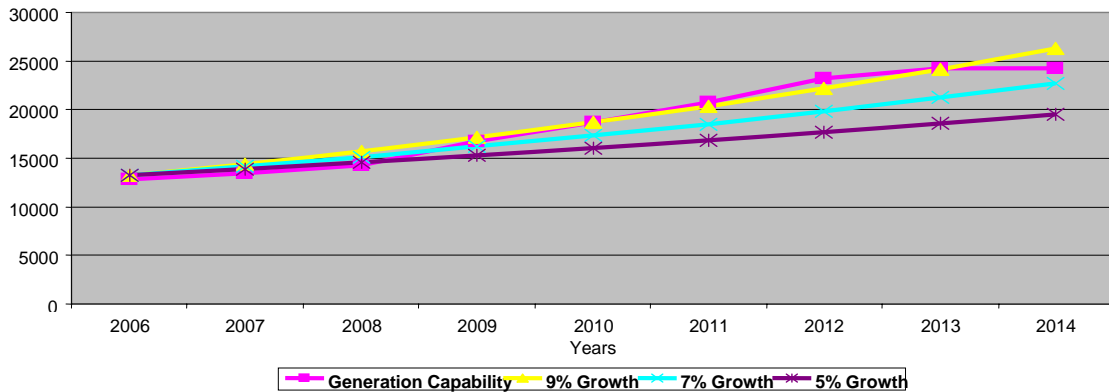
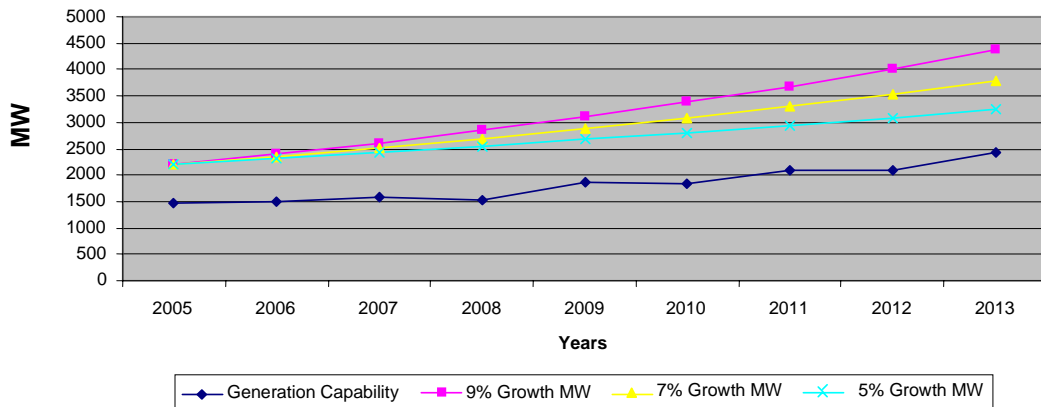


TABLE 9
Projected Surplus/Deficit in Demand and Supply during Peak Hours (KESC)

Year ending 30 th June	Generation Capability (MW)	Peak Demand 9% Growth (MW)	Surplus/ (Deficit) (MW)	Peak Demand 7% Growth (MW)	Surplus/ (Deficit) (MW)	Peak Demand 5% Growth (MW)	Surplus/ (Deficit) (MW)
2006	1409	2223	(814)	2223	(814)	2223	(814)
2007	1458	2354 (Actual 5.9%)	(896)	2354 (Actual 5.9%)	(896)	2354 (Actual 5.9%)	(896)
2008	1667	2566	(899)	2519	(852)	2472	(805)
2009	1692	2797	(1105)	2695	(1003)	2595	(903)
2010	2265	3048	(783)	2884	(618)	2725	(460)
2011	2265	3323	(1057)	3086	(820)	2861	(596)
2012	2265	3622	(1357)	3302	(1036)	3004	(739)
2013	2265	3948	(1682)	3533	(1267)	3155	(889)

Source: KESC

Projected Surplus/Deficit in Demand and Supply during Peak Hours KESC



ELECTRICITY GENERATION

Total installed generation capacity of Pakistan is 19,550MW comprising Thermal, Hydel and Nuclear electric power generation sources. The Water and Power Development Authority (WAPDA), Ex-WAPDA Generation Companies (GENCOs), Pakistan Atomic Energy Commission are three public sector organizations involved in power generation in the country. Besides, the Independent Power Producers (IPPs) are also a part of power generation mix.

Total installed capacity of Ex-WAPDA system stood at 17,395MW during the year 2005-06 of which hydel generation capacity was 6,493MW (37.32%) and thermal including nuclear was 10,902MW (62.67%). During the reporting period, 92,889 GWh energy was generated as against 84,697 GWh during the previous year; showing an increase of 9.67 percent. Table 10 gives details of electricity generation in public as well as in private sector, during 2005-06.

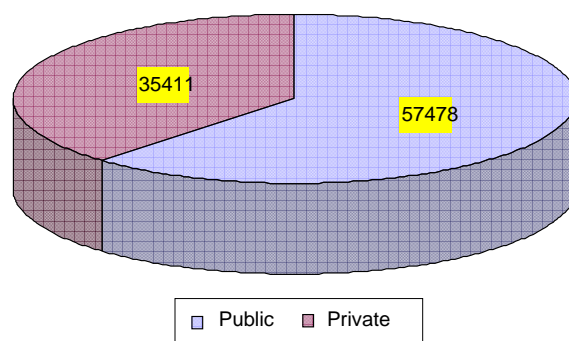
TABLE 10
Energy Generation by Sector and Source

Sector/Source of Generation	2005-06 (GWh)
Public Sector	57478
Hydel	30751
Thermal*	26727
Private Sector	35411
Hydel	104
Thermal	35307
Total	92889

* Thermal includes Nuclear

Source: Power System Statistics 31st Edition, NPCC and KESC

Energy Generation by Source



Above Table shows share of public and private sector in total electricity generation of the country. The total energy generated during 2005-06 was 92,889 GWh, which is 9.67% more than the energy generated during 2004-05 i.e 84697 GWh. The share of private and public sector in total electricity generated in the country during 2005-06 reached 38.12% and 61.8% respectively whereas during 2004-05 the share of private and public sector was 38.30% and 61.69% respectively.

Thermal Generation:

Thermal power plants are being operated in public as well as in private sector. The total installed capacity of the thermal power plants is 12,595MW, of which 4,834MW (38.38%) is owned by public sector (through four GENCOs) while remaining 7,761MW (61.61%) is owned by private sector. Share of thermal power plants in the total installed capacity of the country is 64.42 percent. Total electrical energy generated by thermal power plants during 2005-06 was 57,826 GWh which was about 62.25 percent of the total electricity generation of

Pakistan. During 2005-06, consumption of oil in electricity generation increased by 22.2 percent while consumption of gas and coal decreased by 3.20 percent and 16.98 percent respectively, over preceding year.

Licence Granted during 2005-06

Besides existing thermal power plants, NEPRA has granted generation licences to 05 new power plants based on thermal technology for a combined installed capacity of 784MW. Table 11 shows licences issued by NEPRA during 2005-06.

TABLE 11
Licenses Granted by NEPRA during 2005-06

GENERATION COMPANIES:	
Name of Companies	Date of Issue of the Licence
Orient Power Company Limited	22-07-2005
Saif Power Limited	21-06-2006
Sapphire Electric Company Limited	21-06-2006
New Park Energy Limited	27-06-2006
Green Power (Pvt.) Limited	27-06-2006

Public Sector Power Generation Expansion Plan

Planned expansion in installed generation capacity in the country is shown in Table 12 while details of public sector generation projects (on-going/expansion) separately for different provinces are shown in Tables 13 and 14. Table 15 shows year-wise forecast of the addition/deletion in generation capacity of KESC.

TABLE 12
Expansion of Installed Generation Capacity (Ex-WAPDA System)

YEAR	Name of Plant	Capacity of Plant (MW)	EX-WAPDA SYSTEM					Cumulative Total (MW)
			HYDEL (MW)	NUCLEAR (MW)	THERMAL (MW)	WIND (MW)	Total (MW)	
	Existing Capacity		6493	325	10577		17395	17395
2006-07	Rental Plant in Lahore	150			286		286	17681
	Rental Plant in Bhikki	136						
2007-08	Addl. GT from UAE	80	81		80	100	261	17942
	Malakand-III HPP	81						
	Wind Mill Project	100						
2008-09	Attock Power Project	150	323		3764		4087	22029
	CC at Chichoki Mallian	320						
	Khan Khwar HPP	72						
	Gulf Power Project	179						
	Taiyo Hills Project	150						
	EPSCO/Glimmer Pasrur	150						
	Orient Thermal Project	225						
	Bhikki Power Project	225						
	Allai Khwar HPP	121						
	CC at Chichoki Mallian	180						
	WARDA Power Project	200						
	Existing IPPs Expansion	405						
	Nishat Chunian Project	200						
	Atlas Shirazi Project	200						
	Gulistan Power Project	200						
	Muridke Power Project	225						
	Mari Power Project	175						
Western Electric Project	150							
Duber Khwar HPP	130							
Sahiwal Power Project	225							
Green Power Project	205							

YEAR	Name of Plant	Capacity of Plant (MW)	EX-WAPDA AREA					Cumulative Total (MW)
			HYDEL (MW)	NUCLEAR (MW)	THERMAL (MW)	WIND (MW)	Total (MW)	
2009-10	Intergen Lachi	150	96		1483		1579	23608
	Fauji Kornagi Project	150						
	Star Thermal Project	133						
	Engro Power Project	150						
	Jinnah Low Head Hydel	96						
	KAPCO Extension	400						
	Faisalabad ICB Project	400						
	Sukkur (Kandra) Project	100						
2010-11	Chashma Nuclear	325	719	325	800		1844	25452
	Golen Gol HPP	106						
	Keyal Khwar HPP	130						
	New Bong HPP AJK	84						
	Rajdhani HPP	132						
	Chichoki Millian Project (ICB)	350						
	UCH-2 ICB Power Project	450						
	Matiltan Distt. Swat HPP	84						
	Kurram Tangi HPP	83						
	Kotli HPP AJK	100						
2011-12	Gul Pur (Poonch River)	100	1161		2550		3711	29163
	Tarbela Hydro 4 th (Ext.)	960						
	Gabral Kalam HPP	101						
	Habibullah Energy Coal	150						
	Dadabhoi Coal Project	200						
	Lakhra Coal Project	200						
	Imp. Coal based Project	1000						
	Imp. Coal based Project	1000						
2012-13	Sharmai HPP	115	245				245	29408
	Patrind HPP	130						
2013-14	Harighel HPP	53	2181				2181	31589
	Madyan HPP	148						
	Suki Kinari HPP	660						
	Munda Dam HPP	660						
	Kohala Hydel	660						

Source: National Transmission and Despatch Company

Table 12 shows generation expansion plan upto 2013-14.

TABLE 13
Ongoing Projects and Expansion Plan of Power Generation in Punjab

S #	Name of Project	Capacity (MW)	Expected Commissioning Year	Estimated Cost (Million Rupees)
A) Ongoing Projects:				
1	Khokhra Hydropower Project	3.20	June, 2010	478.128
2	Marala Hydropower Project	7.20	June, 2012	1064.000
3	Chianwali Hydropower Project	5.40	June, 2012	827.000
4	Deg out Fall Hydropower Project	5.00	June, 2012	675.000
5	Okara Hydropower Project	4.00	June, 2012	693.000
6	Pakpattan Hydropower Project	3.20	June, 2012	462.000

B) Future Expansion:

There are 317 identified sites on canal falls with a potential of 505MW out of which 48 sites each having a potential of more than 2MW. Punjab Government had also established Punjab Power Development Board (PPDB); an organization to provide one window facility to investors interested in setting up of Hydropower Stations on canal/river falls in Punjab. Expression of Interest (EOI) was invited by the Board for the development of Hydropower Projects on 37 Raw Sites, each with potential of more than 2MW. 14 private investors have shown interest to develop 11 Hydropower raw sites with total aggregate potential of 140MW. The proposals submitted by the private investors are being evaluated and LOI will be issued to pre-qualified sponsors, authorizing them to carry out feasibility studies of Raw Sites. Recently one solicited site namely Sahiwal HPP with power potential of 4.8MW on Lower Bari Doab Canal (RD 329+058) has also been offered to private sector and currently pre-qualification of private investors is in progress.

