NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

State of Industry Report - 2004


بسم الله الرحمن الرحيم

Report

on

STATE OF ELECTRIC POWER INDUSTRY IN PAKISTAN

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

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GLOSSARY OF ABBREVIATIONS

ADB	Asian Development Bank
AJK	Azad Jammu & Kashmir
BOO	Build-Own-Operate
BTU	British Thermal Unit
COD	Commercial Operation Date
CNG	Compressed Natural Gas
DISCO	Distribution Company
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
FATA	Federally Administered Tribal Areas
FO	Furnace/Fuel Oil
FSA	Fuel Supply Agreement
GENCO	Generation Company
GOP	Government of Pakistan
GPA	Gas Purchase Agreement
GSA	Gas Supply Agreement
GST	General Sales Tax
GWh	Giga Watt Hour (Million Kilo Watt Hour)
HOBC	High Octane Blending Component
HSD	High Speed Diesel
HSFO	High Sulphur Fuel Oil
IA	Implementation Agreement
IFC	International Finance Corporation
IPP	Independent Power Producer
IRR	Internal Rate of Return
KESC	Karachi Electric Supply Corporation
kW	Kilo Watt
kWh	Kilo Watt Hour
LDO	Light Diesel Oil
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas (cooking gas)
LSFO	Low Sulphur Fuel Oil
LOI	Letter of Interest
LOS	Letter of Support
LSFO	Low Sulphur Fuel Oil

MKWh	Million Kilo Watt Hour
MMBTU	Million British Thermal Units
MMCFD	Million Cubic Feet per Day
MMCFT	Million Cubic Feet
MPNR	Ministry of Petroleum and Natural Resources
MS	Motor Spirit (Gasoline)
MW	Mega Watt
NEPRA	National Electric Power Regulatory Authority
NWFP	North West Frontier Province
NTDC	National Transmission & Dispatch Company
O&M	Operation & Maintenance
OGDCL	Oil and Gas Development Company Ltd.
OGRA	Oil and Gas Regulatory Authority
PA	Per Annum
PEPCO	Pakistan Electric Power Company
PPA	Power Purchase Agreement
PPIB	Private Power and Infrastructure Board
PSO	Pakistan State Oil (Marketing Company)
RFP	Request for Proposals
Rs or PKR	Pakistan Rupee
SCADA	Supervisory Control And Data Acquisition
SNGPL	Sui Northern Gas Pipeline Company Ltd
SSGC	Sui Southern Gas Company
SRO	Statutory Reversionary Order
TCF	Trillion Cubic Feet
TKC	Turnkey Construction
TONNES	Metric Ton
WAPDA	Water and Power Development Authority
$ or US$	United States Dollar
%	Percent

SOURCES OF INFORMATION

The following sources of information have been used in the compilation of the Report on State of Electric Power Industry in Pakistan:-

i. Tariff Petitions submitted to NEPRA by Generation and Distribution Companies KESC and NTDC.

ii. Tariff Determinations by NEPRA for KESC, NTDC and Generation Companies.

iii. WAPDA Power System Statistics.

iv. KESC.

v. Pakistan Energy Year Book, 2003 by Hydrocarbon Development Institute of Pakistan.

vi. Private Power & Infrastructure Board (PPIB)

vii. The World Bank

viii. Power Technology News Letter (www.power-technology.com).

ix. Economic Survey of Pakistan.

x. Various Web based articles on Pakistan and Power Sector Projects.

Foreword:

As the electricity regulation moves to achieve the desired objective of "safe and economical" provision of electricity, NEPRA complements the initiative by "information disclosure" to create awareness among all stakeholders. Working under a "public accountability" regime, all decisions of NEPRA are consensual with consumer advocacy groups kept privy to all tariff and licensing proceedings. Without a history of independent regulation and with conflicting demands of utility managers, political managers and consumers, a need to educate is strongly felt. To achieve a uniformity of views and to fully realize the potential of the competitive market, NEPRA has been in the forefront of educating all the stakeholders by organizing training workshops. Salient among these are an International Training Program under the South Asia Forum for Infrastructure Regulation (SAFIR) and Financial Modeling Training Course conducted by Macro Consulting, an energy specialist firm based in Argentina.

In the spirit of public accountability and as mandated in NEPRA Act, affairs of electricity companies are being brought to the public forum in one consolidated form. This report is not current as it lists the affairs as of June 30, 2003. Efforts to be more current are being undertaken with collection of electric power statistics on formal and regular basis. This report is an attempt to present the facts and the prognosis based on the exiting condition in the electric power industry.

We at NEPRA are committed to reforming the decision making process. Strong institutions overseeing the commercial pursuits in a transparent decision making regime are essential to ensure sustainable development where entrepreneurs and consumers alike share in enrichment of quality of life through provision of efficient public services. It is our belief that disclosure of information instills discipline among the providers of public goods. A labyrinth of red tape and lack of information in the public domain is expected to gradually erode as both the managements of the infrastructure firms and the consumers learn to trust each other and cooperate to reduce pilferage and improve delivery. With these sentiments this report is published by NEPRA.

Lieutenant General (Retd.) Saeed uz Zafar, HI(M)
Chairman

1. INTRODUCTION

The National Electric Power Regulatory Authority (NEPRA) was created through an Act of Parliament known as the NEPRA Act, (ACT No. XL of 1997), passed by the National Assembly in December 1997. The Act provides the framework for regulation of the electricity sector in Pakistan. Under the terms of the Act, NEPRA as an institution is exclusively responsible for regulating the power sector. NEPRA is responsible for developing as well as implementing the regulatory framework and relevant applicable documents in accordance with requirements and obligations set out in the Act, and in Rules and Licenses developed under the NEPRA Act.

Under the NEPRA Act, NEPRA is envisaged to be an independent and autonomous regulatory institution. Under the Section 42 (b) of the NEPRA Act reproduced hereunder, NEPRA is obligated to produce a State of the Industry Report:

"Section 42. Reports of the Authority:-

(1) The Authority shall submit, to the Council of Common Interests and to the Federal Government, at the end of every financial year, but before the last day of September of that year-

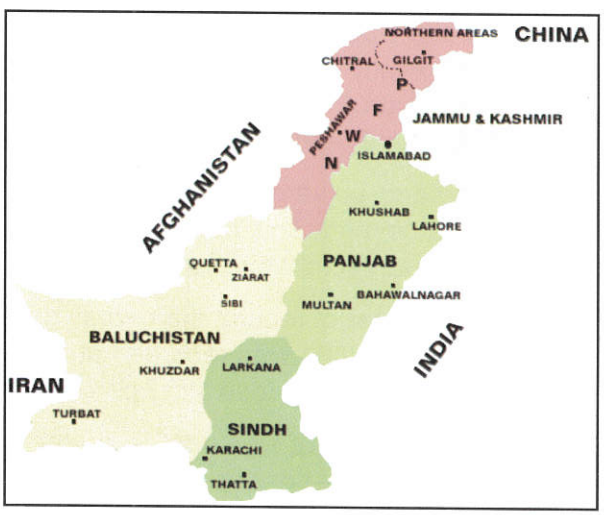
(a) a report on the conduct of its affairs for that year including anticipated developments for the following year; and

(b) a report on the state of electric power services in the country identifying the ownership, operation, management, efficiency and control of electric power facilities, amount of transmission and generation capacity, present and future demand of electricity, cost of electric power services and other matters relating to electric power services."

2. COUNTRY BACKGROUND

The Islamic Republic of Pakistan is located in South Asia, sharing its borders with India in the east, China in the northeast, Iran in the southwest, and Afghanistan in the northwest. The Arabian Sea is Pakistan's southern boundary, with a coastline of 1,064 km.

The country has a total area of 796,095 sq km, about four times the size of the United Kingdom. From Gwadar Bay in its southeastern corner, the country extends more than 1,800 km to the Khunjerab Pass on Chinese border. Pakistan has a population of about 150.7 Million, growing at about 2.1% per annum (July 2003 estimates).



MAP OF PAKISTAN

2.1 Economic Prospects

The 5.1% growth in GDP in 2002-03 was the highest rate recorded since 1995-96.

Pakistan's overall macroeconomic performance remains favourable for the fiscal year 2003-04; IMF's recent (April 2004) review mission has anticipated 5.8 percent GDP growth in current fiscal year 2003-04 and 6 percent in the next fiscal year, subject to continuity in current growth momentum and occurrence of no exogenous shock.

Pakistan's debt situation continues to improve towards sustainable levels. During July-February 2003-04, industrial units have shown 14.19 percent increase in production over the corresponding period of last fiscal year.

Automobile sector led the rally with 68.27 percent increase. Automobile production has gone up from 36,430 units during the first seven months of 2002-03, to 60,673 units in the same period of 2003-04.

An Industries and Production Ministry's statement on industrial production data indicated that cars production went up by 65.90 percent, jeeps 123.83 percent, LCVs 5.69 percent, trucks 7.37 percent, buses 5.67 percent, tractors 51.29 percent and motorcycles 67.37 percent during the first seven months of the 2003-04 fiscal year.

In the case of iron and steel products, growth rates showed upward trend by 9.27 percent.

Glass sheet production increased by 10.66 percent, cement 14.41 percent, bicycles 6.72 percent, motorcycles 17.71 percent and motor tubes 10.80 percent.

In the same period, sugar went up by 20.83 percent, cigarettes 10.32 percent, cotton yarn 2 percent, cotton cloth (mill sector) 13.71 percent and cotton cloth (non-mill sector) 4.98 percent.

Jute goods showed 11.94 percent, sacking 37.25 percent. Paper and board-papers growth increased by 11.84 percent, printing 17.76 percent, writing 9.33 percent, packing 13.33 percent, chip board 0.89 percent, soda ash 3.54 percent and caustic soda 13.21 percent.

Fertilizer-urea production increased by 4.77 percent, ammonium nitrate 10.60 percent, ammonium sulphate (unchanged), nitrogen phosphate 31.29 percent, sodium phosphate 15.66 percent, di ammonium phosphate (unchanged), NPK 14.85 percent, fertilizer nitrogenous 9.88 percent and fertilizer phosphate 98.80 percent.

The same upward trend is expected in the remaining period of the current fiscal year and years beyond. This upward trend is indicative of substantial increase in growth of the industrial sector as well as with exports.

As a matter of record, the overall growth in Large Scale Manufacturing during the 1st Half of FY2004 was recorded at a spectacular 14.7 percent. The comparable growth rate for last year stood at 5.3 percent.

Consumption of electricity is another indicator of economic activity. Economic growth has a strong positive co-relation with electricity consumption. Last year, electricity consumption reached 51922 GWh amounting to a 3.2 percent increase over prior year.

During the year ending June 2003 the electricity consumption reached 54397 Gwh indicating a 4.8% percent increase over the last year, representing increased industrial activity. (Source: WAPDA Statistical Report)

2.2 Investment Climate

As part of an integrated investment promotion strategy, the Government has undertaken a comprehensive programme of radical economic reforms including liberalisation, de-regulation and privatisation, to bring the economy into a full market-oriented system, with the aim of capturing the private sector's potential in all areas of economic activity.

Several sectors are now open to foreign investment, including electric power, telecommunication, highway construction, port development and operations, oil and gas, services/infrastructure, and the social and agriculture sectors. The key features of Pakistan's foreign investment climate include:

Relaxation of foreign exchange controls, and a general policy of permitting foreign investors to participate in local projects on a 100% equity basis in various sectors (including the electricity sector);

Allowing of foreign companies registered in Pakistan to undertake export and import trade;

Safeguards to protect foreign investment;

Withdrawal of work permits restrictions on expatriate managers and technical personnel working in industrial undertakings and easing of remittance restrictions;

Abolition of the ceiling on payments of royalties and technical fees;

Elimination of the requirement of obtaining a "No Objection Certificate" from the appropriate provincial government.

The Government of Pakistan is committed to providing full protection to foreign investment. Foreign investors are allowed to participate under the same procedures as the local investors in the bidding process for projects that are to be privatised.

Exemptions or relief from import duties have also been allowed on imported plant and machinery that are not manufactured locally, to keep Pakistan competitive in the international market.

2.3 Privatisation Programme of the Power Sector

Since the privatisation process began in 1988, all sectors of the economy have become open to private sector investment including the electric power sector.

Kot Addu Power Plant (1,638MW) was the first one to be privatised and was transferred to the private sector management in 1996 with initial shareholding of 26% and current shareholding of 36% held by National Power of UK and 64% by GOP/WAPDA.

The present Government accelerated the privatisation programme by resolving the outstanding disputes with the IPPs. The lifting of the G-7 economic sanctions in 2001 further helped investor confidence. The present Government made privatisation a

cornerstone of its new economic policy, aggressively pursuing the privatisation of several well-known power sector companies in Pakistan, including the strategic sales of the Karachi Electric Supply Corporation (KESC), Jamshoro Power Generation Company, Faisalabad Electric Supply Company (FESCO) and Peshawar Electric Supply Company (PESCO).

3 ELECTRICITY SECTOR IN PAKISTAN

3.1 Overview

Electricity constitutes one of the most important components of infrastructure and plays a key role in national growth and development. With only about half of nearly 150.7 million people (July 2003 population estimate) having access to electricity, a huge population base provides an ideal opportunity for expansion of electricity generation, transmission and distribution. The growing pace of urbanization and industrialization also puts a premium on demand for electricity.

Presently, the combined generation capacity available in the public and private sector is sufficient to meet the future power demand up to year 2004-05. However, it would require augmentation during the subsequent years.

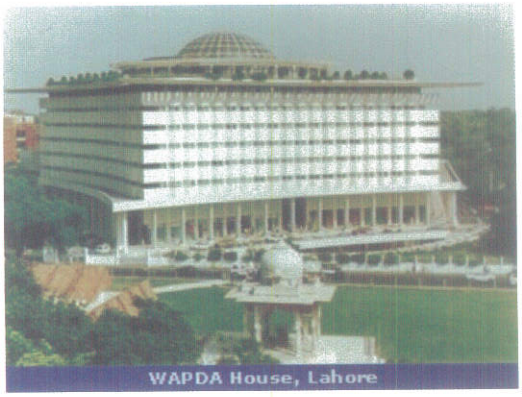
In view of the long lead-time required to bring new power plants on line, particularly those based on hydro, work on new indigenous fuel based power projects has to be started forthwith.

3.2 General Background

The power sector in Pakistan has historically consisted of two major state-owned utilities, the Water & Power Development Authority (WAPDA) and Karachi Electric Supply Corporation (KESC). These two utilities have operated independent of each other, except for a 220 kV double circuit and two 132 kV links. Together, they have been responsible for power generation, transmission and distribution to more than 15 million consumers in the country. Both WAPDA and KESC are controlled by the Ministry of Water and Power. Approximately 95% of the grid system is operated by WAPDA and the balance by KESC.

3.3 WAPDA

WAPDA was established in 1958 for the integrated maintenance of water and power resources, as well as controlling soil salinity and water logging.



WAPDA House, Lahore

Recent reforms have led to the unbundling of WAPDA's Power Wing into separate generation, transmission, and distribution companies. The total WAPDA system accounted for an installed generation capacity of 15,820 MW including 56 MW of isolated system installed at Pasni and Panjgoor, IPPs

and nuclear plants with a customer base of about 13.32 million in June 2003. Accounted for an installed generation capacity of 15,820 MW including 56 MW of isolated system installed at Pasni and Panjgoor, IPPs and nuclear plants with a customer base of about 13.32 million in June 2003.

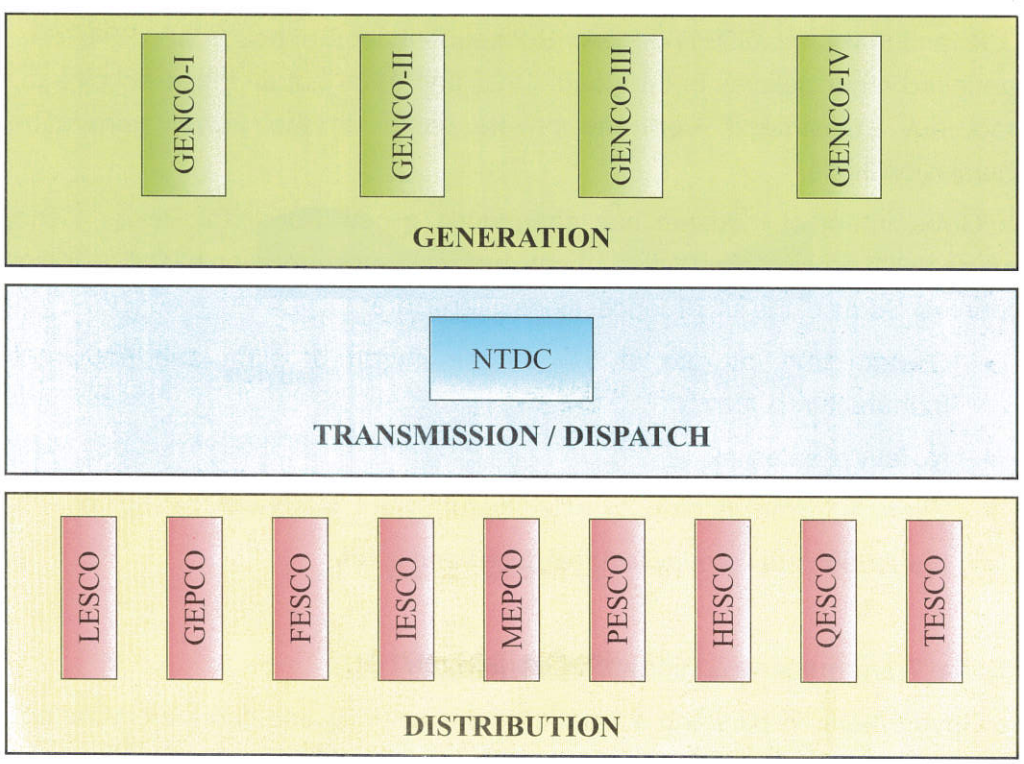
3.4 KESC

KESC is a public limited joint stock company incorporated in 1913. The company which serves about 1.685 million customers (as of June 2003), is a vertically integrated utility that generates, transmits and distributes electricity to Karachi and its adjoining areas (including part of the Balochistan province). KESC has an installed generation capacity of 2155 MW, which is entirely thermal including 137 MW Karachi Nuclear Power Plant (KANUPP). The privatisation of KESC is targeted for sale in 2004-05.

3.5 WAPDA Unbundling

In order to meet the country's substantial power needs and improve the performance of the sector, the Government has been pursuing an extensive restructuring and reform programme since the approval of a Strategic Plan in 1992. As part of this programme, WAPDA's power assets have been unbundled into 14 separate companies, consisting of (i) 4 generation companies, (ii) the National Transmission & Dispatch Company (NTDC); and 9 distribution companies .