Source: I & P Department, Government of Punjab

TABLE 14
Ongoing Projects and Expansion Plan of Power Generation in NWFP

S #	Name of Project	Capacity (MW)	Expected Commissioning Year	Estimated Cost (Million Rs.)
A) Ongoing Projects:				
1	Malakand III Project, Dargai	81	2008	6379.55
2	Pehur Hydropower Project District Swabi	81	2008	862.00
3	Shishi Hydropower Project District Chitral	1.875	2008	286.58
B) Expansion:				
1	Extension of Reshum HPP District Chitral	1.4 (total 4.2)	2007	132.00
C) Future Expansion:				
1	Daral Khwar HPP District Swat	36.6	2011	3075.00
2	Ranalia Khwar HPP District Kohistan	12	2011	1077.46
3	Machai Canal HPP District Mardan	2.6	2011	318.39

Source: I & P Department, Government of NWFP

TABLE 15
Year-wise Addition/Deletion in Installed Generation Capacity (KESC)

Year	Name of Plant	Additions (MW)	Retirement (MW)
2007-08	KTPS	-	66
2008-09	KTPS	350	-
2009-10	-	-	-
2010-11	KTPS	350	125
2011-12	-	-	-
2012-13	KTPS	350	-

Source: Karachi Electric Supply Corporation (KESC)

Investment Plan for Power Generation Projects

Table 16 and 17 give investment plans for public and private sector power generation projects whereas Table 18 shows KESC investment plans for its power generation Projects.

TABLE 16
Investment Plan for Public Sector Power Generation Projects

S #	Name of the Project	Capacity (MW)	Expected Commissioning Year	Estimated Cost (Million Rupees)
1	Rental Plant at Bhikki	136	2007-08	N.A.
2	Malakand-III HPP	81	2007-08	5120
3	Khan Khwar HPP	72	2008-09	4900
4	Allai Khwar HPP	121	2008-09	7896
5	Duber Khwar HPP	130	2008-09	8326
6	Nandipur Power Project	450	2009-10	22335
7	Khuzdar Combined Cycle	100	2009-10	7035
	Total	1090		55612

Source: NTDC

TABLE 17
Investment Plan for Private Sector Power Generation Projects

S #	Name of the Project	Capacity (MW)	Investments (US\$ Million)	Expected COD
OIL/BAGASSE				
1	Attock Gen Power Project	150	113	October, 2008
2	Gulf Power	179	134	October, 2008
3	Taiyo Hills	127	95	October, 2008
4	Eastern Power (EPCO)	150	113	October, 2008
5	Associated Technologies Project	200	150	March, 2009
6	Warda Power Project	200	150	March, 2009
7	Amazon Power Project	117	88	October, 2009
8	Kohinoor Energy-Capacity Expansion	143	107	October, 2009
9	Tapal Energy-Capacity Expansion	161	121	October, 2009
10	Japan Power-Capacity Expansion	101	76	October, 2009
11	Nishat Power Project	200	150	December, 2009
12	Sheikhupura (Atlas) Power Project	225	169	March, 2009
13	Gujranwala (Gulistan) Project	200	150	March, 2010
14	HUBCO -Narowal Project	225	169	March, 2010
15	KAPCO-Expansion Project	400	300	March, 2010
16	Nishat Chunian Power Project	200	150	June, 2010
17	InterGen Power Project	150	113	June, 2010
18	Chichoki Mallian ICB Project	350	263	June, 2010
19	Shaheen (SBIG) Power Project	800	600	June, 2010
20	Liberty Power Tech Project	200	150	December, 2010
21	Fatima Sugar Cogeneration Project	125	94	July, 2011
Sub-Total (Oil)		4603	3455	
PIPELINE QUALITY GAS/DUAL-FUEL/LNG				
22	Orient Power Project	225	169	December, 2008
23	Muridke (Sapphire) Power Project	225	169	March, 2009
24	Bhikki (Halmore) Power Project	225	169	October, 2009
25	Tecna Power Project	300	225	December, 2009
26	Sahiwal (Saif) Power Project	225	169	February, 2010
27	Faisalabad ICB Project	400	300	June, 2010
Sub-Total (Pipeline Quality Gas/Dual-Fuel)		1600	1201	

S #	Name of the Project	Capacity (MW)	Investments (US\$ Million)	Expected COD
DEDICATED GAS FIELDS				
28	Fauji Mari Power Project	175	131	July, 2009
29	Green Power Project	205	154	June, 2009
30	Engro Power Project	150	113	December, 2009
31	Star Thermal Power Project	134	101	February, 2010
32	Uch II ICB Project	450	338	November, 2010
33	Kandra Power Project	60	45	July, 2011
Sub-Total (Dedicated Gas Field)		1174	882	
HYDEL				
34	New Bong Escape Hydel Project	84	105	March, 2011
35	Kotli Hydel Project	100	125	June, 2011
36	Gulpur Hydro Power Project	100	125	November, 2011
37	Gabral-Kalam Hydro Power Project	101	126	June, 2012
38	Rajdhani Hydro Power Project	132	165	September, 2012
39	Matiltan Hydro Power Project	84	105	December, 2012
40	Patrind Hydropower Project	150	188	January, 2013
41	Madyan Hydropower Project	148	185	December, 2013
42	Sharmai Hydropower Project	115	144	December, 2013
43	Karot Hydel Project	240	300	January, 2014
44	Azad Patan Hydel Project	222	278	January, 2014
45	Asrit-Kedam Hydel Project	209	261	January, 2014
46	Kalam-Asrit Hydel Project	197	246	January, 2014
47	Sehra Hydel Project	65	81	January, 2014
48	Tarbela 4 th Extension	960	500	January, 2015
49	Chakothi-Hattian Project	139	174	January, 2015
50	Munda Hydropower Project	660	825	March, 2015
51	Shogosin Hydropower Project	102	128	June, 2015
52	Shushgai Zhendoli Hydel Project	127	159	June, 2015
53	Kaigah Hydel Project	548	685	January, 2016
54	Suki Kinari Hydropower Project	655	819	April, 2016
Sub-Total (Hydel)		5138	5724	
COAL				
55	Habibullah Energy Project	150	150	June, 2012
56	Dadabhoy Coal Project	200	200	June, 2012
57	Lakhra Coal Project by Fateh Group	200	200	June, 2012
58	AES Imported Coal Project	1000	1000	June, 2012
59	Mitsui Imported Coal Project	1000	1000	June, 2012
Sub-Total (Coal)		2550	2550	
GRAND TOTAL		15065	13812	

Source: Private Power and Infrastructure Board

TABLE 18
Investment Plan for Power Generation Projects (KESC)

S #	Name of the Project	Capacity (MW)	Expected Commissioning Year	Estimated cost (Million US\$)
1	Combined Cycle at KTPS	220	2007-08	180
2	Combined Cycle at BQPS	575	2008-09	300

Source: KESC

Hydel Generation:

In Pakistan, hydel power plants are being operated in public as well as in private sector. The total installed capacity of the hydel power plants are 6,493MW, of which 6,463MW (99.53%) is owned by public sector while remaining 30MW (0.46%) is owned by private sector. Share of hydel power plants (installed capacity) in the total installed capacity of the country is 33.21 percent. The total electrical energy generated by hydel power plants during 2005-06 was 30855 GWh which is about 33.21 percent of total electricity generation of Pakistan.

Maximum Hydel Generation

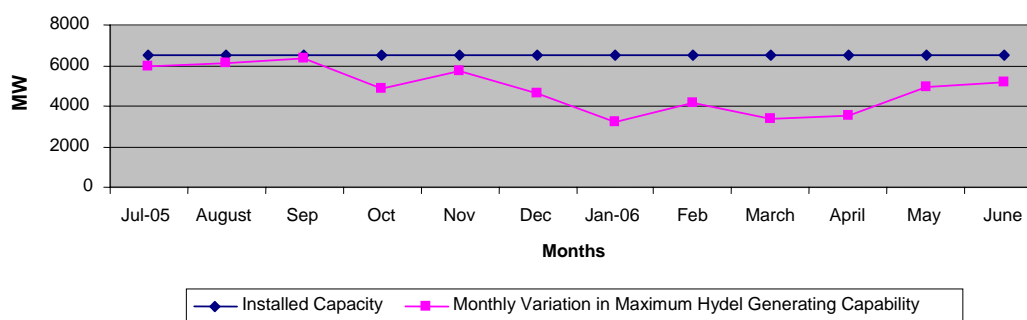
Availability of hydro capacity varies with reservoir levels and the inflow of water. The actual generation, therefore varies over the year. Details of recorded month-wise hydro generation capacity during 2005-06 is given in Table 19.

TABLE 19
Monthly Variation in Maximum Hydel Generating Capacity

S #	Month	Tarbela	Mangla	Ghazi Brotha	Warsak	Chashma	Small Hydels	Total (MW)
1	July, 2005	3593	1090	1050	144	51	63	5991
2	August	3585	996	1112	194	158	66	6111
3	September	3597	1068	1233	195	181	67	6341
4	October	2380	672	1406	181	182	56	4877
5	November	3062	1002	1254	170	170	58	5716
6	December	2209	788	1310	148	141	50	4646
7	January, 2006	1111	571	1244	138	112	32	3208
8	February	1687	747	1428	145	118	47	4172
9	March	1205	550	1336	138	104	60	3393
10	April	1259	763	1136	163	132	72	3525
11	May	2176	916	1398	189	170	71	4920
12	June	2326	977	1432	205	159	70	5169

Source: National Power Control Centre

Monthly Variation in Maximum Hydel Generating Capability



Generating capability of hydel power plants depends on water releases and reservoir levels. Minimum contribution of hydel occurs during January when canals are closed for maintenance and releases from major reservoirs at their lowest.

Hydro Power Potential and Major Hydro Power Plants

Pakistan's total hydropower potential has been estimated as over 40,000MW, some 24,000MW of which could be easily harnessed and approximately 6463 has actually been exploited. There is a need to develop the hydropower capacity of Pakistan. The government is considering large projects like Bhasha to take care of future needs. Such projects will also add to the national water storage capacity. WAPDA recently announced plans to carryout studies for a number of storage projects on the Indus and its tributaries including the Bhasha Dam and several off channel storages as part of its Vision 2025 programme. Besides WAPDA, provincial governments and AEDB are also working to develop hydropower capacity of Pakistan.

WAPDA controls almost all the hydroelectric power plants, the largest being Tarbela power plant of 3,478MW followed by Mangla (1,000MW), Warsak (243MW), Chashma (184MW), Ghazi Barotha (1,450MW) and other small power plants (108.2MW). In addition, Sarhad Hydel Development Organization is also constructing a hydel power plant of 87.3MW in public sector while a 30MW hydel power plant is in operation in AJK in private sector. The water storage capacities of the three existing reservoirs of the Indus Basin: Tarbela, Mangla and Chashma are declining due to sedimentation. The live storage capacity of the three reservoirs has been reported to have reduced by about 20 percent.

Renewable Energy:

The development of renewable energy sources in the country has gained momentum over the past 3-4 years on account of depletion of conventional energy resources in the country and expanding gap between power demand and supply. In 2003, the Pakistani government created the Alternative Energy Development Board (AEDB) to promote wind, solar, Bio-mass and mini/small hydro based electric power plants. AEDB is also responsible for developing country's medium and long term policy for renewable energy sources. AEDB's primary objective is to help Pakistan to achieve a 10 percent renewable energy share in the country's energy mix by 2015. AEDB is working to create an environment in Pakistan that is conducive to investment from the private sector in renewable energy and currently involved in several power projects of solar, Bio-mass, micro hydro power and wind energy. So far five (5) generation licences for wind turbines for a combined installed capacity of 449MW have been issued while two (2) generation licences for 98.5MW capacity are being processed by NEPRA.

The main challenge AEDB is facing in the execution of its projects is the availability of equipment. Wind turbines are not available off-the shelf in the world market as all the leading manufacturers of wind equipment have fully committed to supply their production mainly to USA market. Tables 20 to 22 give details of executed, under construction and planned Renewable Energy Projects.

TABLE 20
Details of Renewable Energy Projects

S#	Name of Project	Technology	Capacity (MW)	Expected Commissioning Year	Estimated Cost (Million Rs.)
A) Existing Projects (in-operation and under construction)					
1	100 Solar Homes Programme per Province	Solar	0.04	2006	90.00
2	Pilot Project for installation of indigenously developed Micro Wind Turbine	Micro Wind Turbine	0.059	2006	18.40
3	Pilot Project for Production Plant of Bio diesel	Bio-diesel	0.0056	2007	21.43
4	Solar Thermal Power Plants (Demonstration Unit)	Solar Thermal	0.042	2009	39.08
5	Rural Electrification Programme Through Alternative Renewable Energy Technologies	Solar	1.344	2008	1.156
6	Landhi Cattle Colony Waste to Energy Project	Waste to Energy	0.25	2007	-
7	Blue Star Energy, Machai Upper Swat Canal	Hydel	4	2007	-
8	Small/Mini Hydel Power Project	Hydel	80.1	2008	8.7

S#	Name of Project	Technology	Capacity (MW)	Expected Commissioning Year	Estimated Cost (Million Rs.)
B) Future Projects					
1	Mega Watt Wind Project [#]	Wind	300	2009	50
2	Solar Thermal Power Plant [#]	Solar Thermal	50	2012	80
3	Landhi Cattle Waste to Energy Project	Waste to Energy	25	2009	4.5

[#] Project to be implemented by private sector

Source: AEDB

TABLE 21
Renewable Energy Plans

Technology	Short Term	Medium Term		Long Term	
	2010	2015	2020	2025	2030
	Capacity in MW				
Wind	700	1500	3000	5000	8000
Solar	---	100	100	200	300
Bio Mass	---	100	250	450	700
Hydro	---	100	300	500	700

Source: AEDB

TABLE 22
Details of AEDB Executed Projects

S #	Name of Village and District	Province	No. of Installed solar panel/ wind turbines	No. of houses electrified
Solar Energy – Solar Photovoltaic				
1	Takhat, Kalat	Balochistan	Not Available	100
2	Killi Mama Macherzai, Killa Saifullah	Balochistan	Not Available	100
3	Alah Baksh Bazar Dandar, Turbat	Balochistan	Not Available	121
4	Basti Bugha, D. G. Khan	Punjab	Not Available	100
5	Lakhi Bhair, D. G. Khan	Punjab	Not Available	135
6	Pinpario, Chachro	Sindh	Not Available	100
7	Bharomal, Chachro	Sindh	Not Available	115
8	Shnow Garii, Kohat	NWFP	Not Available	100
9	Jhanak, Kohat	NWFP	Not Available	120
TOTAL				991
Wind Energy-Micro Wind Turbines				
10	Goth Gul Muhammad Khaskheli – Mirpur Sakro	Sindh	03	12
11	Goth Jumo Khan Khaskheli – Mirpur Sakro	Sindh	12	60
12	Goth Ismail Khaskheli 1 – Mirpur Sakro	Sindh	01	05
13	Goth Ismail Mahpar – Mirpur Sakro	Sindh	02	08
14	Goth Muhammad Hasan Khaskheli – Mirpur Sakro	Sindh	03	14
15	Goth Allah Dino Mahpar – Mirpur Sakro	Sindh	03	14
16	Hot Khan – Gharo	Sindh	02	10
17	Goth Sher Muhammad Hamaiti – Gujjo	Sindh	10	48
18	Goth Daandaari – Ghorabari	Sindh	40	250
19	Goth Lukman – Ghorabari	Sindh	04	20
20	Goth Sammo – Ghorabari	Sindh	04	19
21	Goth Ali Hasan Paareri – Ghorabari	Sindh	01	120
TOTAL			85	580

S #	Name of Village and District	Province	No. of Installed solar panel/ wind turbines	No. of houses electrified
22	Goth Meer Isa – Kund Malir, Lasbela	Balochistan	01	03
23	Goth Ramzan – Kund Malir, Lasbela	Balochistan	02	15
24	Goth Haji Sher Muhammad – Kund Malir, Lasbela	Balochistan	05	35
25	Goth Yaaqob – Kund Malir, Lasbela	Balochistan	02	18
26	Goth Mir Abdullah – Kund Malir, Lasbela	Balochistan	01	08
27	Goth Haji Washi/Daghari – Kund Malir, Lasbela	Balochistan	04	32
TOTAL			15	111
28	Government of Balochistan*	Balochistan	39	

Source: AEDB

* To be installed as per the direction and advice of the I&P Department, Balochistan

Nuclear Power Plants:

The Ordinance for establishment of Pakistan Atomic Energy Commission (PAEC) was promulgated on 27th May, 1965 later approved by National Assembly on 21st July 1965. PAEC, inter alia, undertakes the projects of nuclear power plants' development, operation and maintenance. First Nuclear Power Plant (KANUPP) of 137MW was started in 1966 at Karachi and it was commissioned in 1971 while the construction of Pakistan's second nuclear power plant started in 1992 with the help of China. The plant was connected to the national grid on June 13, 2000. It has a gross capacity of 325MW and is located at Chashma. The Pakistan Atomic Energy Commission operates both the nuclear power plants. During 2005-06, nuclear power provided about 4.53 percent of electricity generation in the country. Pakistan is currently working on a third nuclear power plant (Chashma-2), with the help of China National Nuclear Corporation. The plant will have 340MW of installed capacity and expected to be completed by 2009.

Available Power Generation Capacity:

Like hydro capacity which varies with reservoir levels and water inflows, capability of thermal generation units also varies, due to their age, auxiliary consumption, fuel (gas) availability (nine months) and site conditions. Table 23 shows availability of different power plants (technology wise) against their installed capacity.

TABLE 23
Available Power Generation Capacity (June 2006)

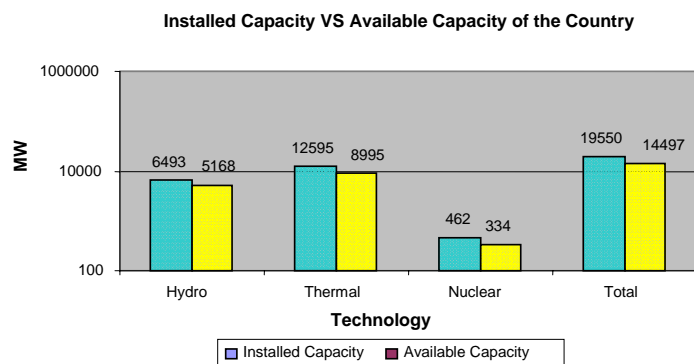
		Hydro	Thermal*	Nuclear	Total
Installed Capacity (MW)	KESC Area	0	2018	137	2155
	Ex-WAPDA Area	6493**	10577	325	17395
	Total	6493	12595	462	19550
Available Capacity (MW)	KESC Area	0	1550	40	1590
	Ex-WAPDA Area	5168#	7445	294	12907
	Total	5168	8995	334	14497
Available: Percent of Installed Capacity	KESC Area	0	76.80	29.19	73.78
	Ex-WAPDA Area	79.96	70.38	90.46	74.19

* Inclusive of IPPs in respective Area

** Inclusive of Hydel IPP of 30MW located in AJK

Availability of WAPDA's Hydel power plants only (Hydel IPP is not included)

Source: NPCC /KESC



The available capacity (annual average) against the installed capacities of hydro, thermal and nuclear power plants, during 2005-06, is shown in Table 10 above.

Economic Load Despatch System:

National Power Control Centre (NPCC), located in Islamabad is responsible for preparing merit order of the power plants operation located in the country except for those which fall in the KESC area. NPCC determines merit order Despatch using present net heat rates of power plants. NPCC is also responsible for coordinating the operation of power plants and 500/220 KV transmission lines and grid stations. NPCC has two regional power control centers one is in the south, located at Jamshoro while other is in the north located at Islamabad. The main function of these regional control centres is to control the operation of 132 kV and 66 kV electric lines. KESC has its own Load Despatch centre located in Karachi through which it operates power plants in accordance with their economic merit order and coordinates operation of its 220, 132 and 66 kV transmission lines and grid stations. Merit order position of power plants in the area of NTDC and KESC area during 2005-06 is given in Tables 24 and 25 respectively.

TABLE 24
Merit Order for Power Generation Plants
Based on the Present Net Heat Rate at 100% Plant Factor (as on June 22, 2006)

S #	Plant Groups	Fuel Type	Fuel Cost Rs/kWh	O&M Cost Rs/kWh	Specific Cost Rs/kWh
1	Uch (Upto 152.375 GWh)	GAS	0.33340*	0.11160	0.44500
2	Liberty (Upto 61.904 GWh)	GAS	0.59565	0.15530	0.75095
3	Lakhra	COAL	0.75798	0.09498	0.85296
4	Altern	GAS	1.03124	0.32132	1.35256
5	Uch (+152.375 GWh)	GAS	1.30510*	0.11160	1.45530
6	Guddu CC 3	R. GAS	1.65871	0.05509	1.71380
7	Guddu CC 1&2	R. GAS	1.73160	0.05509	1.78669
8	Guddu-3 Steam	R. GAS	1.98274	0.04246	2.02520
9	KAPCO-I	GAS	1.91393	0.12423	2.03816
10	Guddu-4 Steam	R. GAS	1.99794	0.04246	2.04041
11	Rousch	GAS	2.01827	0.13121	2.14948
12	HCPC	GAS	1.96284	0.19734	2.16018
13	Guddu CC-3 (OC)	R. GAS	2.11078	0.05329	2.16406
14	Guddu 1-2 Steam	R. GAS	2.17139	0.04246	2.21385
15	KAPCO-II	GAS	2.09926	0.14532	2.24458
16	Guddu CC 1&2 (OC)	R. GAS	2.19355	0.05329	2.24684
17	FKPCL	GAS	1.99507	0.35071	2.34578
18	Muzaffargarh-4	GAS	2.35890	0.01747	2.37637
19	GTPS Kotri CC	GAS	2.36291	0.03319	2.39609
20	Muzaffargarh 1-3	GAS	2.38820	0.01747	2.40566

S #	Plant Groups	Fuel Type	Fuel Cost Rs/kWh	O&M Cost Rs/kWh	Specific Cost Rs/kWh
21	GTPS Faisalabad CC	GAS	2.37041	0.03813	2.40854
22	KAPCO-III	GAS	2.17116	0.28010	2.45126
23	Muzaffargarh 5-6	GAS	2.50668	0.01747	2.52414
24	Jamshoro 2-4	GAS	2.55526	0.04915	2.60441
25	SPS Faisalabad	GAS	3.09813	0.02989	3.12802
26	Liberty (+61.904 GWh)	GAS	2.97827	0.15530	3.13357
27	NGPS Multan 3-4	GAS	3.22018	0.05219	3.27237
28	NGPS Multan 1	GAS	3.25107	0.05219	3.30326
29	GTPS Kotri 3-4 OC	GAS	3.37738	0.03262	3.41001
30	GTPS Kotri 5-6 CC	GAS	3.38832	0.03262	3.42095
31	GTPS Faisalabad OC	GAS	3.41838	0.03757	3.45595
32	Guddu-3 Steam	MIX**	3.45343	0.04246	3.49589
33	Guddu-4 Steam	MIX**	3.47992	0.04246	3.52238
34	GTPS Kotri 1-2 OC	GAS	3.89156	0.03278	3.92435
35	Muzaffargarh-4	MIX**	4.07242	0.01747	4.08989
36	Muzaffargarh 1-3	MIX**	4.12300	0.01747	4.14046
37	Jamshoro 2-4	MIX**	4.20344	0.04915	4.25259
38	Muzaffargarh 5-6	MIX**	4.32754	0.01747	4.34501
39	KAPCO-I	FO	4.53959	0.21550	4.75509
40	Guddu-3 Steam	FO	4.98412	0.04246	4.96658
41	Guddu-4 Steam	FO	4.96189	0.04246	5.00435
42	KAPCO-II	FO	4.98228	0.30334	5.28562
43	SPS Faisalabad	MIX**	5.29899	0.02989	5.32888
44	HUBCO	FO	5.28737	0.07983	5.36720
45	Japan Power	FO	5.10446	0.26570	5.37016
46	AES Pak-Gen	FO	5.34158	0.07993	5.42151
47	SEPCOL	FO	5.05852	0.40782	5.46634
48	KEL	FO	5.16939***	0.31580	5.48519
49	Jamshoro-1	FO	5.45927	0.04915	5.50842
50	NGPS Multan 3-4	MIX**	5.47334	0.05219	5.52553
51	AES Lal-Pir	FO	5.49158***	0.07993	5.57151
52	NGPS Multan 1	MIX**	5.52584	0.05219	5.57803
53	Saba Power	FO	5.50680	0.08030	5.58710
54	Muzaffargarh 4	FO	5.78594	0.01747	5.80341
55	Muzaffargarh 1-3	FO	5.85780	0.01747	5.87526
56	Jamshoro 2-4	FO	5.85163	0.04915	5.90078
57	Muzaffargarh 5-6	FO	6.14840	0.01747	6.16587
58	KAPCO-I	HSD	6.80023	0.12492	6.92515
59	SPS Faisalabad	FO	7.49984	0.02989	7.52973
60	KAPCO-II	HSD	7.46333	0.16795	7.63128
61	NGPS Multan 3-4	FO	7.72650	0.05219	7.77869
62	NGPS Multan 1	FO	7.80061	0.05219	7.85280
63	KAPCO-III	HSD	7.71867	0.42413	8.14280

* Includes an excise duty @ Rs.0.03860 per kWh ** 50% FO 50% GAS *** Includes a premium value @ Rs.0.15 per kWh
Note: Cost of Ex-WAPDA Thermal Plants is based on 100% Plant Factor & cost of IPPs is as per PPA

Source: National Power Control Centre

Table 24 shows the merit order Despatch position during 2005-06. The merit order Despatch is based on the present net heat rate. Like 2004-05, the Uch & Liberty remained the 1st and 2nd economical plants during 2005-06.