Unbundling of WAPDA



The WAPDA restructuring programme and the transformation of power assets into autonomous corporatised entities have been led by the Pakistan Electric Power Company (PEPCO), which was established for the purpose of completing the above

restructuring. While all the corporatised companies continue to function in an integrated manner, PEPCO is aggressively pursuing a plan to establish their autonomy by completing the transfer of employees, registration of assets, and transfer of liabilities.

NTDC would remain as a state-owned entity responsible for dispatch, transmission, and system planning in the former WAPDA region. NTDC would also be responsible for entering into the long term Power Purchase Agreements with the new IPPs.

3.6 Private Sector Participation

In 1985, in view of an anticipated gap in the demand and supply of electricity, as well as a shortfall of the fund-raising capacity in the public sector, the Government of Pakistan announced certain measures to encourage private sector participation in the power sector. These measures encouraged the private sector to come forward and submit their proposals for establishing power plants. Keeping in view the difficulties of the protracted negotiations on tariff and other project parameters, a policy and package of incentives for private power sector was announced in March 1994, which was based on a fixed across the board tariff for all power plants. As a result of these private power initiatives and policy announced by the Government, a total capacity of 4,432 MW has been added to the system in the country as of June 2003. In addition, the Kot Addu Power Plant (1,638MW) was also transferred to private sector management in 1996 with initial shareholding of 26% and current shareholding of 36% held by National Power of UK and 64% by GOP/WAPDA. Subsequent to the policy of 1994, the GOP announced other policies in the years 1995 and 1998 but all these policies failed to attract any investments from the private sector in the power generation and transmission fields.

The Government of Pakistan has announced a new Policy for Power Generation Projects, 2002 providing attractive incentives for power generation based on indigenous resources. Some of the fiscal concessions offered are:

- Custom duty at rate of 5% on the import of plant and equipment not manufactured locally.
- No levy of sales tax.
- Exemption from income tax including turnover tax and withholding tax.
- Exemption from provincial/local duties and taxes.

3.7 National Transmission & Dispatch Company (NTDC)

The Government, in pursuing a long-term restructuring and commercialization of the power sector created a national transmission and dispatch company, NTDC. NTDC was

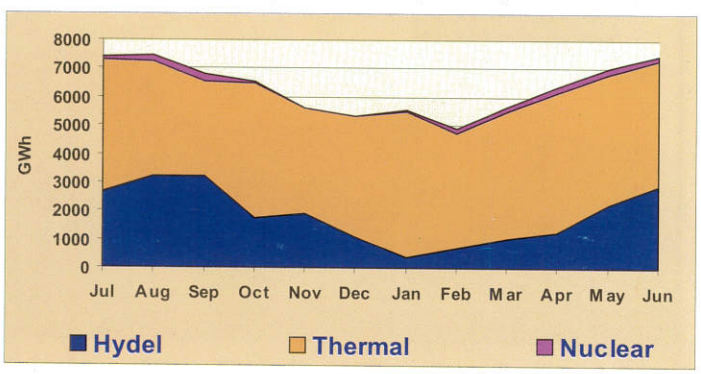
incorporated in 1998 under the Companies Ordinance of 1984 and was granted Transmission Licence by NEPRA on 31-12-2002.

NTDC is responsible to carryout transmission business in its territory. The territory includes whole of Pakistan excluding area served by KESC. NTDC owns and operates 500 kV and 220 kV and some 132 kV Transmission Lines and Grid Stations in its territory.

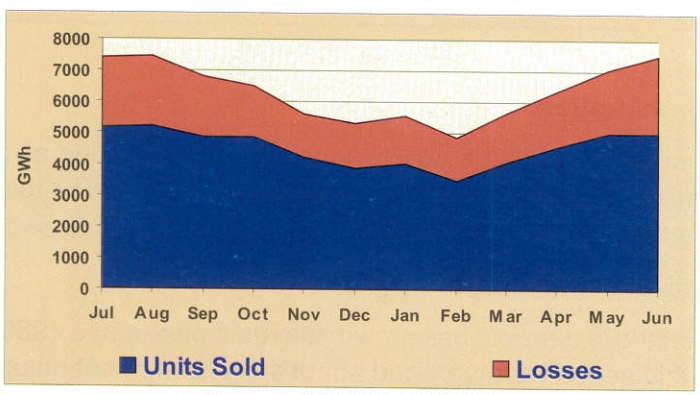
3.8 Load Pattern and Peak Load Hours

The electric load varies in Pakistan during summer and winter seasons. During the summer and sowing seasons due to tube wells operation, the induction load increases due to air conditioning and other motor operated appliances (such as fans), while in the winter; the resistive load increases due to electric heaters. The monthly load pattern for fiscal year 2003 is illustrated in the figure below.

Monthly Generation (FY 2003)



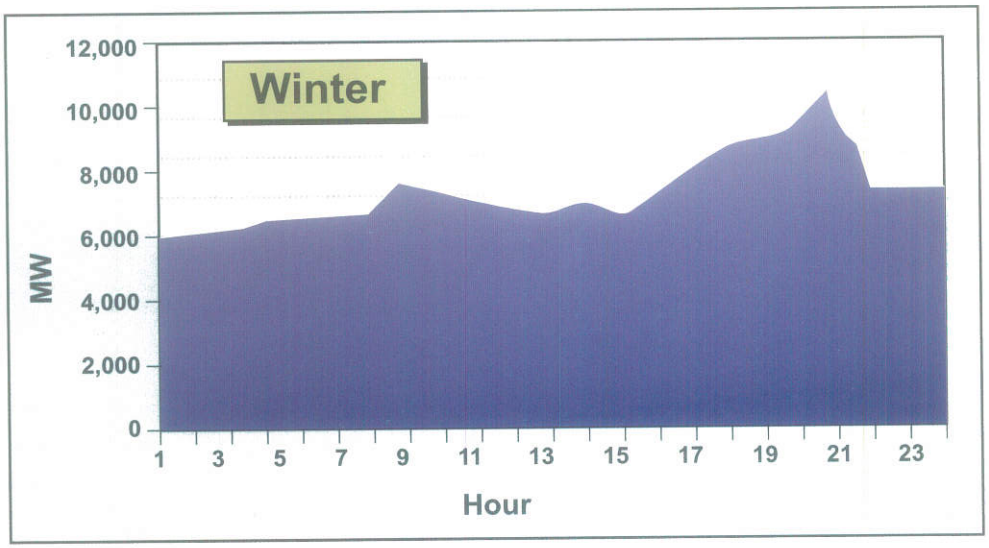
Monthly Consumption (FY 2003)

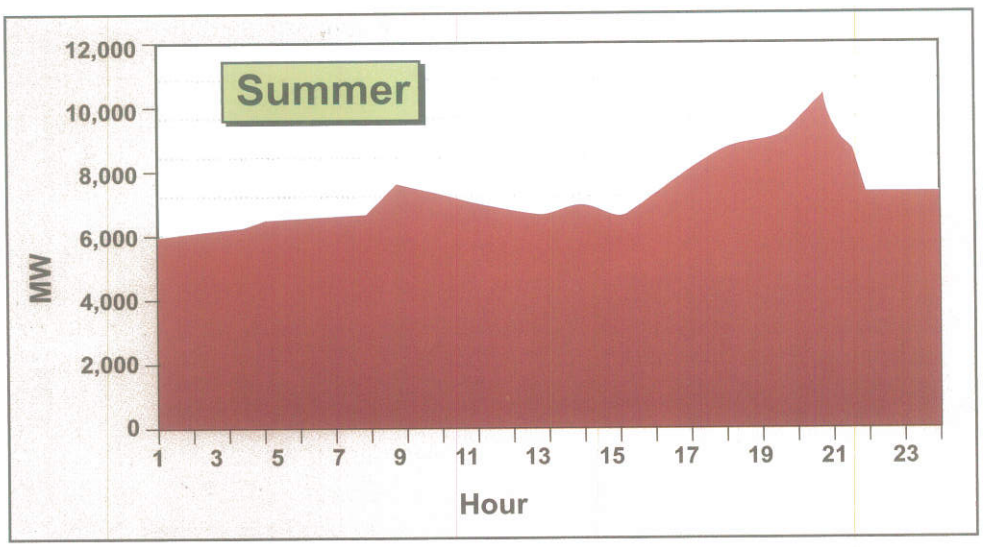


Source WAPDA/ KESC

The peak load hours in Pakistan are generally between 4pm to 9pm. This load decreases to its minimum between midnight and 5am. The hourly load figures for a typical winter and summer day are presented below.

Typical Hourly Loads of WAPDA System in Winter and Summer





Source: WAPDA

3.9 Demand/Consumption

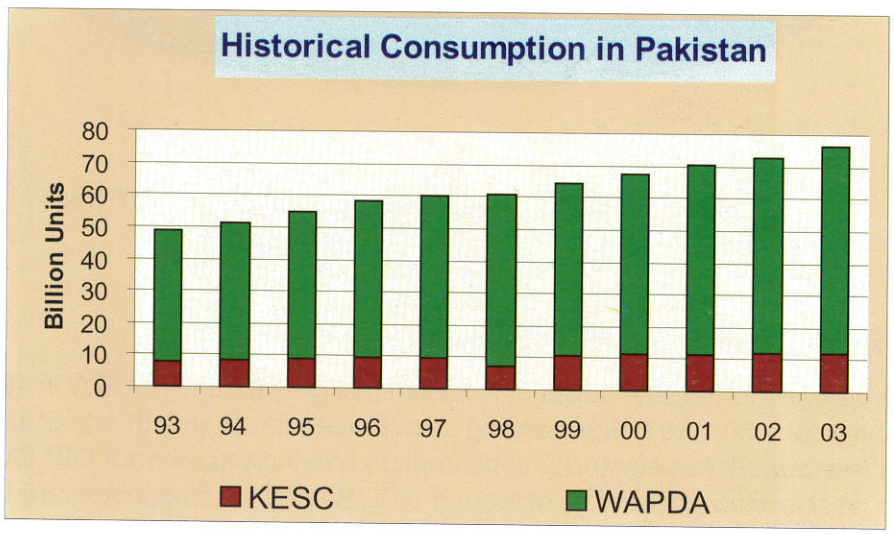
The maximum demand on the WAPDA system was recorded as 11044 MW. Similarly the peak demand recorded in KESC system was 1973 MW. The total maximum demand of the country, therefore, has been taken as 13,017 MW until June 30, 2003.

3.9.1 Demand Growth in Pakistan

Pakistan's electricity demand has grown at a rapid pace since 1985. While the real GDP growth over this period has averaged about 4.7%, consumption of electricity increased from 16,934 GWh in FY1985 to 45,518 GWh in FY2000, representing an annual

average growth rate of about 7%. The growth in the electricity demand, however, has been uneven over the years, closely following the general trend in the GDP growth. As shown below, while electricity consumption grew at a rate of 11.3% during FY1985-99 (peaking at 16% in FY1988), the growth rate slowed down to 6.9% during FY1990-1995 and 2.4% during FY1996-2000. Since FY2000, however, the trend has reversed and the electricity demand has picked up, mirroring the overall economic growth in the country.

The historical consumption of the country is as below:



Source: WAPDA/KESC

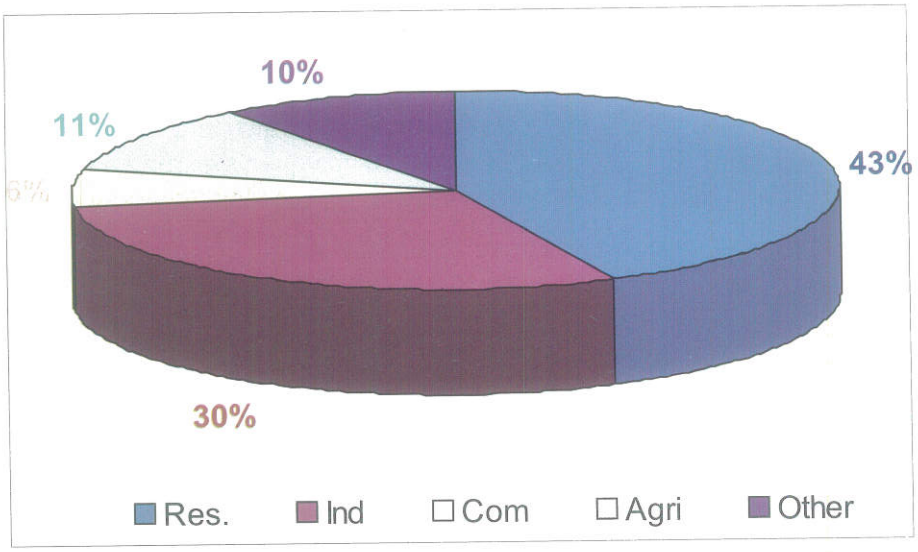
310 Consumption by Customer Category

Residential customers comprise the bulk of the country's consumption (43.4%) followed by industrial consumption (29.75%). Annual consumption of electricity in the residential sector is currently about 1909 kWh per customer, whereas annual consumption per industrial customer is approximately 37 times higher at 71,376 kWh per customer. The consumption of the major customer categories in Pakistan is presented in the table below:

Table 3.10
Consumption by Customer Category in Pakistan

Customer Category	Consumption in FY2003 (GWh)	Share of Consumption
Residential	23,581	43.40%
Industrial	16,181	29.75%
Commercial	18 3,2	5.90%
Agriculture Tube Well	6,017	11.00%
Other	5,400	9.92%
Total	54,397	100.00%

Source: WAPDA/KESC



3.11 History of Demand Growth in Pakistan

Peak demand for electric power in Pakistan has grown from 184 MW in 1960 to 13,017 MW until June 30, 2003, representing an average annual growth rate of around 12%. In the same period, net electricity consumption has increased from 860 GWh to 54,397 GWh, at an annual growth rate of around 10%. By way of comparison, growth in the level of economic activity over the same period (measured by GDP) was approximately 5.5%, implying that a 1% GDP growth roughly corresponds to a 2% increase in electricity demand. The Asian Development Bank has calculated the ratio at 1.74 for Pakistan.

This relationship between the GDP growth rate and electricity demand have not been maintained in Pakistan during the last few years. The following Table 3.11 illustrates the electricity demand growth against GDP growth rate.

TABLE 3.11
GROWTH RATES OF GDP VERSES ELECTRICTY DEMAND GROWTH

Year Ending 30th June	Growth Rate of GDP	Maximum Demand (MW)	Percentage Increase in Maximum Demand	Energy Demand/Sales (GWH)	Percentage Increase in sales
1985	9.2	4588	13.93	16934	7.58
1986	7.0	4805	4.73	19076	12.65
1987	5.7	5270	9.67	21684	13.67
1988	5.8	5996	13.77	25144	15.95
1989	6.7	6500	8.4	26715	6.24
1990	7.0	6803	4.66	28931	8.29
1991	3.9	7310	7.45	31513	8.92

1992	3.4	7805	6.77	34296	8.83
1993	2.8	8860	13.51	36635	6.82
1994	4.5	9489	7.1	37867	3.36
1995	5.3	9697	2.19	40456	6.83
1996	4.6	9791	0.97	42468	4.97
1997	1.9	10081	2.96	44078	3.79
1998	3.5	10554	4.7	45646	3.55
1999	4.2	10922	3.48	43207	(5.34) Decrease
2000	3.9	11144	2.03	45518	5.34
2001	2.2	11578	3.89	48480	6.5
2002	3.4	11993	3.58	50332	3.8
2003	5.1	13017	8.53	54397	8.07

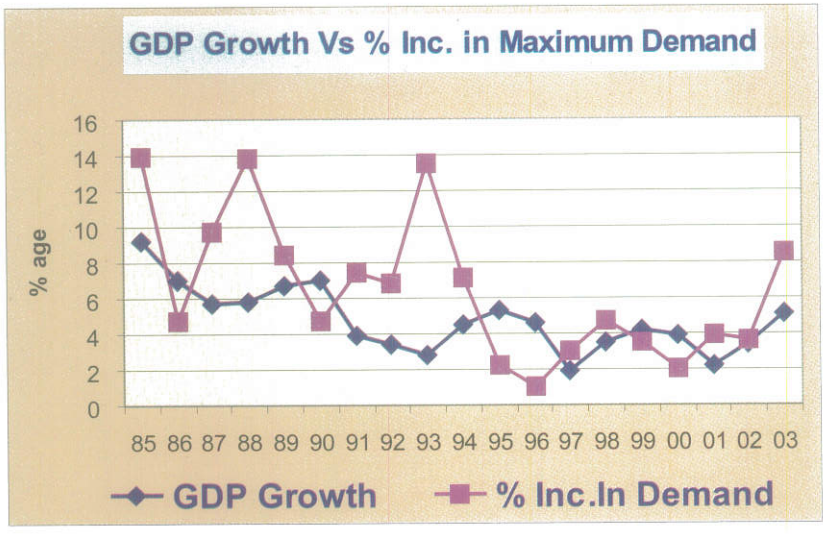
The natural, unrestricted rate of growth of demand for electricity in Pakistan based on the historical data and corresponding to GDP growth rate is estimated to be in the range of 11 to 12%. However, in view of various physical, financial, technical and political constraints limiting the rate of system expansion and the measures of the Government to discourage electricity consumption during peak demand hours, the total demand for power in the areas having access to electricity is projected to increase at an average rate of around 8.8% per annum. All the planning for the power sector had been based on this demand growth rate.

During the years 1997 to 2001 Pakistan experienced one of the lowest economic growth rates. Given the relationship between the growth of economy and demand growth rate of electricity, following are some of the additional factors affecting the slow growth in electricity demand:

i. The closure of many industries, according to rough estimate around 40-50% of the industry in the country was closed during the years 1997 until 2001. The industrial sector is a major consumer of electricity in Pakistan and its consumption has decreased from 36.3% in the year1992 to around 28% in years 1999 and 2000 of the total consumption. The industrial consumption started picking up from the year 2001 to 30.2% and was 29.75 % of the total consumption of the country recorded for the year ending June 30, 2003. It is assumed that this trend would continue in future.

ii. Mushroom growth of captive power in the industry because of the low reliability and high tariffs of the public sector power utilities. Estimated capacity of these captive units has been assessed as 1000-1200 MW by WAPDA.

iii. Power tariffs in the country have been doubled over the last few years, which motivated the consumers to economise the use of electricity.