TABLE 25
Merit Order - KESC
(Based on the Present Net Heat Rate at 100% Plant Factor)

Plant Groups	Fuel Type	Fuel Cost Rs/kWh	O&M Cost Rs/kWh	Total Cost Rs/KWh
Thermal				
Bin Qasim Thermal Power Station	Gas/F. Oil	3.350	0.263	3.613
Korangi Thermal Power Station	Gas/F. Oil	4.007	0.273	4.280
Gas Turbines				
SITE Gas Turbines	Gas/HSDO	3.835	0.221	4.056
Korangi Gas Turbines	Gas/HSDO	3.888	0.240	4.128

Source: KESC

Merit order criteria arrange the power plants according to the total cost (Rs/kWh). BQPTS & KTPS are base load operation plants whereas other plants are also under same mode of operation during the summer season.

ELECTRICITY TRANSMISSION

National Transmission and Despatch Company:

National Transmission and Despatch Company (NTDC) was incorporated in 1998 under the Companies ordinance of 1984 and was granted Transmission Licence by NEPRA in December 2002. Under the licence, NTDC has been given an exclusive right to transmit electricity at 220 kV and above voltage levels in whole of the country excluding the area of KESC. NTDC owns 500 kV, 220 kV and some 132 kV Transmission lines and Grid station in its territory. Pursuant to its transmission licence NTDC is required to establish the following:

- i) "Central Power Purchasing Agency (CPPA)" for the procurement of power on behalf of the Ex-WAPDA DISCOs,
- ii) "System Operator" to carryout the job of Despatching of plants and provision of balancing services,
- iii) "Transmission Network Operator" for the operation and maintenance of the transmission system including planning, design and capacity expansion of its transmission system, generation expansion, least cost planning and siting of new generation facilities,
- iv) "Contract Registrar and Power Exchange Administrator (CRPEA)" to look after bi-lateral trading contracts of generation licensees with Bulk Power Consumers (BPCs)/distribution companies.

The integrated transmission system of NTDC comprises of 500 kV and 220 kV transmission network running from hydro power stations in the north to Jamshoro and HUBCO in the south of the country. NTDC is operating and maintaining about 4486 and 6993 circuit kilometer of 500 kV and 220 kV transmission lines respectively. NTDC is also maintaining ten (10) 500 kV grid stations and twenty seven (27) 220 kV grid stations.

Transmission and Grid Station Expansion Plan:

To evacuate power from up-coming power plants, NTDC is working on the development and expansion of its transmission and grid stations system. Table 26 shows transmission and grid station expansion plans and corresponding investment requirements.

TABLE 26
Power Sector Investment Plan (NTDC)

(Million Rs.)

S #	Name of Project	Transmission Line		Capacity (MVA)	Expected COD	Estimated Cost
		Voltage Level (kV)	Line Length (km)			
1	500kV Muzaffargarh-Gatti T/L and substation extension at either end	500	280	500/220kV 1x600	31-12-2007	6771.00
2	Provision of secured metering system at delivery points between electric supply companies	--	--	--	2006-07	1009.00
3	Transmission scheme for dispersal of power from Neelum Jhelum Hydro Power Project	500	(110+235)	--	2011-12	11216.00
4	Feasibility study for import of power from Tajikistan to Pakistan	--	--	--	2007-08	173
5	Transmission scheme for dispersal of power from 2x50MW wind mill power plant at Mirpur Sakro	132	(60+15)	-	2006-07	815.68
6	Feasibility study for power Transmission Enhancement Project	--	--	--	2006-07	40.50

Source: National Transmission and Despatch Company

Transmission and Grid Station System in KESC Area:

KESC is operating and maintaining its own transmission system. Its application for Special Purpose Transmission Licence (SPTL) is currently being processed by NEPRA. KESC system is connected to the national grid through a 220 kV double circuit and two 132 kV links. 220 kV transmission system of KESC consists of 302 circuit kilometres (overhead) and 16 Kilometers (underground) while the length of 132 kV transmission lines in KESC area is around 1378 circuit kilometres (overhead) and 88 kilometers underground. KESC is also maintaining 66 kV lines (194 kilometers overhead and 3 kilometers underground) in its system. The details of transmission lines and grid station, operated and maintained by KESC are shown in Table 27. Transmission line investment plan for year 2007-08 to 2008-09 is given in Table 28 while transmission and grid station expansion plans of KESC are shown separately in the Tables 29 and 30 respectively.

TABLE 27
Status of Lines and Grid Stations under KESC (As on June 30, 2006)

	LINES (Km)							GRID STATIONS (NOs.)				
	220 kV	132 kV	66 kV	33 kV	11 kV	LT	Total	220 kV	132 kV	66 kV	33 kV	Total
Overhead Lines	302	1378	188	NA	6287	NA	8155	6	40	6	0	52

Source: KESC

TABLE 28
Transmission Line Investment Plan of KESC

(In million US\$)

DESCRIPTION	2007-08			2008-09			TOTAL (2007-2009)		
	FC	LC	Total	FC	LC	Total	FC	LC	Total
Grid Station	63.17	15.79	78.96	27.9	6.98	34.88	91.07	22.77	113.84
Transmission	73.152	18.288	91.44	8.02	2.005	10.025	81.172	20.293	101.465
SCADA	14.42	7.93	22.35	--	--	--	14.42	7.93	22.35
Reinforcement	20.93	5.23	26.167	2.016	0.504	2.52	22.946	5.734	28.687
Total	171.672	47.24	218.917	37.936	9.489	47.425	209.608	56.730	266.342

Note: Local currency has been converted in equivalent US\$ at an exchange rate of 1 US\$ = Rs.60/=

Source: KESC

TABLE 29
Transmission Lines Expansion Plan of KESC (2007-2010)

UNDERGROUND CABLE LINKS	ESTIMATED LENGTH (ROUTE) (KM)	EXPECTED DATE OF COMPLETION
2007-08	52.9	June 2008
2008-09	25	June 2009
2009-10	7	June 2010
OVERHEAD TRANSMISSION LINE	ESTIMATED LENGTH (ROUTE) (KM)	EXPECTED DATE OF COMPLETION
2007-08	45	June 2008
2008-09	20	June 2009
2009-10	29.7	June 2010

Source: KESC

TABLE 30
Grid Stations Expansion Plan of KESC (2007-2010)

NEW GRID STATION	CAPACITY MVA (132/11KV)	CAPACITY MVA (220/132KV)	EXPECTED DATE OF COMPLETION
2007-08	6x40 = 240MVA	2x250 = 500MVA	June, 2008
2008-09	11x40 = 440MVA	2x250 = 500MVA	June, 2009
2009-10	10x40 = 400MVA	4x250 = 1000MVA	June, 2010
EXTENSION			
2207-08	--	3x250 = 750MVA	June, 2008
2008-09	--	--	--
2009-10	--	--	--
ADDITION/REINFORCEMENT OF TRANSFORMERS AT EXHAUSTIVE GRID STATIONS	CAPACITY MVA (132/11KV)	CAPACITY MVA (220/132KV)	EXPECTED DATE OF COMPLETION
Old Town	40MVA	--	August, 2007
West Wharf	40MVA	--	August, 2007
Mauripur	40MVA	--	15 th May, 2007

Source: KESC

ELECTRICITY DISTRIBUTION

Ex-WAPDA Distribution Companies:

The electricity to approximately 16 million consumers of the entire country excluding KESC area is being supplied through nine distribution companies. While consumers in the city of Karachi and its adjoining area in the Balochistan province are being supplied through KESC's distribution network. These nine distribution companies were established through restructuring and unbundling of the power wing of Water and Power Development Authority (WAPDA). The details of unit purchased, sold and losses incurred in each DISCO are given in Table 31.

Distribution network consists of 132kV lines and grid stations and lower voltage capacities and relevant distribution company is responsible for constructing, operating and maintaining power distribution facilities within its dedicated area. The total number of grid stations and total length of distribution lines, of each individual DISCO as on June 30th 2006, are shown in Table 32.

End users are classified as residential, commercial, industrial, agricultural and bulk consumers. Category wise details about consumers for individual DISCO are given in Table 33.

TESCO was not envisaged in the earlier plan for restructuring of WAPDA, however, later in 2003 TESCO has been created as public limited company incorporated in Pakistan under Section 32 of the Companies Ordinance, 1984.

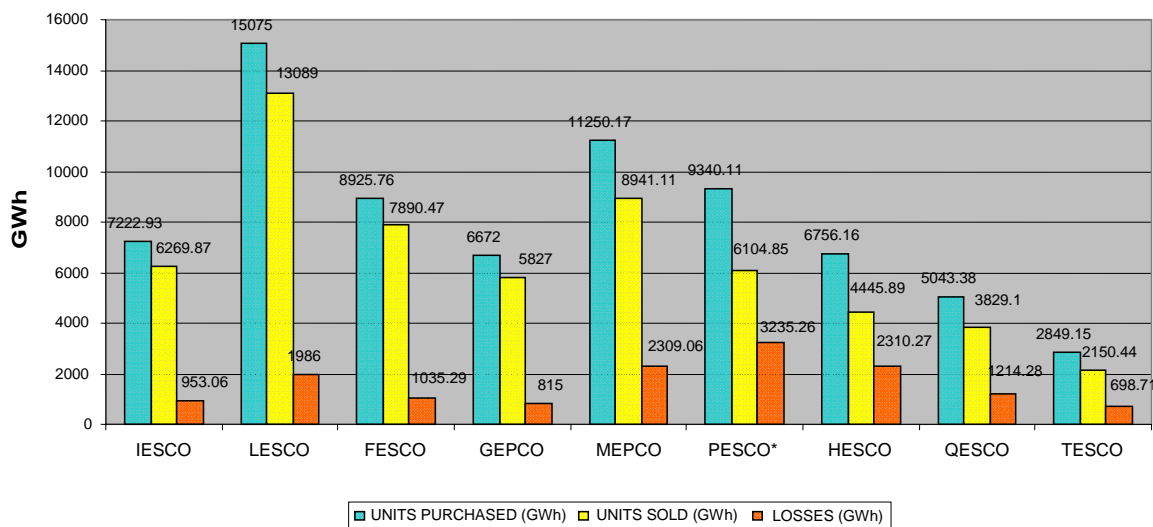
TESCO has applied to NEPRA for a distribution licence, for an area which comprises of seven agencies namely Khyber, Orakzai, Kurram, Bajaur, Mohmand, North Waziristan and South Waziristan in FATA and six other regions. TESCO has been formed after carve out from PESCO. The distribution licence application of TESCO is still being processed by NEPRA; however, this report separately shows PESCO and TESCO statistics.

TABLE 31
Units Purchased, Supplied and Losses of Ex-WAPDA DISCOs (2005-06)

Name of DISCO	Units Purchased (GWh)	Units Sold (GWh)	Losses	
			GWh	%
IESCO	7222.93	6269.87	953.06	13.19
LESCO	15075.00	13089.00	1986.00	13.17
FESCO	8925.76	7890.47	1035.29	11.60
GEPCO	6672.00	5827.00	845.00	12.66
MEPCO	11250.17	8941.11	2309.06	20.50
PESCO	9340.11	6104.85	3235.26	34.60
TESCO	2849.15	2150.44	698.71	24.52
HESCO	6756.16	4445.89	2310.27	34.20
QESCO	5043.38	3829.10	1214.28	24.07

Source: Ex-WAPDA DISCOs

Units Purchased, Supplied and Losses of Ex-WAPDA DISCOs (2005-06)



Above figures and graph show the purchase, sale and distribution losses of electrical energy occurred in each Ex-WAPDA DISCO. During 2005-06; the highest losses were recorded in PESCO (34.60%) followed by HESCO (34.20%), TESCO (24.52%) QESCO (24.07%), MEPCO (20.50%), IESCO (13.19%), GEPCO (12.66%), LESCO (13.17%) and FESCO (11.60%).

TABLE 32
Status of Lines and Grid Stations in Ex-WAPDA DISCOs (As on June 30, 2006)

NAME OF DISCO	LINES (Km)						GRID STATIONS (NOs.)			
	132 kV	66 kV	33 kV	11 kV	Total	LT	132 kV	66 kV	33 kV	Total
IESCO	2251	581	139	18140	21111	20663	48*	11	4	63
LESCO	1700	544	0	22549	24793	13992	71	11	0	82
FESCO	1494	1309	0	30015	32818	18147	45	32	0	77
GEPCO	1682	426	0	17983	20091	15261	37	9	0	46
MEPCO	2764	1479	40	56640	60923	37912	74	30	0	104
PESCO	1776	986	311	28607	31680	39067	57	23	6	86
TESCO	259	3836	280	6864	11239	6368	19	17	0	36
HESCO	5047	2107	0	40813	47967	20146	112	50	0	162
QESCO	3116	345	985	14911	19357	7634	44	11	17	72
Total	20089	11613	1755	236522	269979	179190	507	194	27	728

* Excluding the consumers owned grids

Source: Ex-WAPDA DISCOs

The above Table shows length of distribution lines of different voltage levels in distribution companies. The combined length of HT Lines (132kV–11kV) in all nine (9) Ex-WAPDA DISCOs works out to 269980 circuit Kilometers which is an increase of 17.4% over 2004-05. Similarly, the combined total of LT Lines (in all Ex-WAPDA DISCOs) works to 179190 circuit Kilometers, which is an increase of 7.1% over 2004-05. The Table also shows the number of grid stations being maintained and operated by distribution companies.

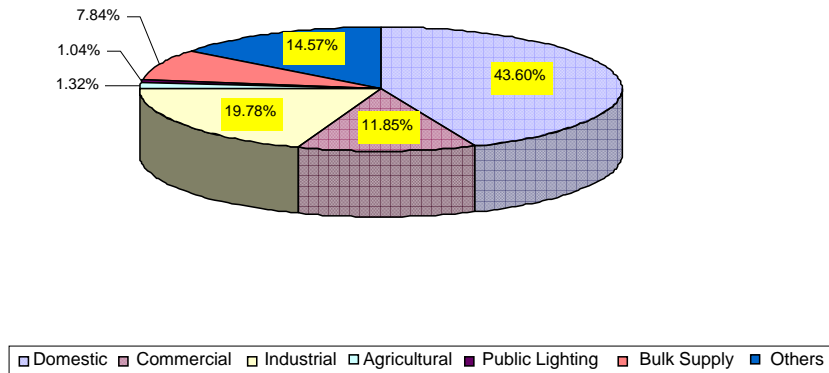
TABLE 33
EX-WAPDA DISTRIBUTION COMPANIES' PROFILES (2005-06)

Islamabad Electric Supply Company Limited (IESCO)

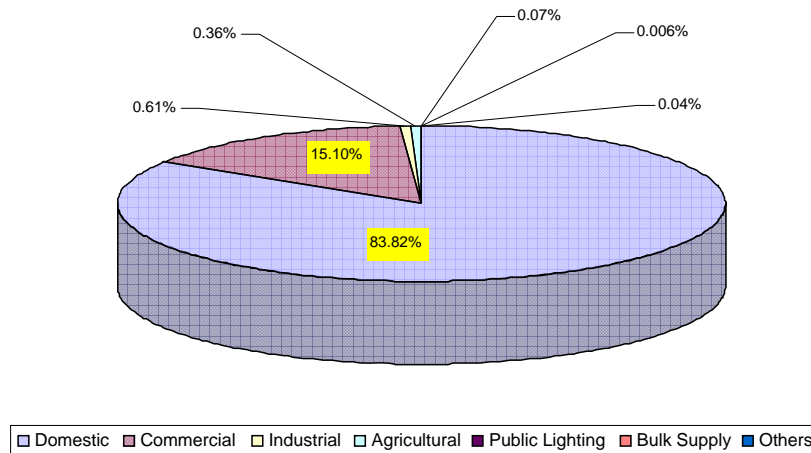
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	2733.445	43.60	1398393
Commercial	742.761	11.84	251872
Industrial	1240.267	19.78	10189
Agricultural	82.751	1.32	5944
Public Lighting	65.407	1.04	1170
Bulk Supply	491.543	7.84	730
Others	913.691	14.57	113
Total	6269.865	100	1668411

Source: Islamabad Electric Supply Company Limited (IESCO)

Islamabad Electric Supply Company Limited (IESCO)
Consumption Share of Individual Category



Islamabad Electric Supply Company Limited (IESCO)
No. of Consumers of Individual Category

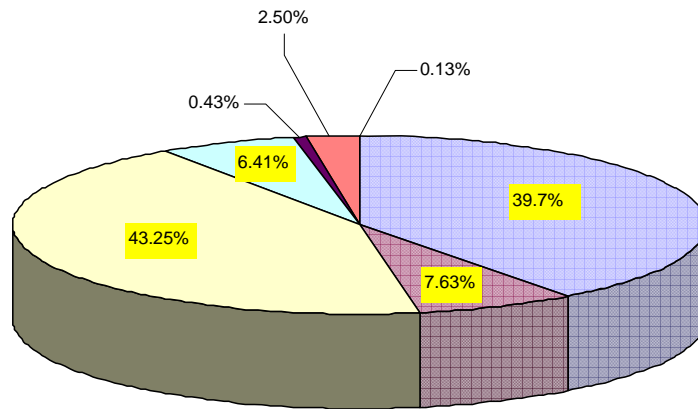


Lahore Electric Supply Company Limited (LESCO)

Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	5190	39.7	2118372
Commercial	999	7.6	420151
Industrial	5661	43.2	56000
Agricultural	839	6.4	41152
Public Lighting	56	0.4	1340
Bulk Supply	327	2.5	475
Others	17	0.1	185
Total	13089	99.9	2637675

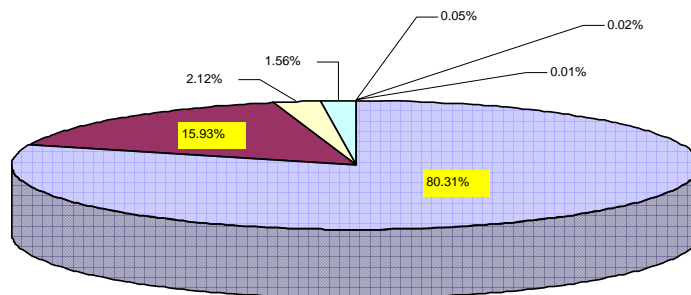
Source: Lahore Electric Supply Company Limited (LESCO)

Lahore Electric Supply Company Limited (LESCO)
Consumption Share of Individual Category



Domestic
 Commercial
 Industrial
 Agricultural
 Public Lighting
 Bulk Supply
 Others

Lahore Electric Supply Company Limited (LESCO)
No. of Consumers of Individual Category



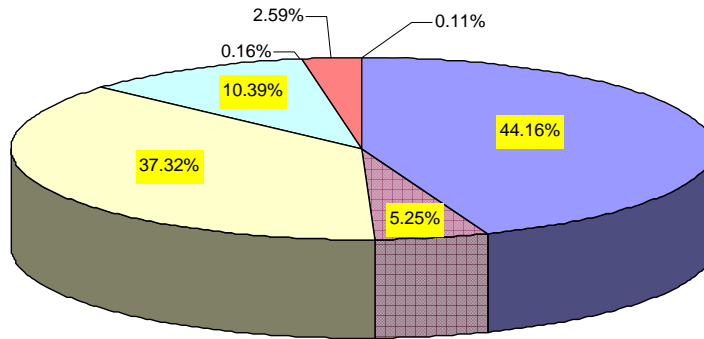
Domestic
 Commercial
 Industrial
 Agricultural
 Public Lighting
 Bulk Supply
 Others

Faisalabad Electric Supply Company Limited (FESCO)

Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	3484.77	44.16	1951817
Commercial	414.50	5.25	257015
Industrial	2945.09	37.32	33330
Agricultural	820.03	10.40	24956
Public Lighting	12.88	0.16	1069
Bulk Supply	204.36	2.60	176
Others	8.84	0.11	81
Total	7890.47	100.00	2268444

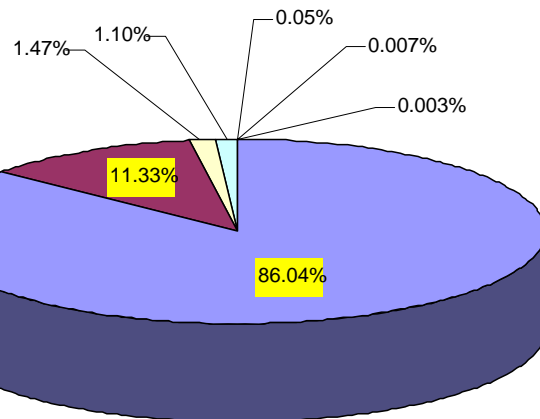
Source: Faisalabad Electric Supply Company Limited (FESCO)

**Faisalabad Electric Supply Company Limited (FESCO)
Consumption Share of Individual Category**



■ Domestic ■ Commercial □ Industrial □ Agricultural ■ Public Lighting ■ Bulk Supply ■ Others

**Faisalabad Electric Supply company Limited (FESCO)
No. of Consumers of Individual Category**



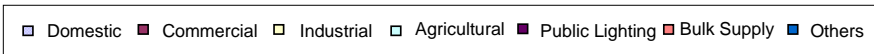
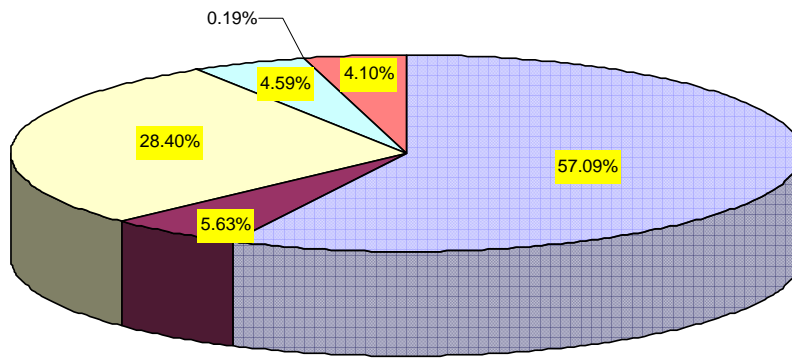
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Gujranwala Electric Power Company Limited (GEPCO)

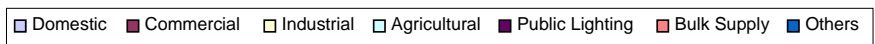
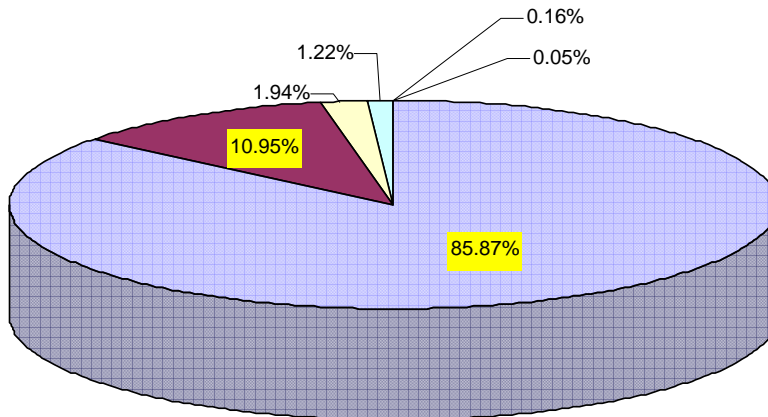
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	3326.8	57.1	1782981
Commercial	328	5.6	227379
Industrial	1655.2	28.4	40271
Agricultural	267.4	4.6	25362
Public Lighting	10.8	0.2	341
Bulk Supply	239.1	4.1	119
Others	0	0	0
Total	5827.3	100	2076453

Source: Gujranwala Electric Power Company Limited (GEPCO)

Gujranwala Electric Power Company Limited (GEPCO)
Consumption Share of Individual Category



Gujranwala Electric Power Company Limited (GEPCO)
No. of Consumers of Individual Category

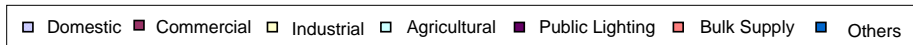
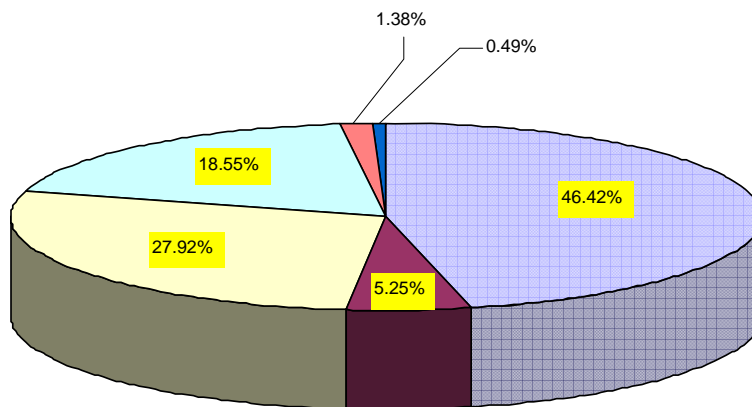


Multan Electric Power Company Limited (MEPCO)