GDP Growth Vs % Inc. in Maximum Demand
% age
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GDP Growth
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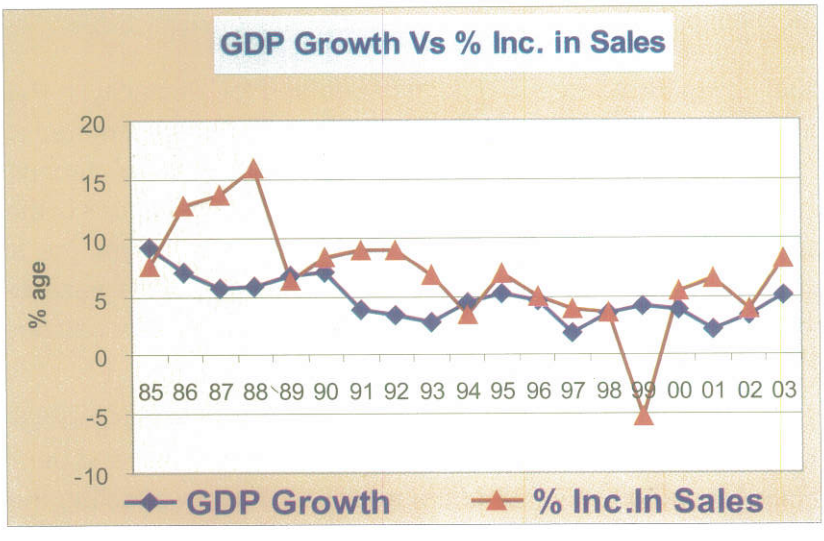
GDP Growth Vs % Inc. in Sales
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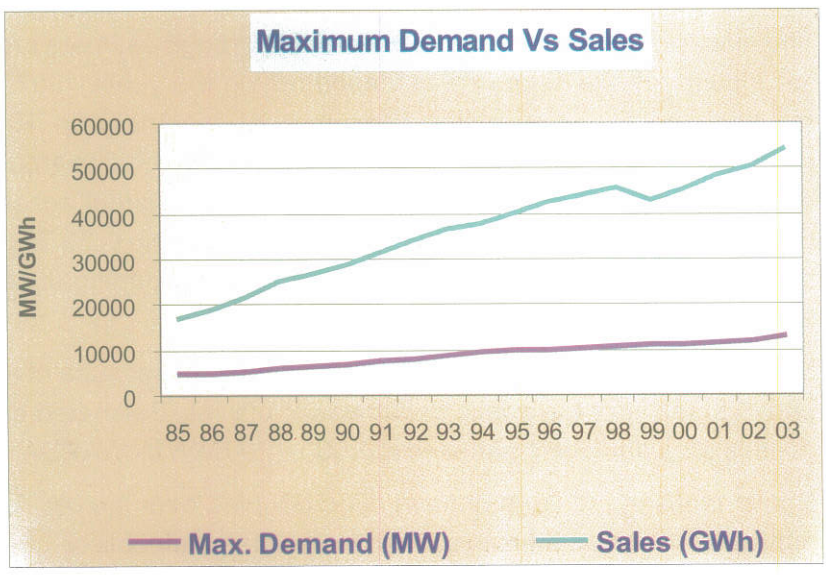
-10
85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
GDP Growth
% Inc.In Sales


Maximum Demand Vs Sales
MW/GWh
60000
50000
40000
30000
20000
10000
0
85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03
Max. Demand (MW)
Sales (GWh)

3.12 Forecast for Future Power Demand

As a universally accepted principle, the economic planning and consequently the power demand cannot be based on the few exceptionally good or bad years. It has to be based on a trend for some reasonable time period and the relevant facts and figures. While developing a matrix for future demand forecast, there is a need to link the historical growth pattern of the country's economy, the environment of growth orientation provided by the fiscal regime announced by the Government and the essential ingredients for a sustained revival and growth of Pakistan's economy.

Base case Scenario

A statistical study of the relevant facts and figures would indicate that:

i) The estimated natural / unrestricted growth rate of 9% should ideally be used. The aggressive revival of the sick industries program announced by the present Government also supports for assuming 9% demand growth, however, it would be optimistic to assume a growth rate of 9% because of the prevailing trend for the last few years.

ii) The second option is to closely relate the estimate with the actual demand increase i.e. a projected constrained / restricted demand growth rate of 7%;

iii) The third scenario could be developed based on a conservative increase in demand growth of 5%.

The following Table 3.12 presents demand scenario for all the three growth rates:

Table 3.12
PROJECTED FUTURE DEMAND (MW)

Year Ending 30th June	Potential Peak Demand 9% Growth	Potential Peak Demand 7% Growth	Potential Peak Demand 5% Growth
2003	13290	13290	13290
2004	14486	14220	13955
2005	15790	15216	14652
2006	17211	16281	15385
2007	18760	17420	16154
2008	20448	18640	16962
2009	22289	19945	17810
2010	24295	21341	18700
2011	26481	22835	19635
2012	28864	24433	20617
2013	31462	26143	21648
2014	34294	27973	22730

2015	37380	29932	23867
2016	40745	32027	25060
2017	44412	34269	26313
2018	48409	36668	27629
2019	52765	39234	29010
2020	57514	41981	30461
2021	62691	44919	31984
2022	68333	48064	33583
2023	74483	51428	35262
2024	81186	55028	37025

Al though the expected demand growth during the next five years i.e. July 2003 to June 2008 is around 3672 MW even at the extremely conservative demand growth rate of 5%, the required generation capacity additions should be much larger on account of the following reasons:

- To accommodate for retiring (old) plants and to cater for increasing system losses. (Losses increased from 24% in 1994 to 28.57 % in 2003).
- Variations of hydro-capacity according to the season of the year are to be accounted for.
- Provision of adequate spinning and maintenance reserves has to be kept to ensure the reliability of the system.

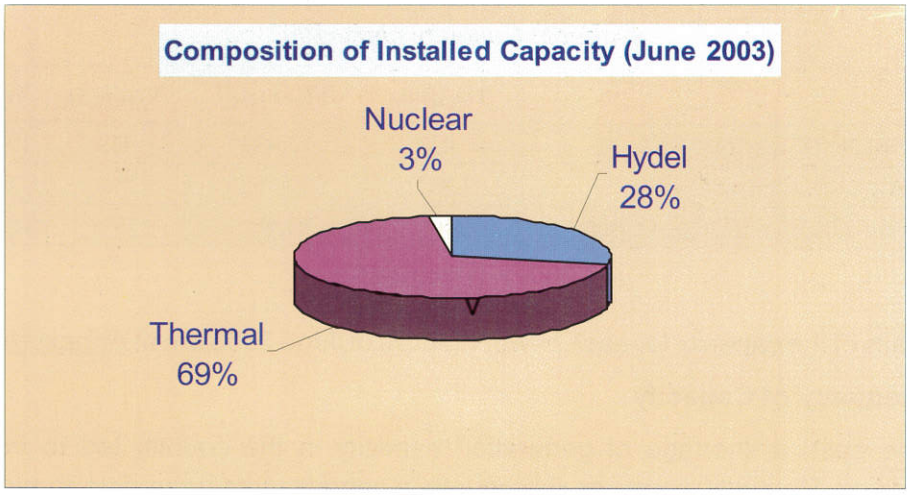
It may be emphasized that even with the addition of 3672 MW to the system, the total generation capacity would be insufficient to cover any unusual shortfalls in hydro capacity on account of dry inflow conditions.

3.13 Supply/Generation Capacity

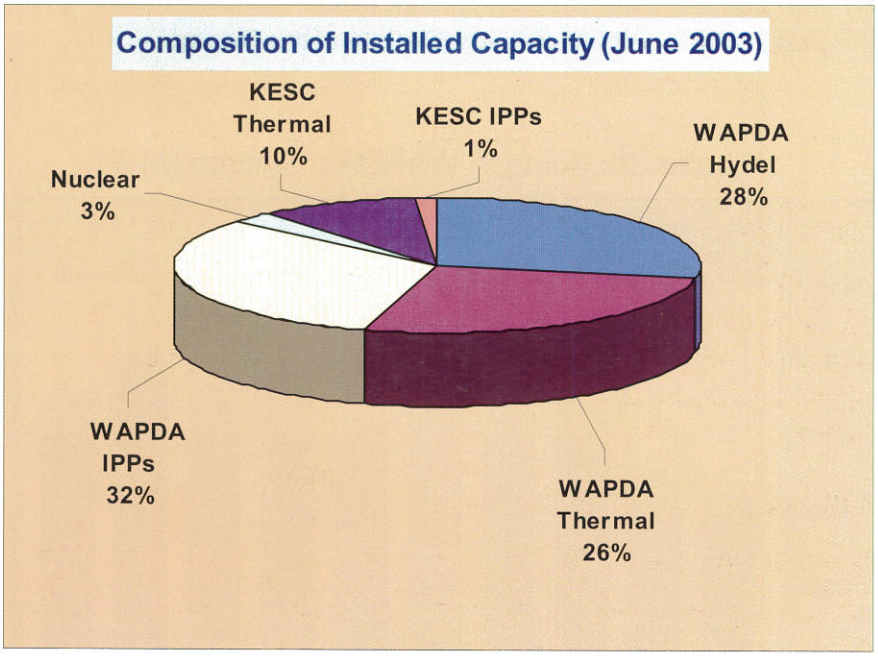
3.13.1 Mix in Generation Capacity

Pakistan's total installed generation capacity as of June 2003 was 17,975 MW which comprised of hydro and thermal generation (plus two nuclear plants, Chashnupp and Kanupp), as shown in the figure below. KESC's total generation capacity (including IPPs) consists entirely of thermal units, while a third of WAPDA's total generaiton capacity (including IPPs) consists of hydro units.

Total Installed Capacity 17975 MW



Source: WAPDA/KESC



Source: WAPDA / KESC

13.13.2 Available Capacity

Availability of hydro capacity varies with the inflow of water in the rivers and canals. Their actual generation, therefore, varies during each year. The average percentage of hydro generation to installed capacity was 58.6% during 1991-2003, excluding the temporary decrease in 2001 due to exceptional drought conditions. (Details of available Hydro Capacity may be seen at Annexure-A)

The available capacity of the thermal units is also less than the installed capacity, due to their age and auxiliary consumption.

The following table shows the available capacity (annual average) as of June 2003:

Available Capacity (June 2003)

	Hydro	Thermal	Nuclear	Total
Installed Capacity (MW)	5,039	12,474	462	17,975
Available Capacity (MW)	3,737	10,592	360	14,689
Available % of Installed Capacity	74%	84.9%	78%	81.72%

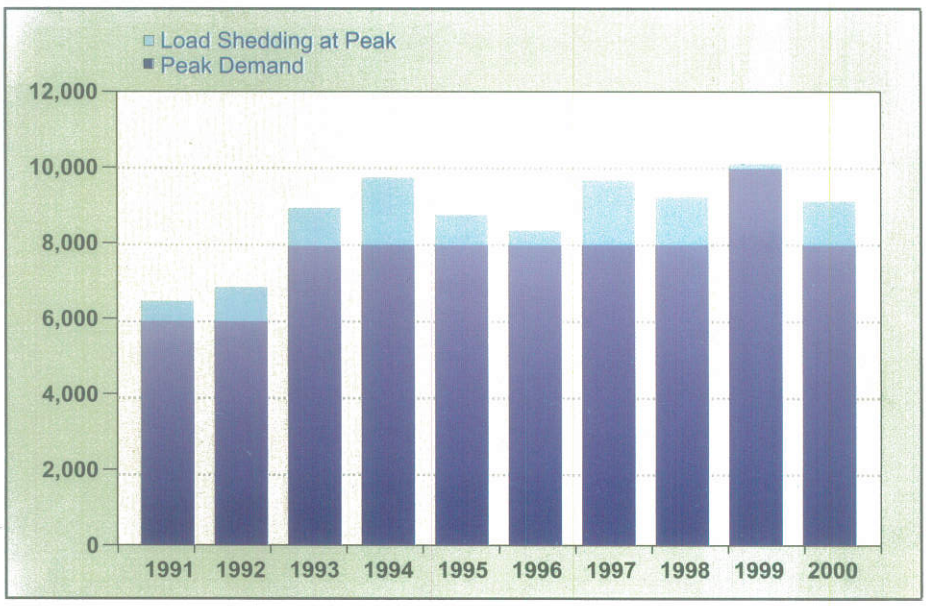
Source: WAPDA/KESC

(Details of the capacity for each power plant as of June 2003 are at Annexure-B)

13.13.3 Adequacy of Capacity

In the past, a shortage of generation capacity in the country led to frequent load shedding. Recently, however, the country's capacity has been able to meet the peak demand, as shown in the figure below, in which the load shedding at peak demand was virtually nil in 2000 for WAPDA's system. However, the load shedding would start again from the year 2005-06 as indicated at table 3.19 of this Report.

Load Shedding in WAPDA's System (MW)



Source: WAPDA

3.14 Growth Pattern of Installed Capacity

Total installed capacity in the country in 1958, when WAPDA was constituted, was 174 MW, out of which 119 MW was in the area where WAPDA operates and 55 MW in the areas where KESC operates now. Decade wise increase in the installed capacity since 1960 is as under:

Growth Pattern of Installed Capacity in Pakistan

YEARS	WAPDA AREAS MW	KESC AREAS MW	PRIVATE MW	TOTAL MW	INCREASE
1960	366	55	-	421	-
1970	1323	392	-	1715	4.1 Times
1980	2685	673	-	3358	2.0 Times
1990	6409	1318	-	7727	2.3 Times
2000	9732	1756	5928	17187	2.2 Times
2003	10075	1893	6007	17975	4.58% in 3 Years

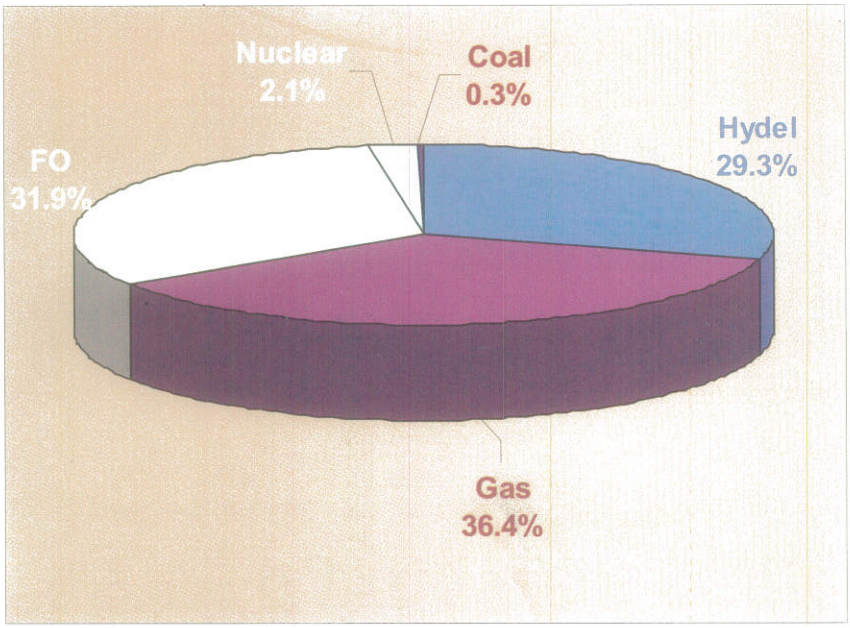
3.15 Monthly Profile of Energy Generation