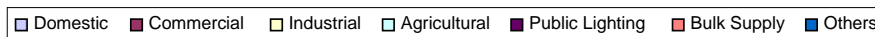
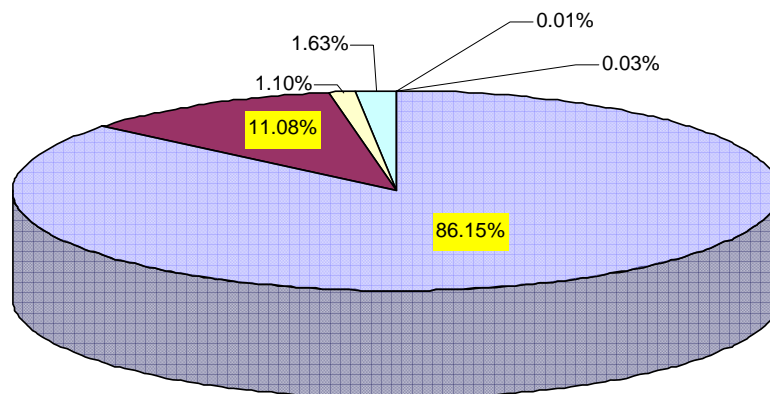
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	4150	46.41	2623853
Commercial	469	5.25	337352
Industrial	2496	27.92	33370
Agricultural	1659	18.55	49531
Public Lighting	0	0.00	0
Bulk Supply	123	1.38	369
Others	44	0.49	1049
Total	8941	100	3045524

Source: Multan Electric Power Company Limited (MEPCO)

Multan Electric Power Company Limited (MEPCO)
Consumption Share of Individual Category



Multan Electric Power Company Limited (MEPCO)
No. of Consumers of Individual Category

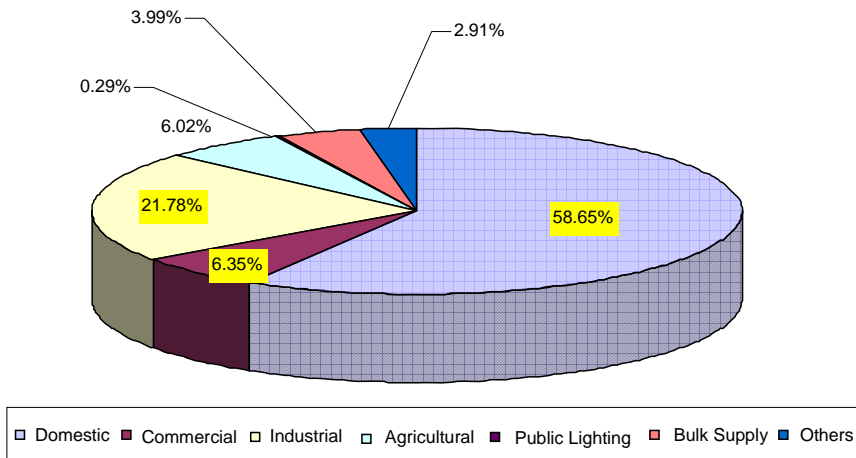


Peshawar Electric Supply Company Limited (PESCO)

Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	3580.53	58.7	1856684
Commercial	387.48	6.3	234878
Industrial	1329.38	21.8	21938
Agricultural	367.71	6.0	24038
Public Lighting	17.99	0.3	738
Bulk Supply	243.88	4.0	794
Others	177.87	2.9	68
Total	6104.84	100	2139138

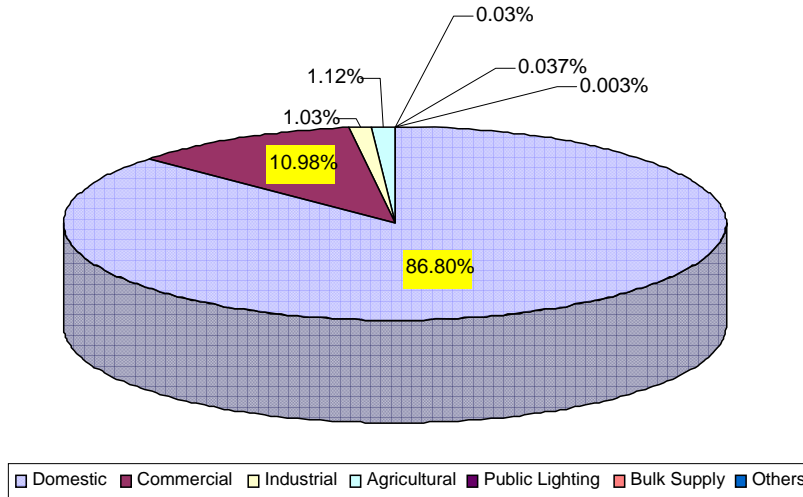
Source: Peshawar Electric Supply Company Limited (PESCO)

Peshawar Electric Supply Company Limited (PESCO)
Consumption Share of Individual Category



Peshawar Electric Supply Company Limited (PESCO)

No. of Consumers of Individual Category

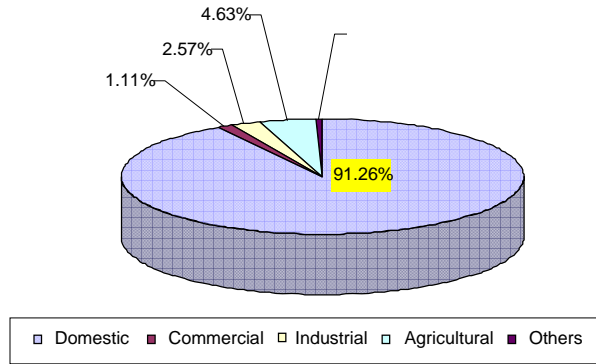


Tribal Area Electric Supply Company Limited (TESCO)

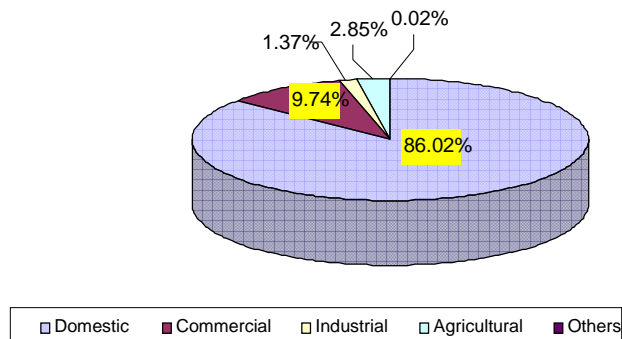
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	1634.80	91.25	249112
Commercial	19.80	1.11	28211
Industrial	45.95	2.57	3960
Agricultural	82.92	4.63	8258
Public Lighting	0.00	0.00	0
Bulk Supply	0.00	0.00	0
Others	7.80	0.44	56
Total	1791.27	100	289597

Source: Tribal Area Electric Supply Company Limited (TESCO)

Tribal Area Electric Supply Company Limited (TESCO)
Consumption Share of Individual Category



Tribal Area Electric Supply Company Limited (TESCO)
No. of Consumers of Individual Category

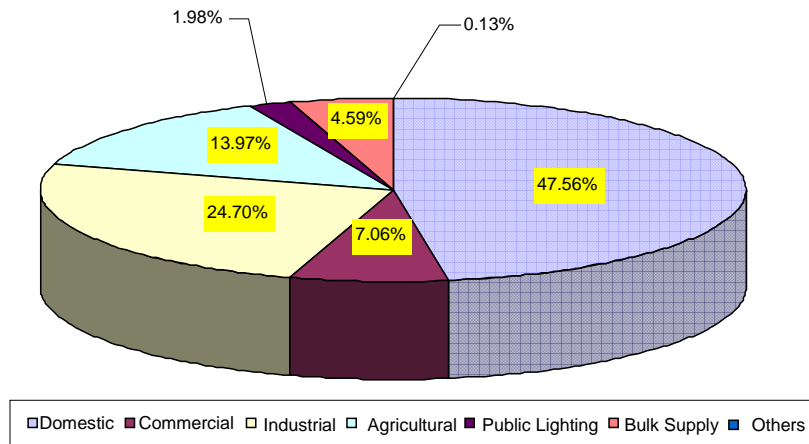


Hyderabad Electric Supply Company Limited (HESCO)

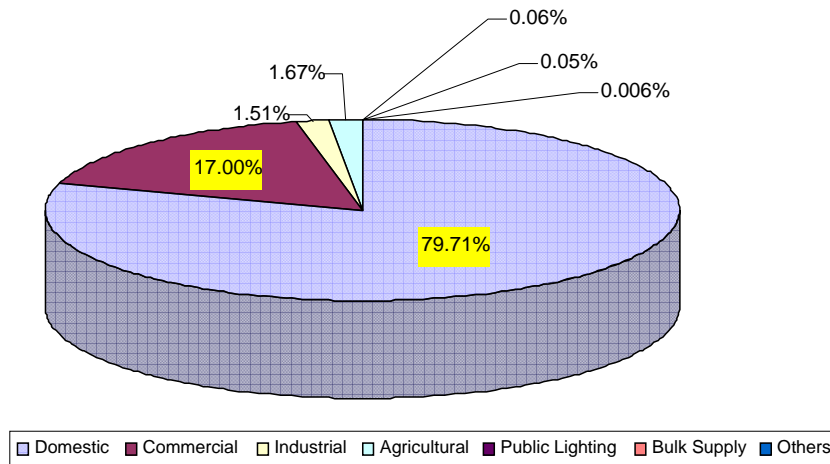
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	2114	47.54	1085917
Commercial	314	7.06	231576
Industrial	1098	24.70	20512
Agricultural	621	13.99	22695
Public Lighting	88	1.98	787
Bulk Supply	204	4.59	726
Others	6	0.14	93
Total	4445	100	1362306

Source: Hyderabad Electric Supply Company Limited (HESCO)

Hyderabad Electric Supply Company Limited (HESCO)
Consumption Share of Individual Category



Hyderabad Electric Supply Company Limited (HESCO)
No. of Consumers of Individual Category

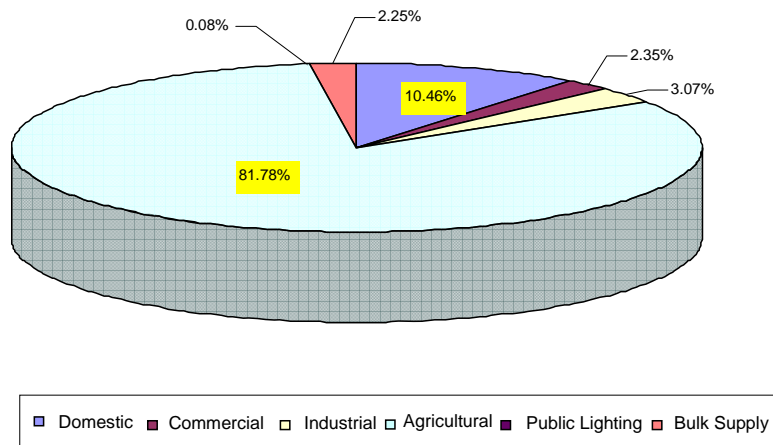


Quetta Electric Supply Company Limited (QESCO)

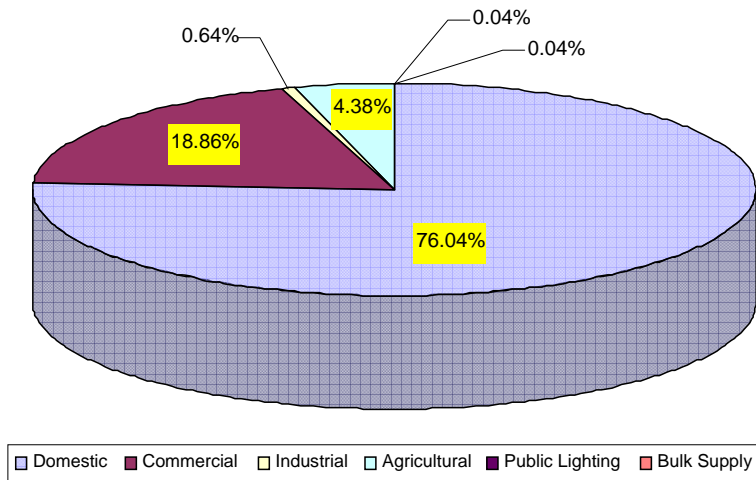
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	400.7	10.4	322102
Commercial	90	2.4	79882
Industrial	117.6	3.1	2711
Agricultural	3131.6	81.8	18565
Public Lighting	3.2	0.1	170
Bulk Supply	86.0	2.2	184
Others	-	-	-
Total	3829.1	100	423614

Source: Quetta Electric Supply Company Limited (QESCO)

Quetta Electric Supply Company Limited (QESCO)
Consumption Share of Individual Category



Quetta Electric Supply Company Limited (QESCO)
No. of Consumers of Individual Category



Electricity Consumption by Economic Groups:

Province wise details about the consumers are given in Tables 34 and 35 while Table 36 shows the average annual consumption per consumer (category-wise). The total electricity consumption by various categories of consumers in KESC and Ex-WAPDA DISCOs are given in Table 37.

TABLE 34
Electricity Consumption by Economic Groups of the Country (2005-06) (GWh)

	Punjab*	Sindh**	NWFP#	Balochistan##	KESC	Total
Domestic	18921.00	2120.63	5566.70	400.66	3759.85	30768.84
Commercial	2953.00	313.54	411.08	89.95	962.16	4729.73
Industrial	13998.00	1098.05	1382.81	117.59	3206.43	19802.88
Agriculture	3668.00	621.91	450.94	3131.57	75.88	7948.30
Public Lights	170.00	87.91	17.99	3.21	73.61	352.72
Bulk Supply	2302.00	208.86	430.51	91.05	745.24	3777.66
Traction/Others	13.00	0.00	0.00	0.00	237.00	250.00
Total	42025.00	4450.9	8260.03	3834.03	9060.17	67630.13
Percent Share	62.14	6.58	12.21	5.67	13.40	100.00

* Islamabad Capital Territory included

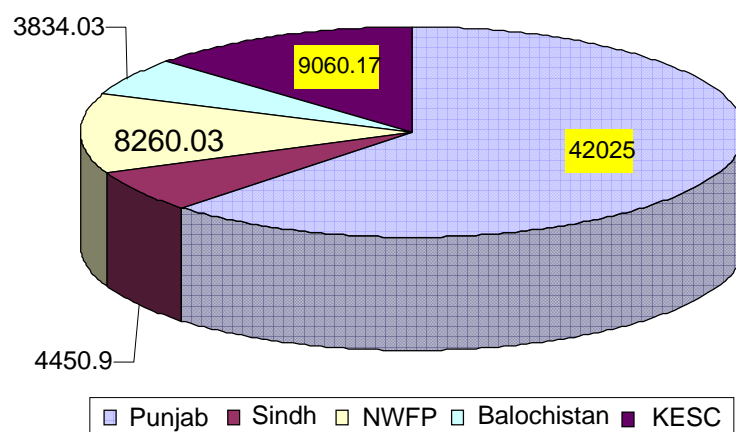
** Consumption in KESC Area not included

FATA included

Area served by KESC not included

Source: Power System Statistics 31st Edition and KESC

Province Wise Electricity Consumption by Economic Group



Above Table and graph show the consumption of electricity by each province and KESC area (customer category wise). The consumption share of Punjab province to the whole country's consumption, during 2005-06 reached upto 62.14% (including Islamabad area) followed by the KESC served area (13.4% including adjoining area of Sindh & Balochistan), NWFP (12.21% including FATA & PATA), Sindh (6.58% excluding area served by KESC) and Balochistan (5.67% excluding the area served by KESC).

TABLE 35
Percentage Electricity Consumption by Economic Groups of the Country (2005-06)
 (%)

	Punjab*	Sindh**	NWFP#	Balochistan##	KESC	Total
Domestic	45.023	47.64	67.40	10.45	41.50	45.50
Commercial	07.026	07.04	04.97	02.34	10.62	07.00
Industrial	33.300	24.67	16.74	03.06	35.40	29.28
Agriculture	08.720	13.97	05.46	81.67	00.83	11.75
Public Lights	00.400	01.97	00.217	00.083	00.81	00.52
Bulk Supply	05.470	04.70	05.21	02.31	08.22	05.58
Others	00.030	00.00	00.00	00.00	02.62	00.37
Total	99.969	99.95	99.99	99.91	100	100

* Islamabad Capital Territory included

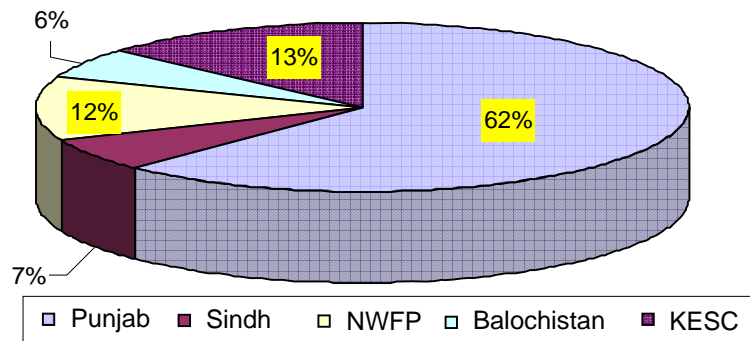
** Consumption in KESC Area not included

FATA included

Area served by KESC not included

Source: Power System Statistics 31st Edition and KESC

Electricity Consumption in Pakistan by Economic Group



Percentage share of electricity consumption by individual customers categories in their respective province and KESC area are shown in the above Table and graph presented thereunder. The data in Table shows that the share of domestic customers in each province is on top except in Balochistan where agriculture sector is consuming 81.06% of the total province's consumption. It is also noted that the consumption share of industrial sector in Balochistan is very low i.e. 3.06% whereas it is the highest in KESC area (35.4%) followed by Punjab (33.3%), Sindh (24.67%) and NWFP (16.74%). The percent consumption share of each group can be taken as an indicator of development of that sector.

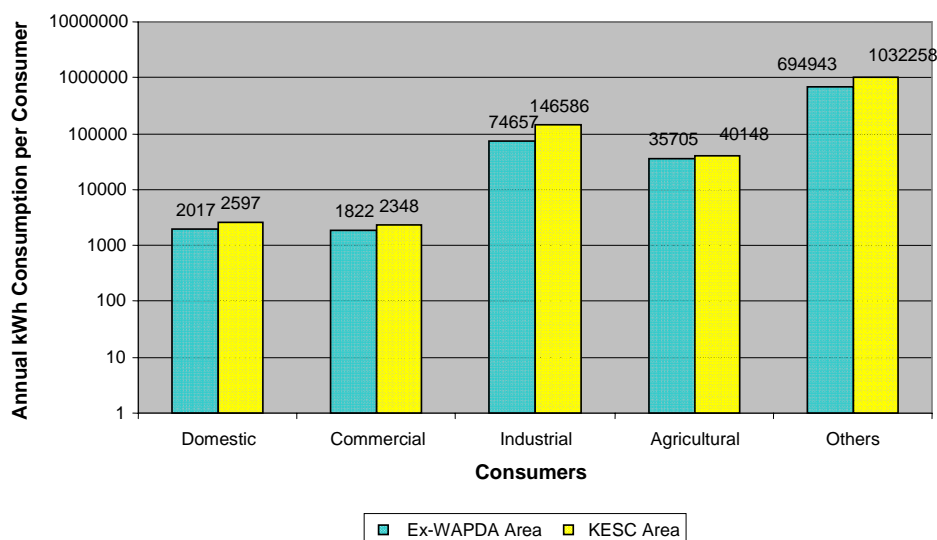
TABLE 36
Electricity Consumption per Consumer

		(kWh)				
Year		Domestic	Commercial	Industrial	Agricultural	Others*
2005-06	Ex-WAPDA Area	2017	1822	74657	35705	694943
	KESC Area	2597	2348	146586	40148	1032258

Sources: Power System Statistics 31st Edition and KESC

* include Bulk Supply, Public Lighting and Traction

Electricity Consumption per Consumer



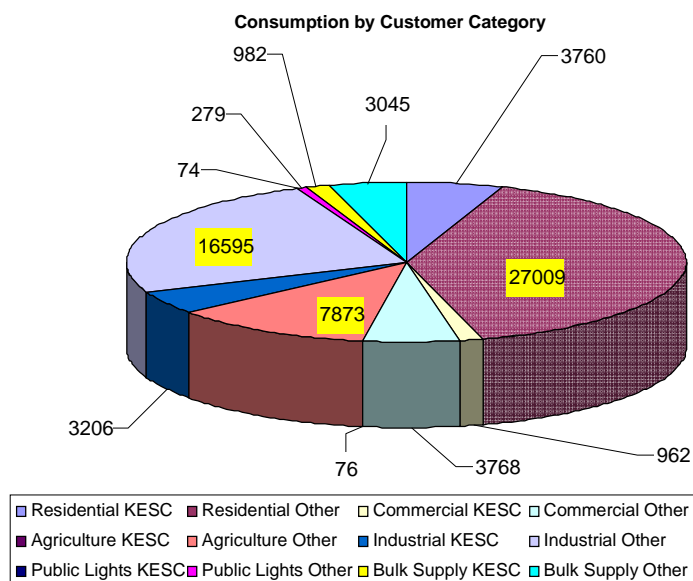
Average annual consumption of electricity per residential consumer in Pakistan (excluding customers served by KESC) is 2017 kWh while for commercial, industrial, agricultural and other consumers this is 1822 kWh, 74657 kWh, 35705 kWh and 69493 kWh respectively.

In KESC area the annual consumption of electricity per residential, commercial, industrial, agricultural and other consumers are 2597 kWh, 2348 kWh, 146586 kWh, 40148 kWh and 1032258 kWh.

TABLE 37
Consumption by Customer Category

Category	Consumption in GWh			Consumption in Percentage		
	KESC	Ex-WAPDA Area	Total	KESC	Ex-WAPDA Area	Total
Residential	3760	27009	30769	41.50	46.11	45.50
Commercial	962	3768	4730	10.62	06.43	07.00
Agriculture	76	7873	7949	0.84	13.44	11.75
Industrial	3206	16595	19801	35.39	28.33	29.25
Public Lights	74	279	353	0.82	00.47	00.57
Bulk supply +Others	982	3045	4027	10.83	05.20	06.00
Total	9060	58569	67629	100	100	100

Sources: Power System Statistics 31st Edition and KESC



Above Table and graph show consumption of electrical energy (in GWh) and percentage share of consumption in different customer categories. The share of residential customers in the total customers of the country during 2005-06 reached 45.50% followed by industrial customers 29.25%, agriculture customers 11.75%, commercial customers 7.01%, bulk supply and other customers 06.0% and public lights 0.57%.

Comparing the figures of 2005-06 with 2004-05, the increasing trend has been noted in all customers' categories except in industrial sector. The decrease in electricity consumption in industrial sector should be a matter of concern.

Investment Plan of Distribution Companies:

Overall, the distribution system of almost all the DISCOs is overstressed and needs to be upgraded and expanded. Substantial investment is required to upgrade the distribution system and accordingly all the distribution companies have prepared their development programs which are being implemented. Table 38 shows investment plan for 2008-12 of the distribution companies.

TABLE 38
Summary of Investment Plan of Ex-WAPDA DISCOs (2008-12)

S #	DISCO	Investment (Rupees in Million)				Total
		Rural Electrification	Expansion/ Development of Power (DoP)	Rehabilitation/ Energy Loss Reduction(ELR)	STG/Grid Expansion	
1	IESCO	900.000	1105.120	1896.780	1749.130	5651.030
2	LESCO	213.000	16226.000	4235.000	22350.000	43024.00
3	FESCO	10800.000	1683.000	1939.000	4123.000	18545.000
4	GEPCO	355.000	7400.000	1922.000	10553.000	20230.000
5	MEPCO	9100.000	1677.000	2580.730	14598.000	27955.730
6	PESCO	491.200	1866.800	3225.200	7397.100	12980.300
7	TESCO	000.000	155.00	45.000	000.000	200.000
8	HESCO	16240.000	1478.961	1745.021	8103.510	27567.495
9	QESCO	1685.115	500.000	604.000	5749.580	8538.695

Source: Ex-WAPDA DISCOs/TESCO

Distribution System of KESC:

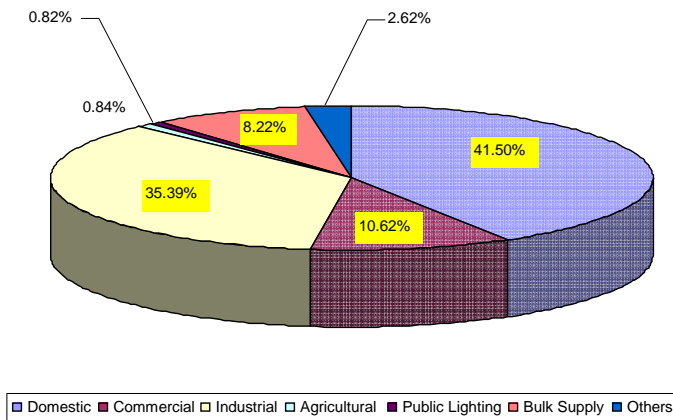
The distribution system of KESC is supplying power to more than 1.88 million consumers; details of which are given in Table 39. The distribution system of KESC comprises of 11 kV and lower voltage capacities. The company is responsible for constructing, operating, and maintaining the power distribution facilities within its area. Table 27 to 30 also provide relevant statistics about KESC.