PAKISTAN POWER COMPANIES
POWER STATION WISE FUEL WISE GENERATION
FY 2002-03

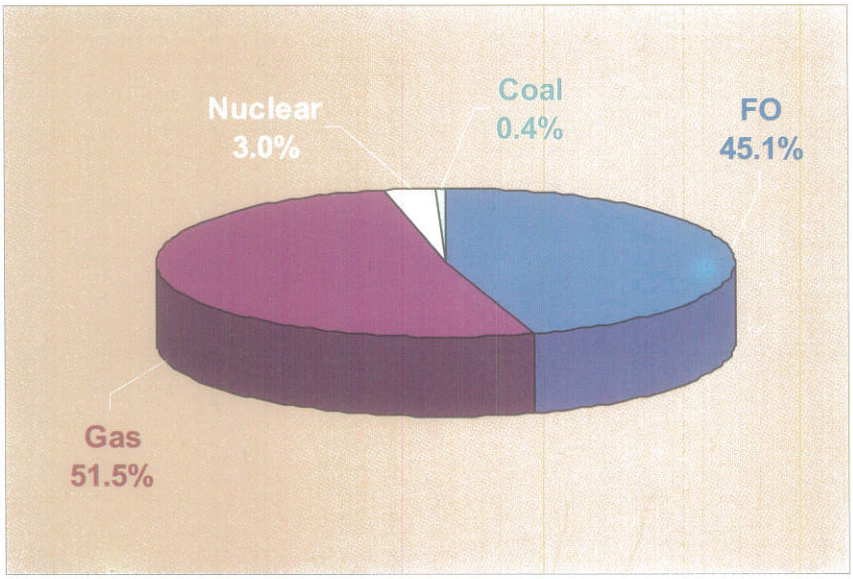
GWh

NAME OF POWER STATIO	Fuel	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
HYDEL														
Tarbela		2,096	2,599	2,405	1,209	1,122	523	236	468	407	539	1,235	1,857	14,694
Mangla		315	360	585	365	601	434	72	128	488	456	763	796	5,363
Warsak		133	133	95	50	42	36	38	32	55	86	113	91	904
Small Hydels		46	45	41	34	31	31	20	23	39	46	49	46	450
Chashma Low Head		66	73	75	85	85	49	32	62	67	96	72	81	843
Jagaran		18	16	10	5	4	3	3	1	3	10	13	11	97
Total - Hydel		2,674	3,226	3,211	1,748	1,885	1,076	401	713	1,059	1,233	2,245	2,881	22,350
KHANOT	Coal	22	18	38	17	19	23	12	14	15	11	23	19	231
Liberty(C.C.)	Gas	135	100	112	148	142	146	151	128	144	143	108	124	1,581
Habibullah	Gas	82	72	66	77	80	81	93	82	86	77	85	81	962
GUDDU COMBINED CYCL	Gas	466	373	383	395	383	578	579	522	559	541	559	541	5,879
Fauji	Gas	102	98	54	110	107	108	91	97	107	95	97	93	1,159
Uch (C.C.)	Gas	172	341	110	96	202	187	393	378	264	397	396	364	3,300
GUDDU -Steam (1-4)	Gas	142	227	202	215	207	46	46	66	59	56	58	56	1,380
MUZAFFARGARH	Gas	200	171	220	213	129	128	98	85	207	191	197	183	2,022
JAMSHORO	Gas	162	161	156	160	162	162	158	160	171	169	170	166	1,957
SPS FAISALABAD	Gas	35	33	34	49	12	-	-	-	20	50	49	57	339
NGPS Multan	Gas	43	44	49	42	32	-	26	24	30	42	45	23	400
KAPCO	Gas	396	361	348	354	314	-	-	-	349	375	402	351	3,251
Altern	Gas	4	3	3	3	2	2	3	3	3	3	3	3	33
GTPS FAISALABAD	Gas	31	19	24	32	17	11	5	32	58	35	63	76	403
KOTRI	Gas	63	62	60	71	60	49	33	48	57	66	68	63	700
TPS KORANGI	Gas	112	100	97	90	80	77	55	41	67	46	51	59	875
GTPS KORANGI	Gas	28	21	18	22	9	9	7	6	23	31	25	17	215
GTPS SITE	Gas	19	18	16	13	11	9	9	20	23	24	24	22	208
TPS BIN QASIM	Gas	242	180	221	257	189	172	157	133	171	401	451	460	3,033
Total Gas WAPDA, KESC & IPPs		2,435	2,384	2,171	2,347	2,138	1,765	1,903	1,824	2,396	2,742	2,850	2,739	27,694
Rousch	F.O.	205	153	104	233	158	231	229	204	210	217	159	160	2,263
Hubco	F.O.	265	77	11	418	107	333	645	136	220	228	100	191	2,730
KEL	F.O.	31	14	6	59	22	37	56	21	31	34	12	16	339
SEPCO	F.O.	44	27	11	49	23	43	67	28	35	35	18	28	408
Japan	F.O.	35	38	25	36	33	59	60	44	44	45	30	41	489
JAMSHORO	F.O.	105	91	82	115	120	130	120	130	133	125	120	115	1,386
MUZAFFARGARH	F.O.	394	324	156	432	295	363	544	452	355	470	445	383	4,613
GUDDU -Steam (1-4)	F.O.	10	2	-	8	20	-	-	20	-	21	1	21	103
KAPCO	F.O.	176	111	38	149	74	381	512	387	133	278	98	12	2,348
Saba	F.O.	46	39	20	1	34	68	82	54	54	54	38	45	534
AES Lalpir	F.O.	50	13	-	-	20	45	81	15	10	21	7	25	287
AES Pak Gen	F.O.	124	64	27	168	-	131	112	60	81	79	50	74	970
SPS FAISALABAD	F.O.	-	-	-	-	-	1	15	-	-	10	17	-	43
NGPS Multan	F.O.	4	4	-	-	-	1	13	-	-	6	7	-	35
TPS KORANGI	F.O.	3	6	14	15	11	17	22	10	6	1	1	2	108
TPS BIN QASIM	F.O.	463	459	415	458	457	494	526	488	483	318	351	319	5,231
GUL AHMED	F.O.	81	82	79	86	82	43	47	52	76	79	86	84	878
TAPAL	F.O.	74	79	77	76	72	44	49	53	79	83	86	84	856
PASMIC	F.O.	11	11	12	13	10	10	7	10	12	13	10	8	127
KTGT & SITE	F.O.	41	35	31	43	19	20	16	12	45	66	62	56	443
Total F.O. WAPDA, KESC & IPPs		2,163	1,625	1,107	2,359	1,556	2,453	3,201	2,177	2,007	2,182	1,697	1,664	24,191
KANUPP Nuclear		53	40	55	37	14	2	-	-	-	-	-	-	201
Chashma Nuclear		66	172	201	-	-	-	54	145	179	181	225	170	1,393
Isolated System		8	8	4	6	7	9	9	8	9	9	9	9	95
Total (Thermal)		4,748	4,247	3,576	4,766	3,734	4,252	5,179	4,168	4,606	5,125	4,803	4,600	53,804
Total Thermal & Hydel		7422	7473	6787	6514	5619	5327	5579	4881	5665	6358	7049	7481	76155
Losses		30.4%	30.0%	28.0%	25.3%	24.5%	27.3%	28.2%	28.5%	28.3%	28.1%	29.1%	33.1%	28.6%
Units Sold		5166	5231	4886	4866	4242	3873	4006	3490	4063	4572	4997	5005	54397

Fuel Wise Energy Generation (FY 2003)

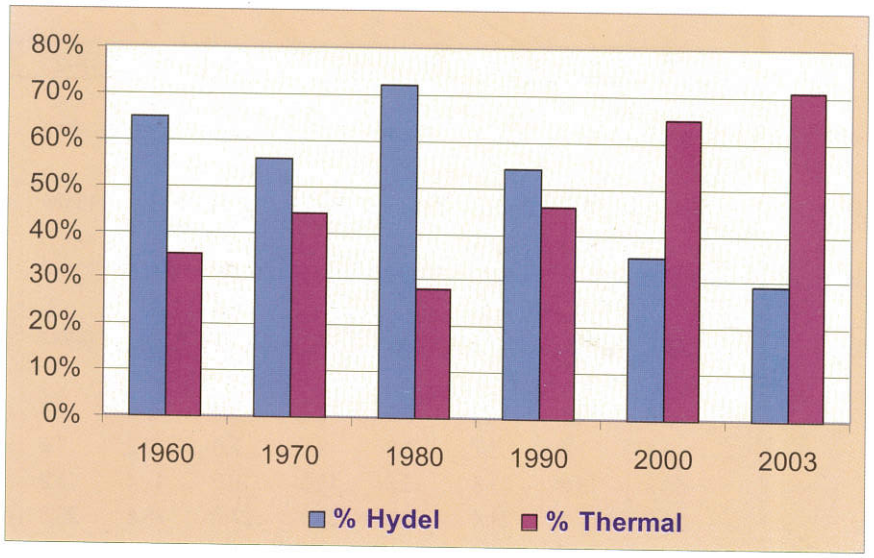


Fuel Wise Thermal Energy Generation (FY 2003)



	Energy Generation By Source Since 1960				
Year	Hydel (GWh)	Thermal* (GWh)	Total (GWh)	% Hydel	% Thermal
Ending					
30th June					
1960	507	540	1047	48%	52%
1970	2915	3465	6380	46%	54%
1980	8714	6260	14974	58%	42%
1990	16925	20720	37645	45%	55%
2000	19288	48031	67319	29%	71%
2003	22350	53805	76155	29%	71%

* including nuclear



Energy Generation By Source Since 1960

3.16 Power System Statistics for the Last Ten years

The installed capacity, energy generation, maximum demand on the system, energy sales and number of consumers for the last ten years for WAPDA, KESC and the country is presented in the following tables;

Table 3.16 A
WAPDA SYSTEM (PUBLIC & PRIVATE)

Fiscal Year Ending 30th June	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Installed Capacity (MW)										
Public Hydel	4725	4825	4825	4825	4825	4825	4825	5009	5009	5009
Public Thermal	4926	5738	6238	5070	5070	5070	4871	4740	4740	4740
Private Hydel			0	0	0	0	0	30	30	30
Private (Thermal)			0	3061	3788	3905	4748	5430	5715	5715
Nuclear			0	0	0	0	0	325	325	325
Total	9651	10563	11063	12956	13683	13800	14444	15534	15819	15819
Addition during the year (MW)	1529	912	500	1893	727	117	644	1090	285	0
Energy Generation (Gwh)										
Public Hydel	19436	22858	23206	20858	22060	22448	19288	17196	18941	22253
Public Thermal	22960	23268	25492	19184	17619	15909	19157	16858	18684	19646
Private Hydel								63	115	97
Private (Thermal)			161	10740	13580	15326	17428	24338	23120	22044
Nuclear										
Total	42396	46126	48859	50782	53259	53683	55873	58455	60860	64040
Maximum Demand (MW)	8067	8252	8278	8552	8825	9192	9289	9718	10108	11044
Energy Sales (GWh)	32131	3502	36925	38529	39422	38900	40910	43384	45204	47421
No. Of Consumers (000)	8592	9067	9482	9869	10217	10800	11585	12166	12678	13318
Villages Electrified	50927	57170	62127	64568	65951	67183	68292	69887	71561	73807
LOSSES (%)										
Auxiliary	2.6	2.6	2.9	2.4	2.0	1.7	2.2	2.0	2.2	2.1
Transmission	8.8	7.6	7.7	8.2	8.5	7.8	7.2	7.9	7.8	7.8
Distribution	12.8	13.9	13.8	13.5	15.5	18.0	17.4	15.9	17.7	17.9
System Losses	24.2	24.1	24.4	24.1	26.0	27.5	26.8	25.8	27.7	27.9

Table 3.16 B
KESC SYSTEM (PUBLIC & PRIVATE)

Fiscal Year Ending 30th June	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Installed Capacity (MW) Including KANUPP										
Public (Thermal)	1738	1738	1738	1525	1735	1735	1756	1756	1756	1756
Private (Thermal)					262	262	262	262	262	262
Nuclear	137	137	137	137	137	137	137	137	137	137
Total	1875	1875	1875	1662	2134	2134	2155	2155	2155	2155
Addition during the year (MW)	0	0	0	-213	472	0	21	0	0	0
Energy Generation (GWh) Including Public (Thermal), Private (Thermal) & Neclear	8632	8760	9386	9327	7318	10620	11446	11677	12115	12115
Total	8632	8760	9386	9327	7318	10620	11446	11677	12115	12115
Maximum Demand (MW)	1422	1445	1513	1529	1729	1730	1855	1860	1973	1973
Energy Sales (GWh)	6087	5632	6021	5640	6385	6131	6430	6924	6718	6976
No. of Consumers (000)	1251	1301	1287	1337	1388	1449	1609	1690	1683	1685
System Losses (%) Incl: Consumption in auxiliary	29.48	35.71	35.14	39.63	41.09	45.74	45.74	45.74	45.74	45.74

Table 3.16 C
COUNTRY (WAPDA+KESC)
(PUBLIC & PRIVATE)

Fiscal Year Ending 30th June	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Installed Capacity (MW)										
Public Hydel	4725	4825	4825	4825	4825	4825	4825	5009	5009	5009
Public Thermal	6664	7476	7976	6595	6805	6805	6627	6497	6497	6497
Private Hydel	0	0	0	0	0	0	0	30	30	30
Private Thermal	0	0	0	3061	4050	4167	5010	5692	5977	5977
Nuclear	137	137	137	137	137	137	137	462	462	462
Total	11526	12438	12938	14618	15817	15934	16599	17690	17975	17975
Addition during the year (MW)	1529	912	500	1680	1199	117	665	1091	285	0
Energy Generation (GWh)										
Public Hydel	19436	22858	23206	20858	22060	22448	19288	17196	18941	22253
Public Thermal	31592	32028	34878	28511	24937	26529	30603	28535	30799	31761
Private Hydel	0	0	0	0	0	0	0	63	115	97
Private (Thermal)	0	0	161	10740	13580	15326	17428	24338	23120	22044
Nuclear	0	0	0	0	0	0	0	0	0	0
Total	51028	54886	58245	60109	60577	64303	67319	70132	72995	76155
Maximum Demand (MW)	9489	9697	9791	10081	10554	10922	11144	11578	12081	13017
Energy Generation (GWh)	51028	54886	58245	60109	61577	64303	67319	70132	72975	76155
Energy Sales (GWh)	38218	40664	42946	44169	45807	45031	47340	50308	51922	54397
Energy Loss (Gwh)	12810	14222	15299	15940	14770	19272	19979	19824	21053	21758
Total System Loss (%)	25.10	25.91	26.27	26.52	34.38	29.97	29.68	28.27	28.85	28.57
No. Of Consumers (000)	9843	10368	10768	11206	11605	12248	13193	13856	14361	15003

3.17 Forecast of Supply Situation

For realistic evaluation of the power supply situation during peak demand hours of the year, the maximum capability of the system to generate power at that particular time should be considered instead of the installed (name plate rating) capacity.

For this purpose, the following items must be deducted from the installed capacity:

- Plant derating for thermal generation
- Reduction in hydro generation due to low water inflows in the rivers.
- Auxiliary consumption

Following Table presents the position of installed capacity and saleable capacity available during peak demand period after discounting the installed capacity for the above noted factors and adding the capacity of all the planned units in the private and public sector until 2012-13.

3.18 Expansion Plan of Installed Generation Capacity in Pakistan

The following table illustrates the expected expansion plan of installed capacity in Pakistan:

TABLE 3.18
EXPANSION OF INSTALLED GENERATION CAPACITY IN PAKISTAN

YEAR	NAME OF PLANT	WAPDA				KESC			COUNTRY	
		Hydel (MW)	Thermal (MW)	Nuclear (MW)	Subtotal (MW)	Thermal (MW)	Nuclear (MW)	Subtotal (MW)	Additions (MW)	Cumulative Total (MW)
2002-03	Existing Capacity	5039	10456	325	15820	2018	137	2155	17975	17975
2003-04	Ghazi Brotha Hydro	1450	-	-	1450	-	-	-	1450	19425
2004-05	-	-	-	-	-	-	-	-	-	19425
2005-06	-	-	-	-	-	-	-	-	-	19425
2006-07	-	-	-	-	-	-	-	-		19425
2007-08	OPI Power Project (IPP) Korangi Power Project (IPP) Western Electric (IPP) Balloki Power Project (IPP) Jarwar Power project (IPP) Interconstruct IPP	-	200 200 123 150	-	673	 150 150	-	300	973	20398
2008-09	Allai Khwar Mari Power Project (IPP)	121	- 175	-	296	-	-	-	296	20694
2009-10	Khan Khwar Thar Coal	130	 600	-	730	-	-	-	730	21424
2010-11	Golen Gol Chashma Nuclear -II	106	-	 360	466	-	-	-	466	21890
2011-12	Jinah	96	-	-	96	-	-	-	96	21986
2012-13	Neelam Jhelum	963	-	-	963	-	-	-	963	22949

3.19 Forecast of the Available/Saleable Future Capacity

The following table is a forecast of the available capacity until the year 2112-2113.

TABLE 3.19

YEAR	Installed Capacity (MW)	Available Capacity During Peak Demand (MW)
2002-03	17975	14689
2003-04	19425	15762
2004-05	19425	15762
2005-06	19425	15762
2006-07	19425	15762
2007-08	20398	16588
2008-09	20694	16826
2009-10	21424	17432
2010-11	21890	17791
2011-12	21986	17862
2012-13	22949	18575

3.20 Projected Supply Demand Gap During Peak Hours

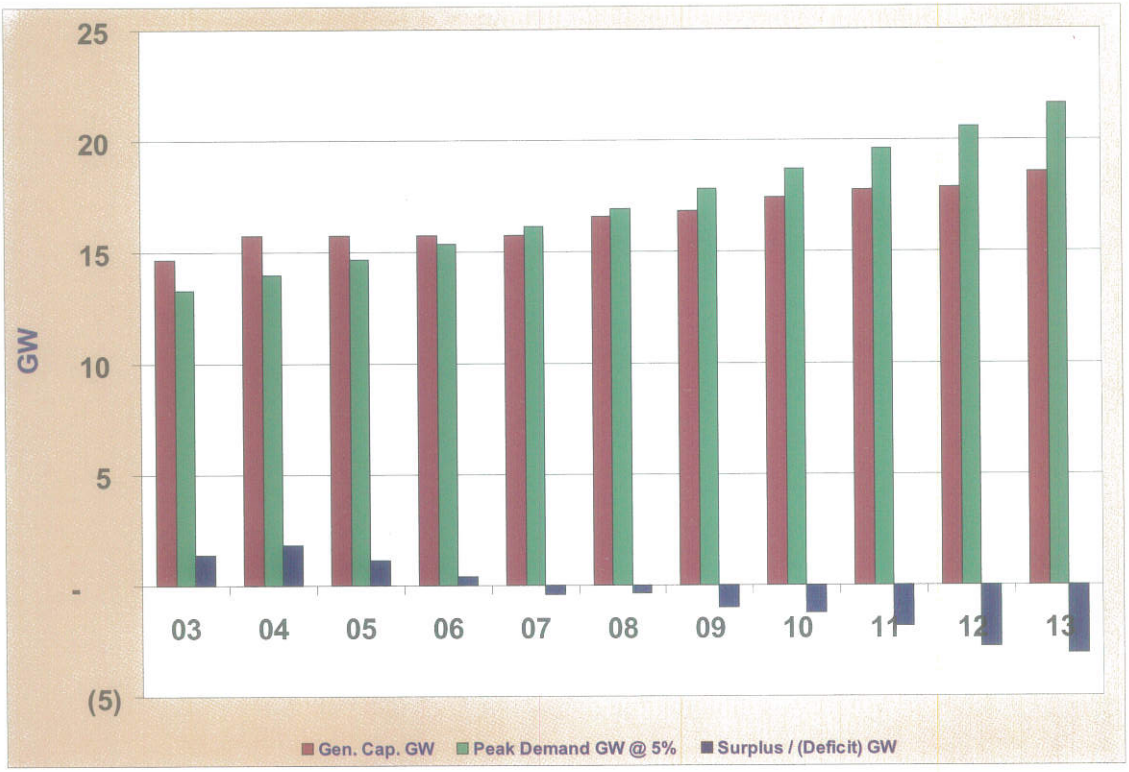
Based on the data tabulated above, the Table at next page compares the demand/supply situation for the next ten years (2002-03 to 2012-13) during peak hours and resulting Surplus/Deficit in the supplies at different estimated demand growth rates.

The table indicates that even at 5% growth rate, the shortages in power supply will start accruing from year 2007-08 even after commissioning of all the planned units in the public and private sector. However, at 7% demand growth rate the shortages would be accruing from the year 2006-07 and at 9% growth rate from the year 2005-06.

However, these figures do not contain any reserve capacity to substitute hydro generation in the extra dry water inflow years and spinning reserves for maintenance / breakdowns.

TABLE 3.20
Projected Surplus/Deficit in Demand and Supply
During Peak Demand Hours of the Year

YEAR ENDING	Generation Capability	Peak Demand	Surplus/(Deficit)	Peak Demand	Surplus/(Deficit)	Peak Demand	Surplus / Deficit
30th JUNE		9% Growth		7% Growth		5% Growth	
	MW	MW	MW	MW	MW	MW	MW
2003	14689	13290	1399	13290	1399	13290	1399
2004	15762	14486	1276	14220.3	1542	13955	1808
2005	15762	15790	(28)	15216	546	14652	1110
2006	15762	17211	(1449)	16281	(519)	15385	377
2007	15762	18760	(2998)	17420	(1658)	16154	(392)
2008	16588	20448	(3860)	18640	(2052)	16962	(374)
2009	16826	22289	(5462)	19945	(3118)	17810	(984)
2010	17432	24295	(6863)	21341	(3909)	18700	(1268)
2011	17791	26481	(8690)	22835	(5043)	19635	(1844)
2012	17862	28864	(11002)	24433	(6571)	20617	(2755)
2013	18575	31462	(12887)	26143	(7569)	21648	(3073)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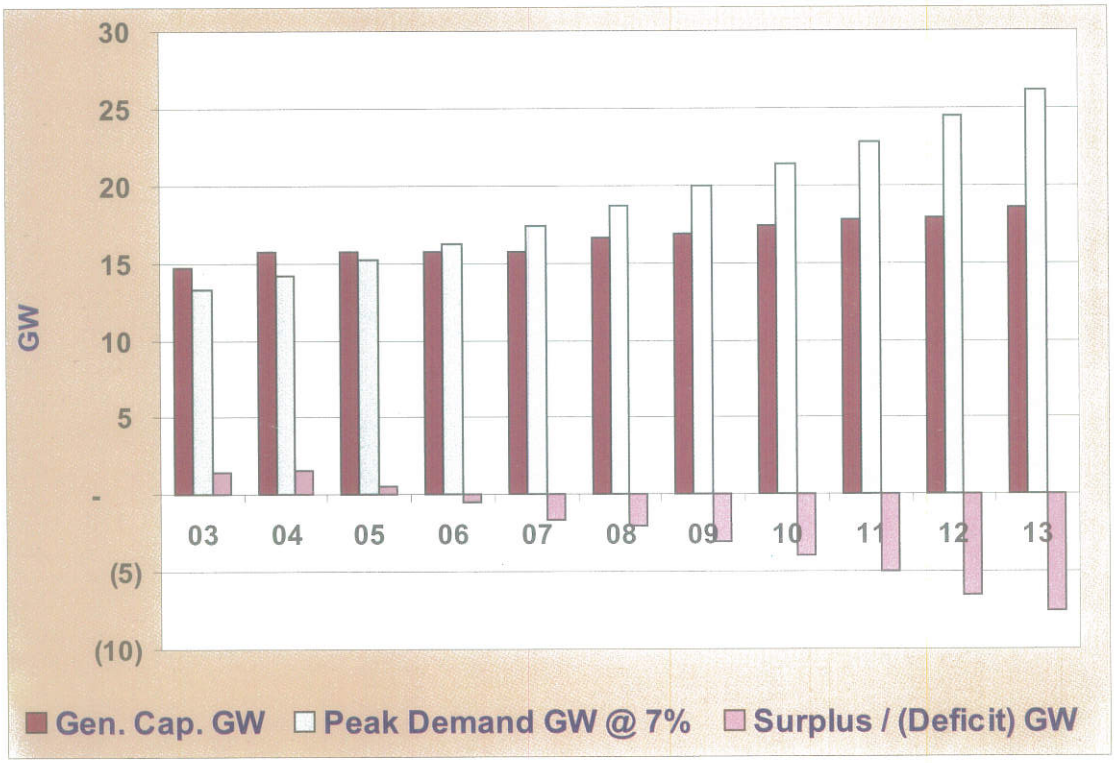
Gen. Cap. GW
Peak Demand GW @ 5%
Surplus / (Deficit) GW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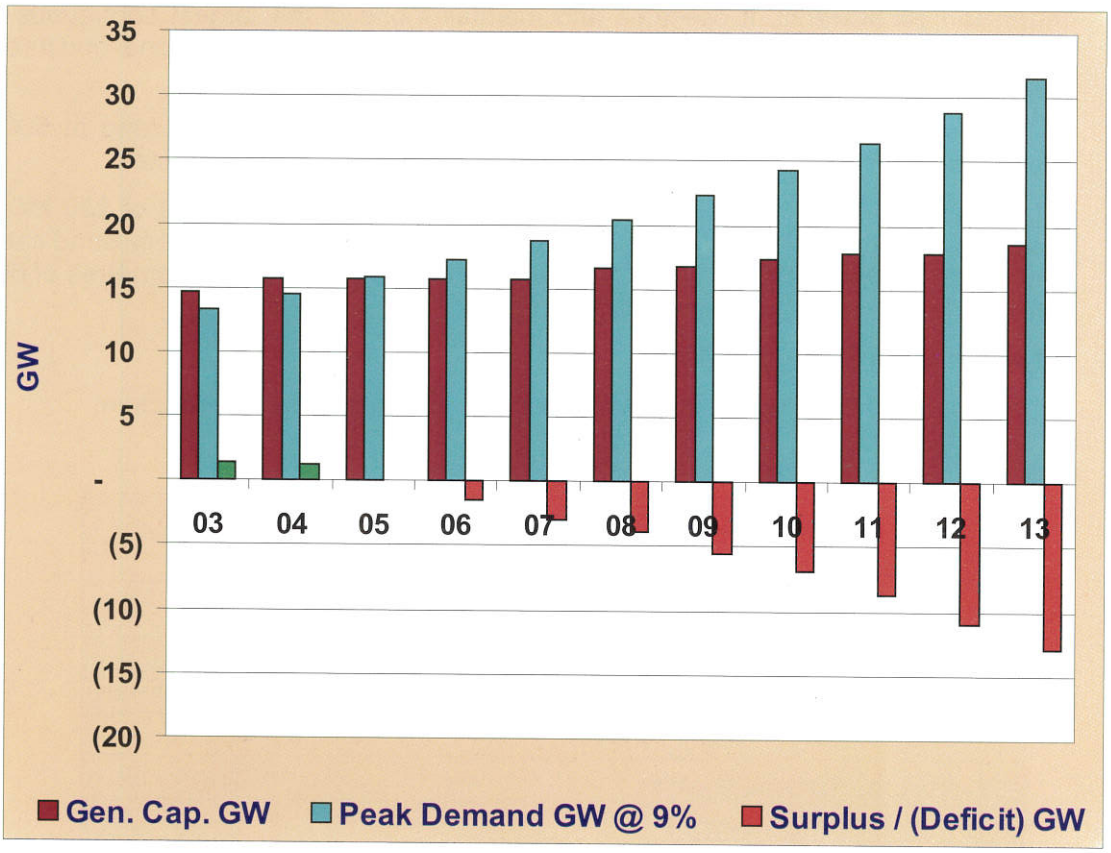
Gen. Cap. GW
Peak Demand GW @ 7%
Surplus / (Deficit) GW



3.21 Small Power Producers (SPPs) in Pakistan

Pakistan's power sector also includes a number of Small Power Producers including Captive Power Plants (CPPs). These SPPs and CPPs were mainly set up by industrial entities for self-generation.

Attractive incentives were provided for industrial self-generation or SPPs under the Policy "Framework and Package of Incentives for Private Sector Power Generation Projects in Pakistan" announced in March 1994, commonly known as 1994 Energy Policy. The installations of SPPs or CPPs were allowed because industries were suffering due to inefficient services by the utilities, frequent power breakdowns and heavy load shedding due to power shortages. This led to a mushroom growth of approximately 2,000 MW of power generation by unregulated SPPs consisting mainly industrial self-generation in Pakistan.

There are about 360 or more self dispatched generation facilities in Pakistan. The total estimated capacity is of the order of 2000 MW that is privately owned and operated by Small Power Producers (SPPs).

NEPRA has granted generation Licenses to 15 SPPs until June 30, 2003. However, applications for licenses by a number of SPPs for generation as well as distribution are under the consideration of NEPRA.

3.22 Existing Transmission System

The national transmission grid in Pakistan is a fully integrated system anchored by a 500 kV and a series of 220KV bulk transmission system running from the hydro units in the

north to near Karachi. It operates and maintains one of the largest contiguous grid systems of the world. The KESC's system is also connected to the national grid through a 220 kV double circuit and two 132 kV links.

NTDC is operating and maintaining about 4241 Circuit Kilometres long of 500 kV transmission lines and 6125 Circuit Kilometres of 220 kV transmission lines.

The transmission system of KESC consists of 264 Circuit Kilometres of 220 kV, 515 Circuit Kilometres of 132 kV while 71 Circuit Kilometres is 132 kV underground cables. There are 222 Circuit Kilometres of 66 kV overhead and 23 Circuit Kilometres of 66 kV under ground cables as of June 2003.

3.23 Transmission Expansion Plan

The following table illustrate the New Transmission Lines under construction:

WORKS IN PROGRESS (2003 04)	
New Transmission Line Under Construction	
	Commissioning
500 kV Barotha-Rewat Double Circuit	2004
500 kV Rewat-Lahore Single Circuit	2004
220 kV Daud-Khail Bannu	2003
220 kV Gatti-Ludewala	2003
220 kV Muzafar Garh-Bhawalpur	2003
220 kV Guddu-Shikarpur (Tee-Off)	2003
220 kV JamshoreHyderabd (University)	2003
220 kV Rewat-Islamabad (University)	2003
220 kV Sh. Muhammadi-Shahibagh	2004
220 kV Shahibagh-Barotha	2004
New Grids Under Construction	
220 kV Islamabad University	2003
220 kV Shahibagh	2004

In order to cater forpower dispersal for new power plants, new transmission lines are required to be constructed. The transmission line expansion plan until 2008 is a follows:

NTDC Expansion Plan (2003-2008)

Sr. No.	Name of Scheme
1	Up-gradation of Load Dispatch System
2	500/220 kV NTDC -KESC Interconnection
	New 500 kV Grid Station in KESC area and 7 km, 220 kV D/C
	Transmission Line
3	Up-gradation of 220 kV Grid Station Sahiwal to 500 kV
4	Extension of 500 kV Rawat Grid Station for addition of 3rd
	500/220 kV 450 MVA Transformer
5	500 kV Thar Coal - Jamshro Transmission Line (approx. 225 km)
6	New 220 kV Grid Station at Ghazi Road Lahore along with 220
	kV D/C Transmission Line (approx. 80km)
7	New 220 kV Grid Station at Khuzdar alongwith 220 kV Dadu-
	Khuzdar D/C Transmission Line (approx. 300 km)
8	New 220 kV Grid Station at Nowshera Ind. Along with 220 kV
	Nowshera-Mardan D/C Transmission Line (approx.10 km)
9	New 220 kV Grid Statuib at D.G. Khan along with 220 kV
	Muzaffargar-D-G Khan D/C Transmission Line (approx. 65 km)
10	New 220 kV Grid Station at Chichawatni
11	New 220 kV Grid Station at Kharian
12	Extension of eight 220 kV Grid Station of NTDC System for
	addition of 160 MVA, 220/132 kV Transformers one at each
	grid station

3.24 Distribution Networks

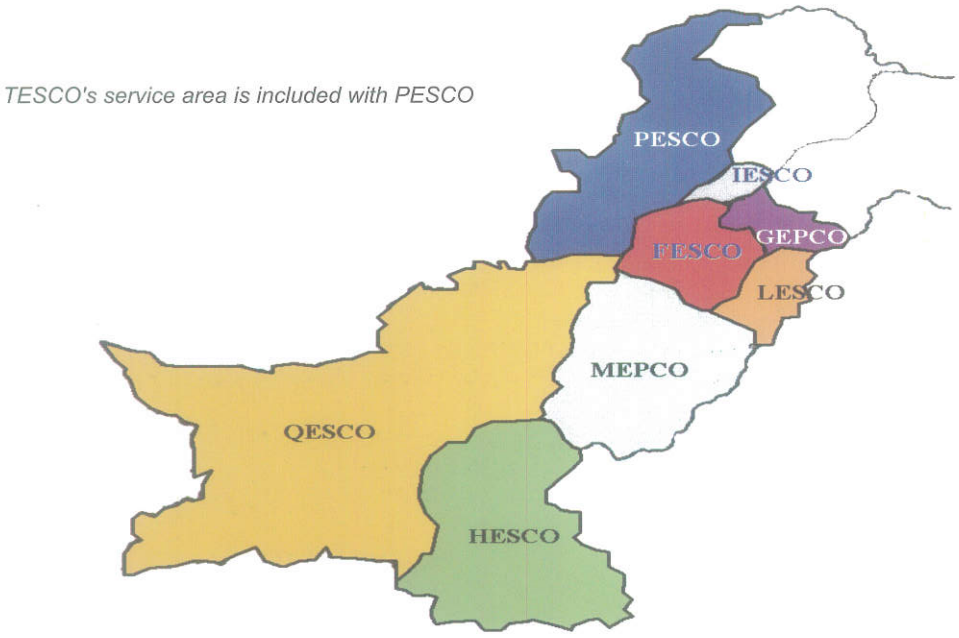
WAPDA is supplying electricity to over 13.32 million consumers in industrial, commercial and domestic sectors of the entire country except Karachi through nine distribution companies (DISCOs). WAPDA sold about 47,421 million units of electricity (MKWh) in 2002-03 by its distribution system.

The ownership, operation and maintenance of 132 kV and 66 kV transmission lines were handed over to the respective DISCO and are now part of the distribution systems.

Corporatised Distribution Companies

Name	Service Area
Lahore Electric Supply Company (LESCO)	Sheikhupura, Kasur, Lahore, Okara
Gujranwala Electric Power Company (GEPCO)	Gujranwala, Sialkot, Mandi Bahauddin, Hafizabad, Narowal, Gujrat
Faisalabad Electric Supply Company (FESCO)	Faisalabad, Sargodha, Khushab, Jhang, Toba Tek Singh, Bhalwal, Mianwali, Bhakkar
Islamabad Electric Supply Company (IESCO)	Islamabad, Rawalpindi, Attock, Jhelum, Chakwal
Multan Electric Power Company (MEPCO)	Rahim Yar Khan, Multan, Khanewal, Sahiwal, Pakpattan, Vehari, Muzaffargarh, Dera Ghazi Khan, Leiah, Rajan Pur, Bahawalpur, Lodhran, Bahawalnagar
Peshawar Electric Supply Company (PESCO)	Whole province of NWFP, except tribal areas
Hyderabad Electric Supply Company (HESCO)	Whole province of Sindh, except Karachi where KESC is responsible for distribution of power
Quetta Electric Supply Company (QESCO)	Whole province of Balochistan, except Lasbela where KESC is responsible for distribution of power
Tribal Electric Supply Company (TESCO)	Tribal areas in NWFP

Source: WAPDA



Map Showing Boundaries of DISCOs

DISCO PEAK DEMAND IN FY 2003

Name of Company	Peak Demand (MW)
PESCO PESHAWAR	1,503
IESCO ISLAMABAD	921
GEPCO GUJRANWALA	923
LESCO LAHORE	2,101
FESCO FAISALABAD	1,232
MEPCO MULTAN	1,431
HESCO H/ABAD	968
QESCO QUETTA	548
Total DISCOs	**9,627**
KESC EXPORT	325
Grand Total	**9,952**

3.25 Village Electrification

According to 1981 Census, the number of villages in the country is 125,083 out of which 73,807 have been electrified until the year 2003. The balance 51,276 are to be electrified for which an investment of Rs. 94 Billion is required over the next 10 years. Table 3.25 shows the Province wise number of villages

Table 3.25
Province Wise Number of Villages

Province	Main Villages	Sub-Villages	Total Villages	Villages Electrified	% of Total
Punjab	25399	40000	65399	39795	53.9%
Sindh	5764	13135	18899	15152	20.5%
NWFP	7809	13932	21741	15472	21%
Balochistan	6111	12933	19044	3388	4.6%
Total	45083	80000	125083	73807	100%

Village electrification has slowed down over the last many years due to inadequate allocation of funds by the government. Village electrification promotes installation of agricultural tube wells as well as small agro based industry. Rural electrification is not commercially viable for the utility, and the government may provide development funds. The year wise village electrification since the year 1992-1993 is presented at the following table:

Village Electrification

Year	Target	Realization	Progressive Total	% Growth
1992-93	2,070	4,824	45,644	-
1993-94	4,500	5,283	50,927	11.6
1994-95	2,000	6,243	57,170	12.3
1995-96	5,000	4,957	62,127	8.7
1996-97	4,000	2,441	64,568	3.9
1997-98	4,000	1,383	65,951	2.1
1998-99	4,000	1,232	67,183	1.9
1999-00	1,852	1,109	68,292	1.6
2000-01	–	1,595	69,887	2.3
2001-02	–	1,674	71,561	2.4
2002-03	–	2,246	73807	3.14

STATUS OF 132 kV, 66 kV AND 33 kV LINES AND GRID STATIONS IN DISCOS FY 2003

Name of DISCO	Lines				Grid Stations			
	132 kV (KMs)	66 kV (KMs)	33 kV (KMs)	Total (KMs)	132 kV (Nos.)	66 kV (Nos.)	33 kV (Nos.)	Total (Nos.)
FESCO	2152	1569	-	3721	42	32	-	74
GEPCO	1346	490	-	1836	34	11	-	45
HESCO	3299	1736	30	5065	74	36	1	111
IESCO	1385	567	-	1952	44	12	4	60
LESCO	1515	628	-	2143	66	13	-	79
MEPCO	2618	1479	-	4097	68	34	1	103
PESCO	1826	1377	237	3440	54	32	5	91
QESCO	2415	692	945	3852	40	10	20	70
AJK	-	-	-	-	6	-	5	11
TOTAL	16556	8538	1212	26106	428	180	32	644

KESC is supplying electricity to 1.685 Million consumers consisting of domestic, industrial, commercial and others, KESC sold 6976 MkWh during the financial year ending June 2003.

Country wise 15.005 Million consumers were supplied with electricity during the year 2002-03 and 54,397 Million units (MkWh) were consumed.

Units Purchased, Supplied and Losses of DISCOs (FY 2003)

	FESCO	QESCO	HESCO	MEPCO	GEPCO	IESCO	LESCO	PESCO
Units Purchased (GWh)	6,995	3,367	5,668	8,109	5,119	5,295	11,757	9,214
Losses	11.20%	15.00%	29.00%	13.58%	12.56%	12.28%	14.39%	27.00%
Units Sold (GWh)	6,212	2,862	4,025	7,008	4,476	4,645	10,065	6,726

PROVINCE WISE
ELECTRICITY CONSUMPTION BY ECONOMIC GROUPS (Gwh)

	Domestic	Commercial	Industrial	Agri	Public Lighting	Bulk Supply	Railway Traction	Export to KESC	Total	% of Total
BALUCHISTAN	344	68	71	2296	1	84	0		2864	5.3%
SINDH	1593	227	1058	552	38	175	0	1801	5443	10%
NWFP	4481	261	1105	475	19	417	0		6758	12.4%
PUNJAB	14437	1960	11229	2662	108	1950	10		32355	59.5%
KESC	2726	702	2719	30	78	720	0		6976	12.8%
TOTAL	23581	3218	16182	6016	244	3345	10	1801	54397	100%

3.26 Economic Load Dispatch System

The economic load dispatch system of WAPDA was commissioned in 1991. This system comprises one National Power Control Center (NPCC) at Islamabad and two Regional Control Centres (RCCs) for North and South areas located respectively at Islamabad and Jamshoro. NPCC is responsible for coordinating the operation of power plants and 500/220 kV transmission lines/grid stations. The RCCs are controlling 132 / 66 kV system in their respective areas.

3.26.1 Criteria

The main criterion for determination of Merit Order Dispatch is economy. In WAPDA system the Merit Order Dispatch is based on the Present Net Heat Rate. The most economical plant in WAPDA system is Liberty Power (Upto 61.904 GWh) and then comes Uch Power (152.375 GWh).

Bin Qasim and Korangi Thermal Power Stations are the most economical plants in KESC system and used as base load power plants.

The Merit Order Dispatch as of June 2003 is presented at next page.

MERIT ORDER

Based on the Present Net Heat Rate

June 21, 2003

Sr No	Plant Groups	Fuel Type	Fuel Cost Rs/kWh	O&M Cost Rs/kWh	Specific Cost Rs/KWh
1	Liberty (Upto 61.904 GWh)	GAS	0.27448	0.14028	0.41476
2	Uch (Upto 152.375 GWh)	GAS (*)	0.28420	0.10110	0.47040
3	Lakhra	COAL	0.75798	0.09498	0.85296
4	AEL	GAS	1.00470	0.29106	1.29576
5	Uch(-152.375 GWh)	GAS (*)	1.25140	0.10110	1.43760
6	KAPCO-1	GAS	1.34168	0.11263	1.45431
7	Guddu CC 3	R. GAS	1.42667	0.05509	1.48176
8	Liberty (+ 61.9004 GWh)	GAS	1.37241	0.14028	1.51269
9	HCPC	GAS	1.37597	0.15384	1.52981
10	Guddu CC 1 & 2	R. GAS	1.48936	0.05509	1.54445
11	KAPCO-II	GAS	1.47160	0.13174	1.60334
12	Muzaffargarh-4	GAS	1.65361	0.01747	1.67108
13	GTPC Kotri CC	GAS	1.65642	0.03319	1.68961
14	Muzaffargarh 1-3	GAS	1.67415	0.01747	1.69161
15	GTPS Faisalabad CC	GAS	1.66168	0.03813	1.69981
16	Guddu-3 Steam	R. GAS	1.70537	0.04246	1.74783
17	Guddu-4 Steam	R. GAS	1.71845	0.04246	1.76091
18	Muzaffargarh 5-6	GAS	1.75720	0.01747	1.77467
19	KAPCO-III	GAS	1.52200	0.25394	1.77594
20	Jamshoro 2-4	GAS	1.79126	0.04915	1.84041
21	Guddu CC -3 (OC)	R. GAS	1.81550	0.05329	1.86878
22	Guddu 1-2 Steam	R. GAS	1.86763	0.04246	1.91009
23	Guddu CC 1&2 OC	R. GAS	1.88669	0.05329	1.93998
24	FKPCL	GAS	1.74085	0.31812	2.05897
25	Muzaffargarh-4	MIX.(**)	2.05650	0.01747	2.07397
26	Muzaffargarh-1-3	MIX.(**)	2.08204	0.01747	2.09951
27	Jamshoro 2-4	MIX.(**)	2.13841	0.04915	2.18756
28	Guddu-3 Steam	MIX.(**)	2.15876	0.04246	2.20122
29	SPS Faisalabad	GAS	2.17182	0.02989	2.20171
30	Muzaffargarh 5-6	MIX.(**)	2.18533	0.01747	2.20280
31	Guddu-4 Steam	MIX.(**)	2.17532	0.04246	2.21778
32	NGPS Multan 3-4	GAS	2.25738	0.05219	2.30956
33	Rousch	FO	2.19475	0.11885	2.31360
34	NGPS Multan 1	GAS	2.27903	0.05219	2.33122
35	Jamshoro -1	FO	2.31890	0.04915	2.36805
36	GTPS Kotri 3-4 OC	GAS	2.36758	0.03262	2.40020
37	GTPS Kotri 5-6 OC	GAS	2.37524	0.03262	2.40787
38	KAPCO-1	FO	2.21827	0.19537	2.41364
39	GTPS Faisalabad OC	GAS	2.39632	0.03757	2.43389
40	Muzaffargarh-4	FO	2.45939	0.01747	2.47685
41	Muzaffargarh-1-3	FO	2.48993	0.01747	2.50740
42	Jamshoro 2-4	FO	2.48556	0.04915	2.53471
43	HUBCO	FO	2.54478	0.06660	2.61138
44	AES Pak-Gen	FO	2.54711	0.07272	2.61983
45	Muzaffargarh 5-6	FO	2.61346	0.01717	2.63093
46	Guddu-3 Steam	FO	2.61215	0.04246	2.65461

MERIT ORDER

Based on the Present Net Heat Rate

June 21, 2003

Sr No	Plant Groups	Fuel Type	Fuel Cost Rs/kWh	O&M Cost Rs/kWh	Specific Cost Rs/KWh
47	Japan Power	FO	2.42571	0.24240	2.66811
48	Guddu-4 Steam	FO	2.63218	0.04246	2.67465
49	Saba Power	FO	2.61880	0.07260	2.69140
50	KAPCO-II	FO	2.43459	0.27501	2.70960
51	GTPS Kotri 1-2 OC	GAS	2.72802	0.03278	2.76081
52	AES Lal-Pir	FO (***)	2.54711	0.07272	2.76483
53	SEPCOL	FO	2.40200	0.36941	2.77111
54	Kel	FO (***)	2.38963	0.28730	2.82193
55	SPS Faisalabad	MIX.(**)	2.81001	0.02989	2.93990
56	NGPS Multan 3-4	MIX.(**)	2.89716	0.05219	2.94935
57	NGPS Multan 1	MIX.(**)	2.92495	0.05219	2.97714
58	SPS Faisalabad	FO	3.44820	0.02989	3.47809
59	KAPCO-I	HSD	3.46200	0.11325	3.57525
60	NGPS Multan 3-4	FO	3.53694	0.05219	3.58913
61	NGPS Multan 1	FO	3.57087	0.05219	3.62306
62	KAPCO-II	HSD	3.79958	0.15227	3.95185
63	KAPCO-III	HSD	3.92958	0.38452	4.31410

* EXCISE DUTY (**) 50% FOQ 50 % GAS *** PREMIUM VALUE

Cost of WAPDA Thermal Plants is based on 100% Plant Factor & cost of IPPs is as per PPA

3.27 System Losses

The most obvious and major cause of high electricity tariffs in the country is the unsustainably high system losses in transmission and distribution systems. The system losses in WAPDA stand at 26% while loses in the KESC are 42.4%. The total system losses for the country are 28.57% in the financial year 2003.

The table 3.27 indicate the losses for WAPDA, KESC and the country;

Table 3.27
System Losses

SOURCE	ENERGY GENERATION GWh	ENERGY SOLD GWh	ENERGY LOST GWh	% LOSS
WAPDA	64040	47421	16619	25.95%
KESC	12115	6976	5139	42.42%
TOTAL COUNTRY	76155	54397	21758	28.57%

3.28. National Electric Power Regulatory Authority (NEPRA)

The National Electric Power Regulatory Authority (NEPRA) was created through an Act of Parliament known as the NEPRA Act, (ACT No. XL of 1997), passed by the National Assembly in December 1997.

Prior to the enactment of the NEPRA Act, the electricity sector in Pakistan was governed primarily by the Electricity Act of 1910 and the Electricity Rules 1937 promulgated under that Act. The licensing and supervisory authorities under the Electricity Act were the Provincial Governments. However, under the WAPDA Act, WAPDA is deemed to be a licensee for the purposes of the Electricity Act and has all the powers and obligations of a licensee thereunder. The NEPRA Act provides for the establishment of NEPRA as the exclusive regulator of the electricity sector in Pakistan. In general, the NEPRA Act and Rules framed thereunder confer comprehensive and exclusive regulatory authority on NEPRA.

In terms of Section 7(1) of the NEPRA Act, NEPRA shall be exclusively responsible for regulating the provision of "electric power services", which expression is defined to mean the generation, transmission or distribution of electric power and all other services incidental thereto. Section 7(2) of the NEPRA Act, elaborates that, in particular and without prejudice to the generality of the power under Section 7(1), only NEPRA shall have the range of powers, including the power to grant licences for generation, transmission and distribution of electric power and the prescription and enforcement of performance standards for generation, transmission and distribution companies.

Under Section 7(3) of the NEPRA Act, NEPRA has been expressly conferred the power to determine tariff, rates, charges and other terms and conditions for the supply of electric power services by generation, transmission and distribution companies and to recommend these to the Federal Government for notification

Section 7(4) of the NEPRA Act stipulates that notwithstanding anything contained therein, the Government of a Province may construct power houses and grid stations and lay transmission lines for use within the Province and determine the tariff for distribution of electricity within the Province. This provision reiterates the provisions of Article 157 of the Constitution.

The NEPRA Act confers the following statuary powers:

- to determine tariffs and other terms and conditions for the supply of electricity by the generation, transmission and distribution companies and to recommend these to the Federal Government, subject to the need to comply with guidelines, not inconsistent with the provisions of the NEPRA Act, laid down by the Federal Government;
- to prescribe procedures and standards for determining or revising tariffs and terms and conditions for generation, transmission, inter-connection, distribution and supply to consumers by licensees, subject to the need to:
- protect consumers against monopolistic prices;
- keep in view the research, development and capital investment programmes of licensees;
- keep in view the economic and social policy objectives of the Federal Government.
- to issue and modify licences;

- to prescribe and enforce performance standards;
- to levy and prescribe fines;
- to review the organisational affairs of licensees and to encourage uniform industry standards.

In performing its functions under the NEPRA Act, NEPRA is required, as far as practicable, to protect the interests of consumers and companies providing electric power services.

The standards and codes, such as the Distribution Code, Grid Code and Performance Standards for Distribution and Transmission have been prepared and are currently under NEPRA's review.

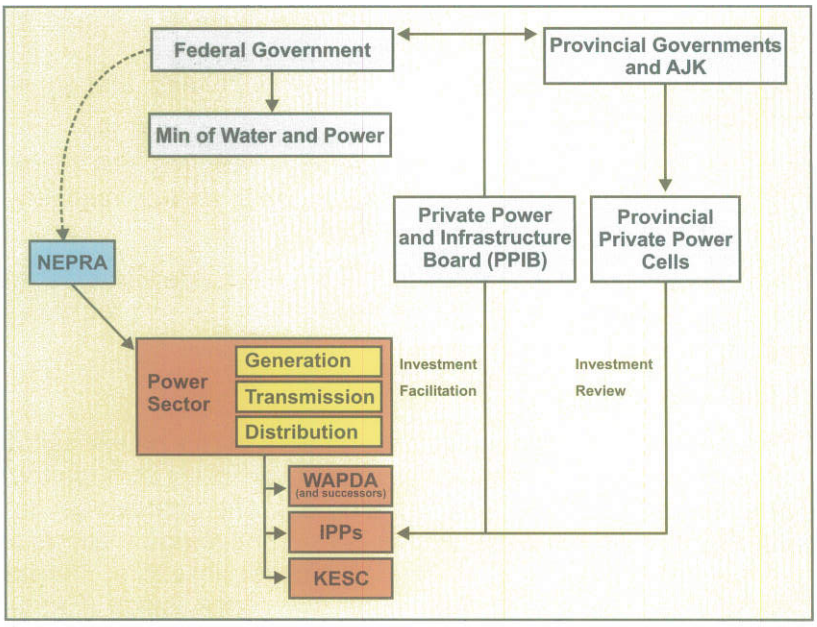
3.29 Institutional Framework

There are a number of actors and stakeholders in the power sector in Pakistan; the overall responsibility rests with the Federal Government through the Ministry of Water and Power. The Private Power & Infrastructure Board has been set up within the Ministry of Water & Power to facilitate the new IPPs as a one-window operation. The two largest players are WAPDA & KESC. Other major players are 15 Independent Power Producers (IPPs) and Pakistan Atomic Energy Commission (PAEC). Northern Areas and the Province of NWFP have small hydel capacities of their own. In addition to the generation, NTDC is responsible for 500 kV and 220 kV transmission as well as Central Power Procurement Agency (CPPA) to be established within NTDC, which will be responsible for the purchase of wholesale electricity from generation companies including existing as well as future IPPs, dispatch, and settlement. In addition there are nine Distribution Companies (DISCOs) responsible for distributing electricity to the end consumers.

NEPRA's role as an independent regulator has already been discussed at section 3.28 herein above.

The primary bodies involved in establishing and executing the power sector policy in Pakistan are shown in the following diagram, with their central roles and accountability relationships noted;

Institutional Framework



3.30 Tariff Setting

The procedures and standards in accordance with which tariffs are required to be determined, modified or revised are prescribed in the National Electric Power Regulatory Authority (Tariff Standards and Procedure) Rules, 1998.

These Tariff Rules specify that tariffs are to be determined, modified or revised in accordance with the standards presented below;

Tariff Standards

Tariffs should allow licensees the recovery of any and all casts prudently incurred to meet the demonstrated needs of their customers, provided that, assessments of licensees' prudence may not be required where tariffs are set on other than cost-of-service basis, such as formula-based tariffs that are designed to be in place for more than one year;

Tariffs should generally be calculated by including a depreciation charge and a rate of return on the capital investment of each licensee commensurate to that earned by other investments of comparable risk;

Tariffs should allow licensees a rate of return which promotes continued reasonable investment in equipment and facilities for improved and efficient service;

Tariffs should include a mechanism to allow licensees a benefit from, and penalties for failure to achieve, the efficiencies in the cost of providing the service and the quality of service;

Tariffs should reflect marginal cost principles to the extent feasible, keeping in view the financial stability of the sector;

The Authority shall have a preference for competition rather than regulation and shall adopt policies and establish tariffs towards that end;

The tariff regime should clearly identify interclass and inter-region subsidies and shall provide such subsidies transparently if found essential, with a view to minimising if not eliminating them, keeping in view the need for an adequate transition period;

Tariffs may be set below the level of cost of providing the service to consumers consuming electric power below the consumption levels determined for the purpose from time to time by the Authority, as long as such tariffs are financially sustainable;

Tariffs should, to the extent feasible, reflect the full cost of service to consumer groups with similar service requirements;

Tariffs should take into account Government subsidies or the need for adjustment to finance rural electrification in accordance with the policies of the Government;

The application of the tariffs should allow reasonable transition periods for the adjustments of tariffs to meet the standards and other requirements pursuant to the Act including the performance standards, industry standards and the uniform codes of conduct;

Tariffs should seek to provide stability and predict ability for customers; and

Tariffs should be comprehensible, free of misinterpretation and shall state explicitly each component thereof.

NEPRA is required to determine electricity tariff so as to protect the interest of the consumers as well as electric power producers/suppliers. Any raise in tariff requested by the producers / suppliers of electricity has to be allowed or rejected by NEPRA after analysing all the costs involved in the proposed sale price. For any determination of tariff the following points are generally considered by NEPRA in addition to other points on case-to-case basis:

- Utility should be able to recover its costs with some surplus for capacity expansion or return on equity.
- The average sale rate should provide for reasonable rate of return.

In order to adequately protect the interest of the consumers, NEPRA's regulatory functions include the following:

a) To set prices of electricity with an ultimate objective to bring in competition in the sector in order to improve the quality of services and reduce prices.

b) To ensure that all costs of the utilities are reasonable: Any expenses that are not reasonable are either reduced or disallowed.

c) To ensure availability of services and quality of services for all the consumers.

d) To ensure that the rates of interest on borrowed money and rate of return on equity are reasonable.

e) To set targets for efficiency improvements and reduction in costs/losses.NEPRA will penalize the utilities for non-achievement of these targets and performance standards.

Tariff charged by utility from consumers generally includes the following:

a) Fuel Cost

b) O&M expenses (maintenance cost + salaries + insurance + other expenses, etc.)

c) Cost of Power purchased from IPPs or other sources like nuclear power.

d) Debt servicing cost

e) Taxes and duties

f) Return on equity or surplus for expansion.

3.31 Subsidies and Cross Subsidies

The tariff of WAPDA and KESC is not based on the cost of service to each consumer. The tariff is driven by the Government's social and political considerations where lowest tariff is charged from low consumption domestic group and highest tariff is charged from the commercial, and higher domestic and industrial consumers. In the process certain categories of consumers provide subsidy through payment of higher tariffs to other categories of consumers.

According to NEPRA's Tariff Standards, the tariff regime should clearly identify interclass and inter-region subsidies and shall provide such subsidies transparently if found essential, with a view to minimising if not eliminating them, keeping in view the need for an adequate transition period.

The average tariff for all categories of consumers was Rs. 3.94 per kWh in 2003. The extent of the Cross Subsidies based on this average tariff is given in the following table:

Category	Variation from the Average	Amount of Subsidy	No of Consumers		Units Sold		Total Revenue	
		Mln. Rs.	Mln.	%	GWh	%	Bln. Rs	%
Dom (0-50)	-2.46	-2,199	2.32	17	894	2	1.3	1
Dom (1-300)	-1.22	-14,035	6.88	52	11,504	24	31.3	17
Dom (301+)	+0.22	+1,462	1.84	14	6,644	14	27.6	15
Commercial	+3.09	+7,765	1.87	14	2,513	5	17.7	9
Industry	+0.48	+6,464	0.21	2	13,466	28	59.5	32
Tube-wells	-0.61	-3,651	0.19	1	5,985	13	20	11
Others	+0.66	+4,234	0.01	0.1	6,415	14	29.5	16
Total	N/A	N/A	13.3	100	47,421	100	187	100

The highest tariff is charged to the Commercial consumers, which is Rs. 3.09/kWh more than the average tariff.

Substantial amount of money is provided for supply of electricity to the tubewells and agricultural consumers of the four Provinces and to the Government of AJ&K as direct subsidy every year. The subsidy is shared between GOP, WAPDA and Provincial Governments.

The lifeline consumers (Those consuming 0-50 kWh per month) presently enjoy a cross subsidy of about Rs. 2.0 billion as they are charged Rs. 1.40/kwh against the average tariff. This tariff has been frozen at this level for the last four years while the prices of electricity for other slabs have gone up substantially.

A statement of the proposed subsidies for the financial year 2003-04 is presented at the next page.

STATEMENT OF SUBSIDY FOR WAPDA
YEAR 2003-2004

S.No	Type of Subsidy	Description	Subsidy Impact	WAPDA Share	GOP Share	Provincial Govt. Share
1	Cross Subsidy					
		Domestic	11,679			
		Commercial	(7,879)			
		Industrial	(5,230)			
		Bulk	(2,237)			
		Tubewells	3,888			
		Others	(221)			
2	Subsidy By GOP on Account of ATA	Domestic			1,447	
		Tubewells			902	
3	AJ&K Subsidy				1,145	
4	Balochistan Agriculture Subsidy			1,781	2,375	1,781
5	Provincial Agriculture Subsidy					
	NWFP			22	22	22
	Punjab & Sindh			283	283	283
Total				2,086	6,174	2,086

4. ANALYSIS OF FINANCIAL HIGHLIGHTS

The financial highlights of WAPDA are presented in the following table:

WAPDA Financial Review - FY 2002- 03

Operating Data	FY 2002-03
Average structural tariff increase	6.6%
Units generated - Hydel (in GWh)	22,252
Units generated - Thermal (in GWh)	19,644
Units Purchased - IPPs (in GWh)	22,142
Total Units generated (in GWh)	64,038
Share of thermal units (% age of units Generated)	65.25%
Share of Hydel units (%age of units generated)	34.75%

Receivable / Payable Position	June -2002	June-2003
Receivables	Rs. Million	Rs. Million
Public Sector	25,037	34,449
Private	21,432	24,267
Total Receivables	46,469	58,716
Net Receivables inclusive of GST	39,360	50,124
Payables		
Oil and Gas	4,517	2,108
IPPs	6,147	496
Total Payables	10,664	2,604

Main Operating and Financial Targets	FY 2002-03
Main operational and financial targets	
Technical and non-technical losses	25.9%
Total receivables to billing	28%
Public sector receivables of total receivables	59%
Increase in O&M Cost	10%

Cash Flow Statement (FY 2002-03)

	Rs. Million
Cash receipts (excluding GST, ED, & W/Tax)	**208,116**
Total cash outflows	**224,048**
Purchase of power from IPPs	116,133
Cost of fuel	47,978
Debt service other than to GOP paid	11,444
Debt service to GOP	20,715
Hydel profit payment	6,000
Operations and maintenance	19,411
Other cash outflows	2,367
Net cash available before investment program	**(15,932)**
Investment Program (Local component)	11,630
Cash surplus (+)/deficit (-)	**(27,562)**
Financing:	
Through Banks	6,847
Payment to GOP Deferred	20,715

Before start of the financial year 2002-03, WAPDA had set revenue targets to meet financial improvement plan agreed with the World Bank and GOP for which a structural tariff increase of 12.8% effective July 1, 2002 was envisaged. However, actual increase allowed was only 6.6% w.e.f. August 13, 2002, which resulted in a revenue shortfall of Rs. 14 Billion vis-à-vis the target.

4.1 Main Operational Targets:

On operational side, WAPDA's generation mix has shown healthy improvements over the last year. WAPDA's hydel generation remained 22,348 GWh compared with the target of 20,232 GWh set for this period. Thermal Generation of WAPDA was recorded, as 19,584 GWh as compared to targeted value of 18,708 GWh. Thermal Generation in the FY 2003 was the highest during the last five years. Increased generation of WAPDA system resulted in lower purchases from IPPs by 2272 GWh. Overall generation has been recorded at 64,040 GWh during this period as against projections of 63,318 GWh. Share of thermal generation in total system reduced to 65% from 68.05% envisaged.

System losses have been reported as 25.8% higher by 0.8% from target of 25%. The increase is mainly due to increase in losses in HESCO and PESCO areas, mainly due to socio-political constraints of HESCO and PESCO areas.

4.2 Financial Targets:

a. Cash Collection/ Inflows:

During FY 2002-03 WAPDA total cash collection against sales of power and other sources was recorded as Rs.208.12 billion (exclusive of GST). The cash collection was slightly behind the target due to stuck-up public sector billings, less number of units sold as compared to target set and change in consumer mix. On the receivables front FATA alone is responsible for outstanding bills amounting to Rs.26.9 billion at the close of FY 2002-03.

b. Cash Outflows:

i) IPPs Payment

Purchases from IPPs were reduced to 22,044 GWh as compared to the projection of 24,378 GWh. This has resulted into less payment to IPPs as compared to target of Rs. 116.133 billion. As already indicated lower purchases form IPPs were possible due to better hydrology and record availability of cheaper fuel (Gas) for WAPDA thermal plants.

ii) Thermal Generation

Although WAPDA thermal generation increased by 876 GWh, the fuel cost did not increase accordingly. The thermal generation on WAPDA thermal plants using less costly gas resulted in a saving of Rs. 4.921 billion accrued from lesser purchases from IPPs.

iii) O& M Expenditure

Expenditure on O & M Cost remained within the target.

iv) Subsidies

WAPDA kept on subsidizing AJ& K, Agriculture Tube wells, Balochistan and other Agricultural consumers from its own resources as per GOP directions. The monetary impact of the subsidies is recorded to be around Rs. 2.366 billion.

4.3 Revenue Shortfall

The shortfall in cash out flow was managed by WAPDA through borrowings of Rs. 6.847 billion from Banks and deferring the payment to GOP on account of debt service liability to the tune of Rs. 20.715 billion.

4.4 KESC Financial Review

The following table highlights KESC's financial position in the year 2002-03:-

KESC Financial Review FY 2002-03
Rs. Million

Cash Flow Position		
	FY 2002-03	FY 2001-02
Cash receipts (excluding GST, ED, & W/Tax)	**33,384**	**30,867**
Total cash outflows	**47,278**	**48,608**
Purchase of power from IPPs	15,582	13,191
Cost of fuel (KESC own plants)	21,050	19,273
Debt service other than to GOP paid	2,139	7,650
Operations and maintenance	8,507	8,494
Cash surplus / (deficit)	**(13,894)**	**(17,741)**
Financing:		
Subsidy from Federal Government	5,751	-
Deficit before Tax	8,143	17,741

KESC's system is entirely based on thermal generation. The increase in demand during the FY 2002-03 was met through import of power from WAPDA and IPPs. The cost of fuel and power purchase has increased by 13% as against 4.2% increase in units available for distribution. The increase in cost of fuel has however been reduced due to improvement in Gas supply position during the year. KESC received 141 MMCFD gas as compared to 122 MMCFD registered during the last year.

Although revenue shows an increase of 8% over the previous year but this is mainly due to increase in sales volume by 4.8% and increase in tariff by 6.5% w.e.f September 13, 2002.

The loss before tax has reduced from Rs. 17741 million in FY 2002 to Rs. 13894 million in FY 2003 but the reduction in loss is due to conversion of debt service liability into the GOP equity and consequently the financial charges reduced from Rs. 8617 million in FY 2002 to Rs.2139 million in FY 2003.

The level of other O&M costs comprising of salaries & wages, stores & spares and repair & maintenance has almost remained the same during the FY 2003.

The transmission and distribution losses show a minor improvement of 0.3% during FY 2003 over the previous dated FY 2002.

4.5 Existing WAPDA / KESC Tariff

Following are the existing average tariffs for various consumer categories of WAPDA/KESC.

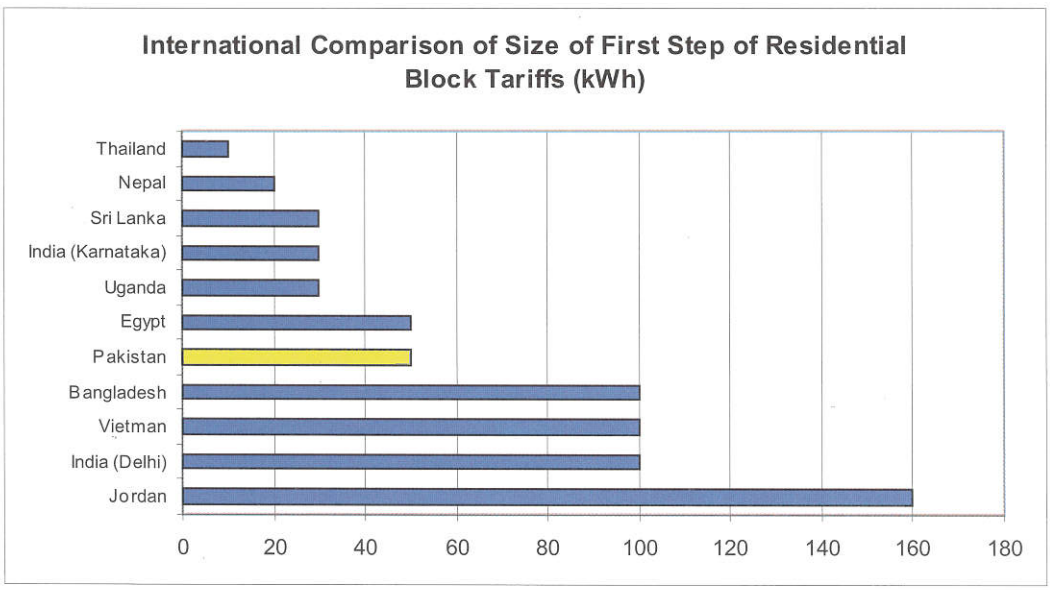
Tariff Paisa / kWh (As of November - 2003)

	Categories	WAPDA	KESC
A	Average Domestic	339	357
B	Average Commercial	683	747
C	Average Industry	436	506
D	Average Bulk	513	582
E	Average Tube wells	339	405
F	Average Public Lighting	669	687

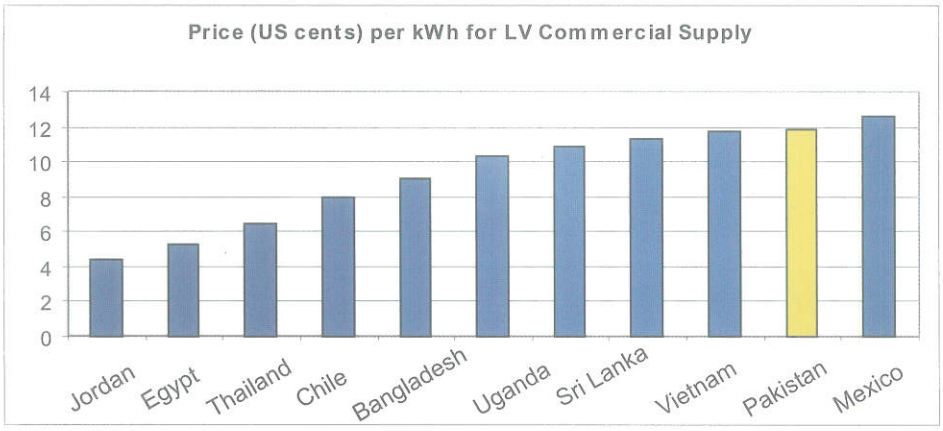
Source: WAPDA / KESC

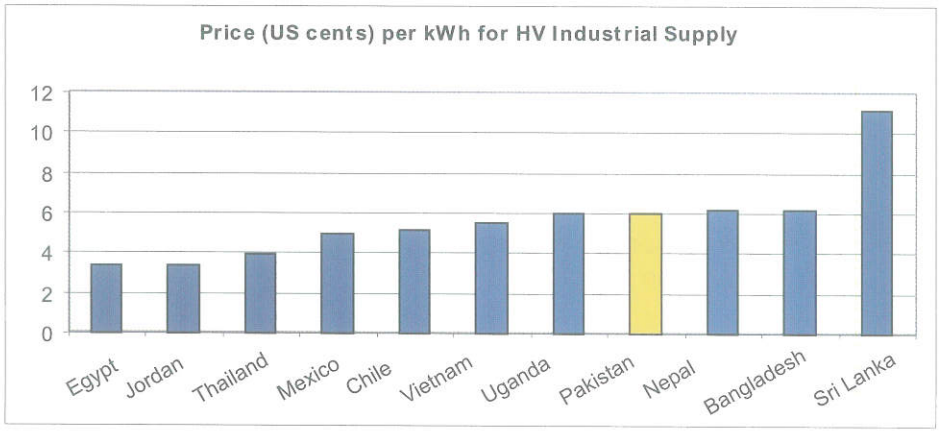
4.6 Comparison of Tariff with other Developing Countries

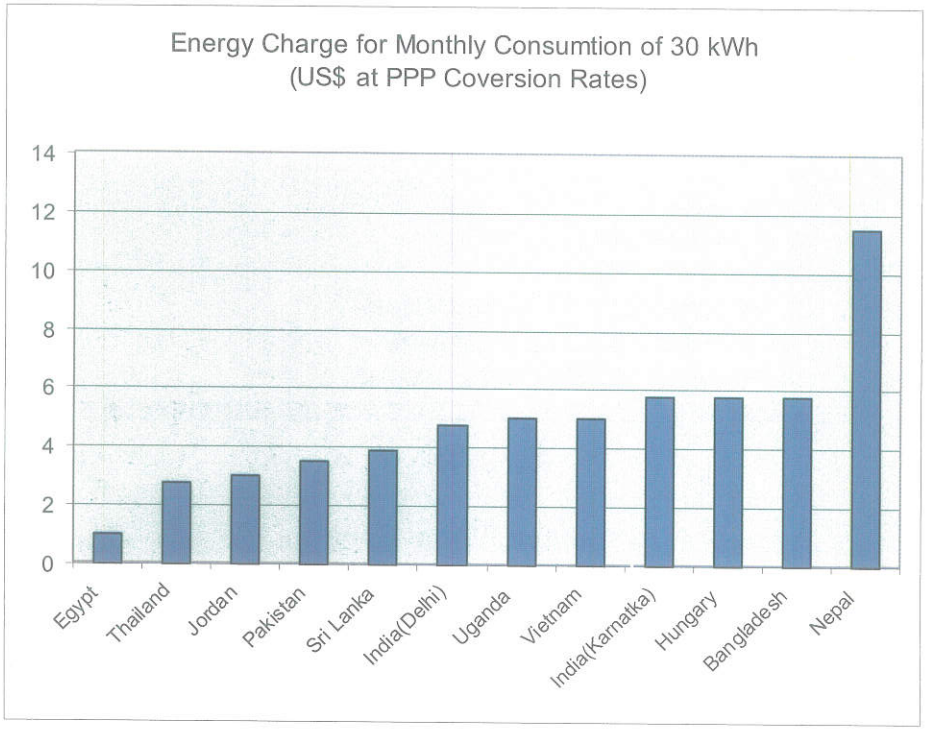
The following tables present a comparison of the tariffs prevailing in different countries with the tariffs in Pakistan.

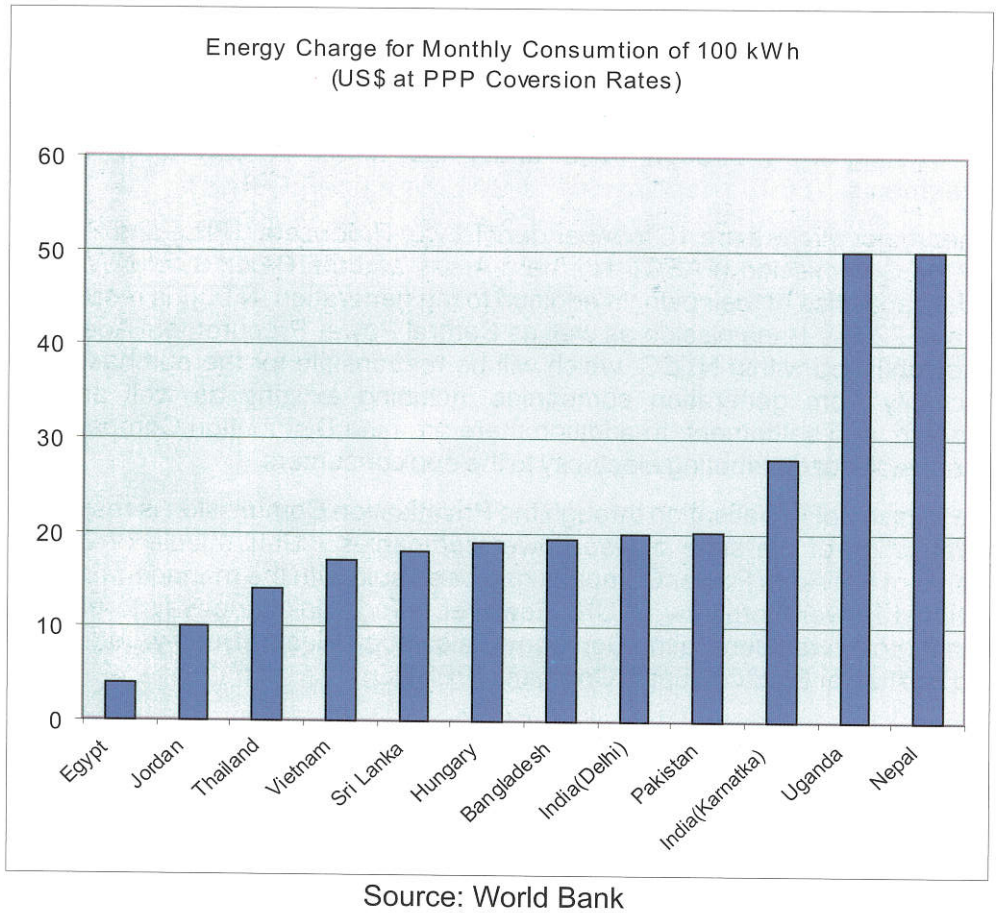


Source: World Bank

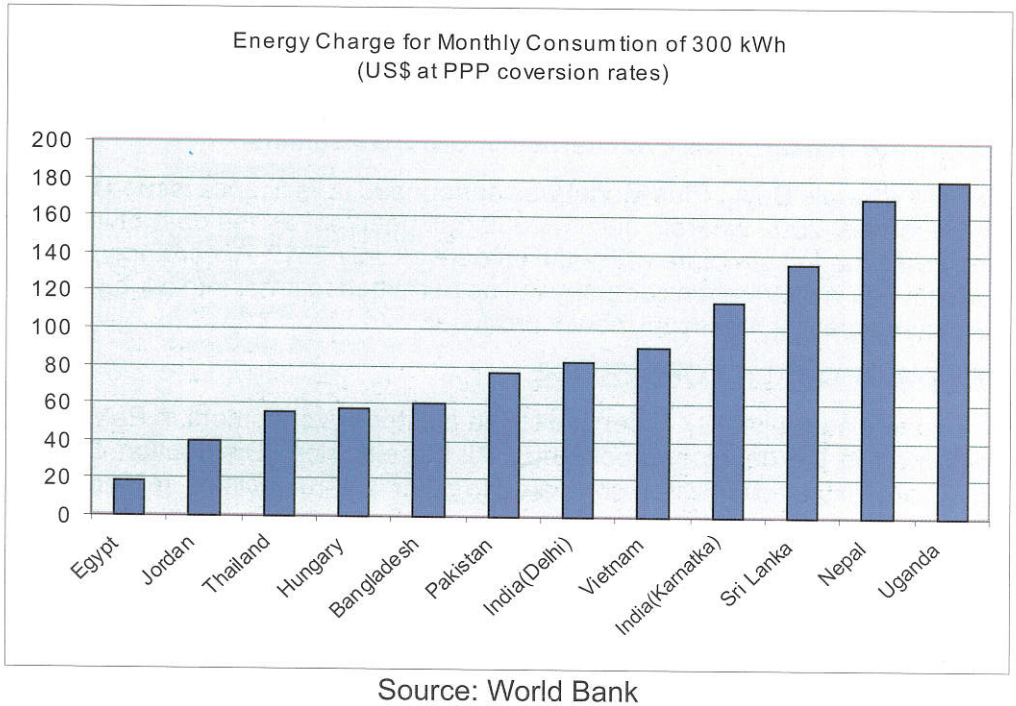

Price (US cents) per kWh for LV Commercial Supply
14
12
10
8
6
4
2
0
Jordan
Egypt
Thailand
Chile
Bangladesh
Uganda
Sri Lanka
Vietnam
Pakistan
Mexico


Price (US cents) per kWh for HV Industrial Supply
12
10
8
6
4
2
0
Egypt
Jordan
Thailand
Mexico
Chile
Vietnam
Uganda
Pakistan
Nepal
Bangladesh
Sri Lanka


Energy Charge for Monthly Consumtion of 30 kWh
(US$ at PPP Coversion Rates)
14
12
10
8
6
4
2
0
Egypt
Thailand
Jordan
Pakistan
Sri Lanka
India(Delhi)
Uganda
Vietnam
India(Karnatka)
Hungary
Bangladesh
Nepal



Source: World Bank



Source: World Bank

5. MANAGEMENT AND GOVERNANCE REVIEW

The Government of Pakistan (GOP) through its various Ministries and specifically through the Ministry of Water & Power directly manages the power sector and retains significant control over the state owned utilities WAPDA and KESC. GOP also monitors the existing IPPs through PPIB under the terms of long term Implementation Agreements.

Other major players are 15 Independent Power Producers (IPPs) and Pakistan Atomic Energy Commission (PAEC). Northern Areas and the Province of NWFP have small hydel capacities of their own. In addition to the generation, NTDC is responsible for 500 kV and 220 kV transmission as well as Central Power Procurement Agency (CPPA) to be established within NTDC, which will be responsible for the purchase of wholesale electricity from generation companies including existing as well as future IPPs, dispatch, and settlement. In addition there are nine Distribution Companies (DISCOs) responsible for distributing electricity to the end consumers.

The Ministry of Privatisation through the Privatisation Commission is responsible for the privatisation of the state owned power companies. Until middle of 2004 only 36% shares of Kot Addu Power Company had been sold with the management control to the National Power Company of UK. However, efforts are underway to privatise KESC, Jamshoro Power Generation Company, Faisalabad Electric Supply Company (FESCO) and Peshawar Electric Supply Company (PESCO).

Pakistan Electric Power Company (PEPCO), was originally established as a holding company, but later converted into a managing company for the purpose of completing the restructuring of WAPDA, so that the corporatised companies continue to function in an integrated manner. PEPCO is pursuing a plan to establish their full autonomy by completing the transfer of employees, registration of assets, and transfer of liabilities.

Although the development and implementation of the national power policy is the primary responsibility of the GOP/Ministry of Water & Power but for the last few years NEPRA has been providing an active support to the initiatives of the GOP in developing policies for the power sector.

NEPRA has taken bold initiatives to reform the power sector with the objective of converting it from the present vertically integrated structure to an efficient private and competitive market for the eventual benefit of the consumers.

NEPRA's Single Buyer Plus Model was announced in its licence issued to the NTDC on 31 December 2002 wherein July 1, 2009 has been set as the date of introduction of a wholesale market structure with a cut off date as July 2012. Accordingly any bulk power consumer or a distribution company will be permitted to enter into a long-term electricity purchase agreement with any power producer.

6. REVIEW OF QUALITY OF SERVICE

The quality and reliability of service to the electricity consumers in Pakistan is poor as compared to the developed countries. All the electricity Distribution Companies and KESC are less efficient when compared to other well-run utilities around the world. The quality of service is also not upto the standard and requires improvements to meet the performance standards. NEPRA has drafted performance standards for the Distribution Companies and KESC. All the Distribution Companies and KESC have to set performance targets in order to achieve these standards.

The following areas require improvement to meet the performance standard criteria

set by NEPRA:

I) Customer Service Performance:
- Voltage Performance
- Continuity of Supply

ii) Technical and Commercial Losses

iii) Restoration of supply following interruption

6.1 Customer Service Performance Targets

The voltage performance and the continuity of supply are generally used to measure the customer service performance. In both cases, the Distribution Companies and KESC fall short of the standards found in well-run utilities.

The table below compares the performance of Pakistan's Distribution Companies with international standards:

	Pakistan Distribution Companies		North America/Europe	
	SAIFI	SAIDI	SAIFI	SAIDI
132kV and 66kV	535	83.3	5.0	0.7
11kV	5,968	14.2	60-180	1.0-4.0

There are three indices that are widely used for system performance, which were originally developed by the Canadian Electricity Association but are now widely used internationally:

(1) System Average Interruption Frequency Index (SAIFI) (frequency of interruptions per connected customers)

$$SAIFI = \frac{\text{Frequency of Interruptions}}{\text{Total Connected Customers}}$$

(2) System Average Interruption Duration Index (SAIDI) (hours of interruptions per connected customers)

$$SAIDI = \frac{\text{Hours of Interruptions}}{\text{Total Connected Customers}}$$

(3) Customer Average Interruption Duration Index (CAIDI) (measured in hours per interruption)

$$CAIDI = \frac{SAIDI}{SAIFI}$$

6.2 Voltage Performance Targets

Most of the 11kV feeders in the large cities are over loaded and in villages the length of 11 kV feeders are very long resulting in extremely low voltages to the end consumers. At these low voltages, no electrical appliances will work properly; most of them will not work at all. This means that at times of peak load, these customers for whom maximum voltage drops are in the range of 20% to 25% are effectively deprived of electricity supply.

6.3 Technical and Commercial Loss Reduction Target

The table 3.27 is reproduced here under for reference

TABLE 3.27
System Losses

SOURCE	ENERGY GENERATION GWH	ENERGY SOLD GWH	ENERGY LOST GWH	% LOSS
WAPDA	64040	47421	16619	25.95%
KESC	12115	6976	5139	42.42%
TOTAL COUNTRY	76155	54397	21758	28.57%

WAPDA's electricity sales gap of 26% of units sent out is estimated to be divided approximately equally between Technical and Commercial losses, while for KESC, the sales gap of 42% of units sent out can be divided in the ratio of 1:3 between Technical and Commercial losses due to the smaller network of KESC. Therefore, approximately 12,164 GWH are lost on account of Commercial losses or theft, which is about 16%. The corresponding Technical Losses are approximately 13% for the country.

Considering Commercial Losses first, Pakistan's value of 16% would be considered unacceptably high in Western Europe and North America. In developed countries, utilities pay close attention to commercial losses, and, in principle the only acceptable level is zero. In practice, the value generally is less than 1%.

While a certain percentage of technical losses in a system are inherent to the system design, poor operational practices have contributed to a higher level of losses for Pakistan. For example, service connections often follow the apparently widespread practice of simply twisting the service cable conductor around the main conductor. With copper conductors, this could be expected to result in a high-resistance (i.e., higher losses) but stable connection. However, with aluminium conductors, such connections would not only increase resistance but also be highly unstable and short-lived. Furthermore, their failure would also damage the main conductor. Overloading of transformers and excessive voltage drops also contribute to higher technical losses.

It is felt that most of the commercial losses are related to theft or old meters that underreport consumption. As there are well-defined procedures in place to detect and correct meter-related losses at 11kV and 132kV levels, it is assumed that most of the losses occur at low and medium voltage levels. While a substantial reduction in technical losses may not be possible without significant investment, commercial losses could be controlled by increasing vigilance, under grounding LV networks, or using insulated aerial bundled conductors as replacement for bare overhead conductors. There is also a need for better quality meters.

Ex-WAPDA Companies and KESC are advised to pay special attention to the improvement of the quality and reliability of service to the consumers, establish complaint centres for speedy complaint registration and restoration of faults to the consumer satisfaction. The middle and senior level officers should be made accountable and accessible to redress public grievances and to ensure the reliability and quality of services.

6.4 Draft Performance Standards

The Distribution Companies have been operating without any standardised Performance Standards and without much accountability for the service reliability, quality of supply, outage and restoration time, safety of supply and other technical criteria for its operation.

NEPRA has drafted the Performance Standards for the Distribution Companies. Initially these Standards shall be limited to supply reliability and supply restoration. These Performance Standards shall be further added /deleted/modified in future reporting years.

7. STATUS OF COST OF SERVICE STUDIES

It is believed that the Pakistan Electric Power Company (PEPCO) has awarded a contract to M/s Inconsult in April 2004 to carry out the Cost of Service Study and complete the assignment within 12 months.

The objective of the study is to have a consumer end tariff based on the cost of service on different voltage levels enabling distribution companies to recover the variable and fixed cost of their system.

8. INVESTMENT PLANS IN POWER SECTOR

8.1 Investment Requirements in Generation

The 1450 MW Ghazi Brotha Hydropower Project started supplying power to the national grid in the year 2003-04. According to WAPDA sources the total cost of the project was Rs. 89,840 Million with Foreign Exchange component of Rs. 50,495 Million and local component of Rs. 39,345 Million.

The increasing demand of electric power until the year 2012-13 would be met through the generation of electricity by public sector as well as private sector power generation projects as listed in table 3.18 of this Report. The investment requirement for the public sector power generation projects is presented in the table below:

Table 7.1 A
Investment Plan for Public Sector Power Generation Projects

Sr. No.	Name of the Project	Capacity (MW)	Expected Commissioning Year	Investment Requirement Million Rupees
1	Ghazi Brotha Hydro Power Project	1450	2003-04	89,850
2	Allai Khawar Hydro Power Project	121	2007-08	8,578
3	Khan Khawar Hydro Power Project	130	2009-10	5,363
4	Thar Coal Thermal Power Project	600	2009-10	38,373
5	Golan Gol Hydro Power Project	106	2010-11	7,035
6	Chashma Nuclear Power Project-II	360	2010-11	40,800*
7	Jinnah Hydro Power Project	96	2011-12	13,547
8	Neelam Jhelum Hydro Power Project	963	2012-13	84,000
	Total	3826		287,546

Source; WAPDA
* International experts estimate

The cost estimates for the private sector power projects listed in table 3.18 are presented below:

Table 7.1 B

Investment Plan for Private Sector Power Generation Projects

Sr. No.	Name of the Project	Capacity (MW)	Expected Commissioning Year	Investment Requirement Million Rupees
1	OPI Power Project (IPP)-WAPDA	200	2007-08	8,120
2	Korangi Power Project (IPP)-KESC	150	2007-08	6,090
3	Western Electric (IPP)-KESC	150	2007-08	5,220
4	Balloki Power Project (IPP)-WAPDA	200	2007-08	8,120
5	Jarwar Power Project (IPP)-WAPDA	123	2007-08	4,994
6	Interconstruct (IPP)-WAPDA	150	2007-08	5,220
7	Mari Power Project (IPP)-WAPDA	175	2008-09	7,105
	Total	1148		44,869

Source: PPIB, Cost Estimates by Enerpro

8.2 CURRENT INVESTMENT PLANS IN TRANSMISSION

The immediate investment requirement in the transmission lines is given in the table 8.2 A below:

Table 8.2 A

Immediate Investment Program in Million Rupees		
	FY 03	FY 04
Secondary Transmission & Grid		
Local Component	2500	2500
Foreign Component	2500	2500
Total	5000	5000
Dispersal of Ghazi Brotha		
Local Component	330	1000
Foreign Component	1567	2000
Total	1897	3000
Muzaffergarh Gatti T/Line		
Local Component	570	570
Foreing Component	0	2200
Total	570	2770
Upgradation of NPCC Islamabad		
Local Component	0	10
Foreing Component	0	100
Total	0	110
Total PSDP		
Local Component	3400	4080
Foreing Component	4067	6800
Total	*7467*	*10880*

The long-term investment plan for the NTDC is given in table 8.2 B below:

Table 8.2 B

NTDC EXPANSION PLAN (2003-2008)					
Sr. No.	Name of Scheme	Project Cost (Rs. In million)			FEC
		Total	Local	FEC	(US$ Million)
1	Up-gradation of Load Dispatch System	2895	1015	1880	32
2	500/220 kV NTDC -KESC Interconnection				
	New 500 kV Grid Station in KESC area and 7 km, 220 kV D/C	3090	1340	1750	30
	Transmission Line				
3	Up-gradation of 220 kV Grid Station Sahiwal to 500 kV	2970	1222	1748	30
4	Extension of 500 kV Rawat Grid Station for addition of 3rd	946	347	599	10
	500/220 kV 450 MVA Transformer				
5	500 kV Thar Coal - Jamshro Transmission Line (approx. 225 km)	4435	2595	1840	31
6	New 220 kV Grid Station at Ghazi Road Lahore alongwith 220 kV	1665	863	802	14
	D/C Transmission Line (approx. 80km)				
7	New 220 kV Grid Station at Khuzdar alongwith 220 kV Dadu-	3810	2241	1569	27
	Khuzdar D/C Transmission Line (approx. 300 km)				
8	New 220 kV Grid Station at Nowshera Ind. Alongwith 220 kV	1218	572	646	11
	Nowshera-Mardan D/C Transmission Line (approx. 10 km)				
9	New 220 kV Grid Station at D.G. Khan alongwith 220 kV	1592	881	711	12
	Muzaffargarh-D-G Khan D/C/Transmission Line (approx. 65 km)				
10	New 220 kV Grid Station at Chichawatni	1207	618	589	10
11	New 220 kV Grid Station at Kharian	805	372	433	7
12	Extension of eight 220 kV Grid Station of NTDC System for				
	addition of 160 MVA, 220/132 kV Transformers one at each	1768	656	1112	19
	Grid station				
	TOTAL	26401	12722	13679	233

8.3 Investment Plans in Distribution

The investment requirement in the Ex-WAPDA DISCOs until the year 2008 is given in the following table:

Table 8.3

DISCO WISE SUMMARY OF INVESTMENT PLAN (2003-08)

Sr. No	DISCO	Investment (Rs. In Million)
		2003-08
1	LESCO	5908.4
2	GEPCO	4592.3
3	FESCO	6167.7
4	IESCO	5726.9
5	MEPCO	9528.1
6	PESCO	7342.4
7	HESCO	7356.0
8	QESCO	6159.0
	TOTAL	**52780.9**

8.4 Investment Plan for KESC

The details of KESC's investment programme is given in the following table:

INVESTMENT PLAN FOR KESC

Sr. No	Description	Investment Million Rs
1	Generation	750
2	Transmission	6,359
3	Distribution	4,191
4	SCADA/Load Dispatch Centre	2,398
	Total	13698

8.5 TOTAL INVESTMENT PLAN FOR THE POWER SECTOR

The total investments required in the Power Sector including investments in generation (Private and Public), transmission and distribution is estimated as Rs. 436 Billion or US $ 7.5 Billion over the next ten years. However, this estimate is contingent upon the electricity demand growth rate of the country and would be inadequate if the demand increases beyond 10% per year for the next ten years.

9. INCREMENTAL BENEFITS OF INVESTMENT

With the restructuring of WAPDA power wing, independent generation, transmission and distribution companies have been incorporated. The government of Pakistan intends to privatise the newly formed generation and distribution companies, while the transmission and hydropower generating companies will remain in the public sector. The idea for privatization is being considered for bringing efficiency and improvement with the incoming of the new management.

It is also expected that after privatization the new management will be able to act freely and implement its decisions for the betterment of the company without any wastage of time which is a normal routine in the public sector while following the formalities.

In some cases there was a requirement of immediate maintenance but due to shortage of funds or non-availability of the necessary approvals, even the job of very emergent nature could not be carried out, resulting in the multiplication of the losses. Some of the major losses to the overall power system are briefly discussed as follows:

The long outstanding major overhauling and even the routine maintenance is not carried out in time, resulting in the downfall of the generating capability and efficiency of the power generation.

The congestion in the transmission network resulted in increased transmission losses as well as non utilization of the available power generation.

Non-implementation of the transmission lines expansion programme resulted in the insufficient capacity of the transmission system, which in turn resulted in under utilization of the installed power generating capability.

The required expansion in the distribution system could not be carried out, which hindered the growth of sales to the customers.

The technical and administrative losses have been increasing due to shortage of transformers and feeders of the required capacity.

The liquidity position of various companies has deteriorated due to lack of commercial expertise in the existing management. It is expected that with the induction of the new efficient management, some of the administrative losses will be reduced and efficiency in operation would be achieved.

In addition to the administrative measures some investment would also be required, resulting in the incremental benefits. These are discussed in the succeeding paragraphs.

9.1 Conversion from Oil to Gas

There is a saving of approximately Rs. 1.50/kWh generated on gas instead of furnace oil. This makes a strong case for conversion from oil to gas. However, currently adequate gas is not available to meet the full requirements of the power sector. Gas prices are also under-going rapid enhancement. Conversion to gas will also have an impact on local oil refineries, which are producing about 3.5 million tonnes of fuel oil annually. The possibility and economic benefit of conversion therefore, need a detailed study. There are also questions of technical and economic feasibility of conversion in some cases like HUBCO, AES etc. As regards the IPPs, in addition to factors mentioned above, since fuel cost is a pass-through item in terms of their Power Purchase Agreements (PPA), most of the IPPs have no incentive for conversion unless the power purchasers share the costs of conversion as well as the benefits.

The cost of conversion from oil to gas is estimated as Rs. 2300 million in case of a 300 MW steam plant. At current prices of gas and furnace oil, if the plant were operated at 60% annual plant factor, the cost of conversion could be recovered in one year.

9.2 Generating Plants Efficiency Improvements

A number of power generation plants have de-rated with the passage of time, resulting in increased fuel consumption and cost of generation. Measures therefore are to be undertaken for restoring the de-rated power plants and improving their efficiency to reduce the cost of generation wherever economically feasible. A rehabilitation program may also be initiated for restoring the lost capacity of the power plants.

9.3 System