TABLE 39
KESC: Consumer wise Consumption and Percentage Share

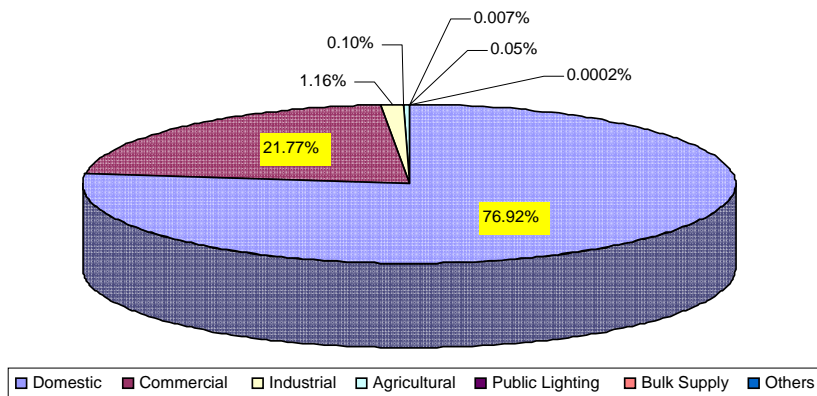
Category	Consumption (GWh)	Percent Share	No. of Consumers
Domestic	3,760	41.50	1,447,728
Commercial	962	10.62	409,723
Industrial	3,206	35.39	21,871
Agricultural	76	0.84	1,893
Public Lighting	74	0.82	138
Bulk Supply	745	8.21	881
Others	237	2.62	4
Total	9,060	100	1,882,238

Source: Karachi Electric Supply Company Limited (KESC)

Karachi Electric Supply Company (KESC)
Consumption Share of Individual Category



Karachi Electric Supply Company (KESC)
No. of Consumers of Individual Category



Rural Electrification:

Pakistan's increasing demand for energy is due in part to its efforts to promote rural electrification. Village electrification promotes installation of agricultural tubewell and small agro based industry. Provision of electricity to all citizens of the country is a social obligation of the State and recently Government has announced an ambitious plan to provide electricity to all the citizens throughout the country at the earliest. Province-wise number of villages electrified upto June 2006 is given in Table 40 while village electrification position in various DISCO including KESC is shown Table 41.

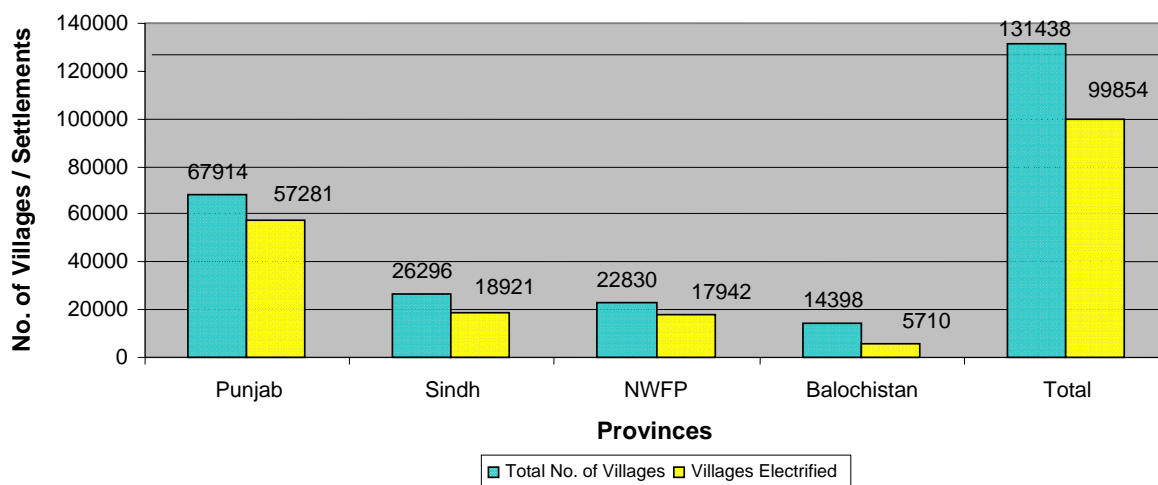
TABLE 40
Province Wise Number of Villages Electrified upto June, 2006

	Punjab	Sindh	NWFP	Balochistan	Total
Total Villages/Settlements ¹	67914	26296	22830	14398	131438
Electrified up to June 2006 ²	57281	18921	17942	5710	99854
Percent of electrification	84.34	71.95	78.58	39.65	75.97

¹ data from State of Industry Report 2006

² data from Power System Statistics 31st Edition

Province Wise Number of Villages Electrified up to July 2006



Upto June 30, 2006, the total number of villages electrified in Pakistan was 99854 which is 75.9% of the total villages in the country i.e 131438. The village electrification share of Punjab province up till 30th June 2006 was 84.34% followed by NWFP 78.58%, Sindh 71.95% and Balochistan 39.65%.

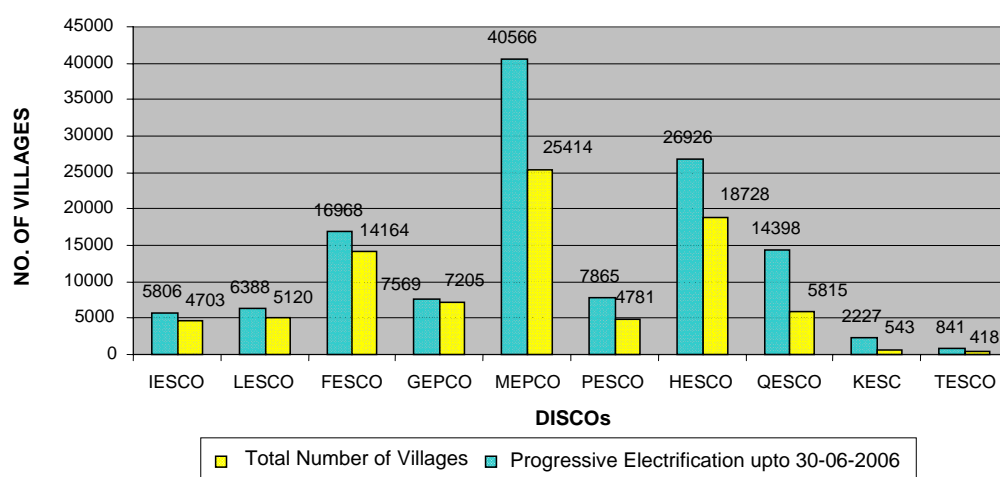
TABLE 41
Village Electrification in all Distribution Companies

DISCOs	Total * Number of Villages	Total Villages Electrified upto 30-06-2005	Villages Electrified during 2005-06	Progressive Electrification upto 30-06-2006	Percent of Total Electrified Villages
IESCO	5806	3479	1224	4703	81
LESCO	6388	4326	794	5120	80.15
FESCO	16968	11664	2500	14164	83.47
GEPCO	7569	6811	394	7205	95.19
MEPCO	40566	21834	3580	25414	62.64
PESCO	7865	2507	2274	4781	60.78
TESCO	841	107	311	418	49.70
HESCO	26926	17646	1082	18728	69.55
QESCO	14398	5053	762	5815	40.38
KESC	2227	508	35	543	24.38

Source: DISCOs /TESCO /KESC /State of Industry Report 2006

* Total number of villages differs from Table 40 due to different source of information.

VILLAGES ELECTRIFIED IN ALL DISCOs



As on June 30, 2006; the position of total electrified villages in each of Ex-WAPDA DISCOs and KESC has been given in the above Table and graph. GEPCO has achieved the highest percentage of electrified villages in its area which is 95.19% followed by FESCO (83.47%), LESCO (80.15%), IESCO (81.0%), HESCO (69.55%), MEPCO (62.64%), TESCO (49.70%), QESCO (40.38%) and KESC (24.38%).

Privatisation of State-held Electric Companies:

The Pakistani government continues to seek reforms in the state-held electric companies. Restructuring of Pakistan's power sector was the formal disintegration of WAPDA. The medium to long term objective is to privatize the public held power producing and distributing companies. As a part of its privatisation plan, the Government of Pakistan has privatized the Karachi Electric Supply Corporation in November, 2005. Now, out of nine Ex-WAPDA Distribution Companies, Faisalabad Electric Supply Company (FESCO) is up for privatisation. Some work was also carried out for PESCO's Privatisation. A number of attempts have also been made for the privatisation of Jamshoro Power Company (one of the GENCOs). Relevant details in respect of above companies such as due diligence reports are available with the Privatisation Commission.

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LIST OF COMPANIES FORMED OUT OF WAPDA UNBUNDLING

COMPANY	DATE OF ISSUING OF LICENCE
<u>GENERATION</u>	
Jamshoro Power Company Limited	01-07-2002
Central Power Generation Company Limited	01-07-2002
Northern Power Generation Company Limited	01-07-2002
WAPDA Hydel Power Stations	03-11-2004
Lakhra Power Generation Company Limited	18-02-2005
<u>TRANSMISSION</u>	
National Transmission & Despatch Company Limited	31-12-2002
<u>DISTRIBUTION</u>	
Islamabad Electric Supply Company Limited	02-11-2001
Lahore Electric Supply Company Limited	01-04-2002
Faisalabad Electric Supply Company Limited	02-04-2002
Gujranwala Electric Supply Company Limited	23-04-2002
Multan Electric Supply Company Limited	25-04-2002
Peshawar Electric Supply Company Limited	30-04-2002
Hyderabad Electric Supply Company Limited	23-04-2002
Quetta Electric Supply Company Limited	30-04-2002
Tribal Area Electric Supply Company Limited	Under process

EX-WAPDA DISTRIBUTION COMPANIES' SERVICE AREA

NAME	SERVICE AREA
Lahore Electric Supply Company Limited (LESCO)	Sheikhupura, Kasur, Lahore, Okara
Gujranwala Electric Power Company Limited (GEPCO)	Gujranwala, Sialkot, Mandi Bahauddin, Hafizabad, Narowal, Gujrat
Faisalabad Electric Supply Company Limited (FESCO)	Faisalabad, Sargodha, Khushab, Jhang, Toba Tek Singh, Bhalwal, Mianwali, Bhakkar
Islamabad Electric Supply Company Limited (IESCO)	Islamabad, Rawalpindi, Attock, Jhelum, Chakwal
Multan Electric Power Company Limited (MEPCO)	Rahim Yar Khan, Multan, Khanewal, Sahiwal, Pakpattan, Vehari, Muzaffargarh, Dera Ghazi Khan, Leiah, Rajan Pur, Bahawalpur, Lodhran, Bahawalnagar
Peshawar Electric Supply Company Limited (PESCO)	Whole Province of NWFP, except Tribal Areas
Hyderabad Electric Supply Company Limited (HESCO)	Whole Province of Sindh, except Karachi and part of Thatta District where KESC is responsible for distribution of power
Quetta Electric Supply Company Limited (QESCO)	Whole Province of Balochistan, except Lasbela where KESC is responsible for distribution of power
Tribal Area Electric Supply Company Limited (TESCO)	Bajaur, Mohmand, Khyber, Orakzai, Kurrum, North Waziristan, South Waziristan, Frontier Region Peshawar, Frontier Region Kohat, Frontier Region Banuu, Frontier Region Tank, Frontier Region Lakki Murwat, Frontier Region Dera Ismail Khan

SOURCES OF INFORMATION

The following sources of information have been used in the compilation of this State of Industry Report 2007:

- i) Alternative Energy Development Board (AEDB)
- ii) Economic Survey of Pakistan
- iii) Ex-WAPDA Distribution Companies
- iv) Irrigation and Power Departments of Provincial Governments
- v) Karachi Electric Supply Corporation (KESC)
- vi) National Power Control Centre (NPCC)
- vii) National Transmission and Despatch Company (NTDC)
- viii) Pakistan Energy Year Book 2005 Hydrocarbon Development Institute of Pakistan
- ix) Private Power and Infrastructure Board (PPIB)
- x) Power System Statistics (Issue 31)
- xi) Sarhad Hydel Development Organization (SHYDO)
- xii) Tariff Petitions submitted to NEPRA by Ex-WAPDA Distribution Companies
- xiii) Water and Power Development Authority (WAPDA)
- xiv) World Development Indicators, the World Bank, and
- xv) Others

ACRONYMS

AEDB	Alternative Energy Development Board
BPC	Bulk Power Consumer
CoD	Commercial Data of Operation
CPPA	Central Power Purchasing Agency
DISCO	Distribution Company
FESCO	Faisalabad Electric Supply Company
GEPCO	Gujranwala Electric Power Company
GENCO	Generation Company
GoP	Government of Pakistan
GWh	Giga Watt per Hour
HESCO	Hyderabad Electric Supply Company
IPP	Independent Power Producers
IESCO	Islamabad Electric Supply Company
KESC	Karachi Electric Supply Corporation
kV	Kilo Volt
kWh	Kilowatt per Hours
LESCO	Lahore Electric Supply Company
MEPCO	Multan Electric Power Company
MW	Mega Watt
NEPRA	National Electric Power Regulatory Authority
NGC	National Grid Company
NTDC	National Transmission and Dispatch Company
PEPCO	Pakistan Electric Power Company
PESCO	Peshawar Electric Supply Company
PPIB	Private Power and Infrastructure Board
QESCO	Quetta Electric Supply Company
WAPDA	Water and Power Development Authority

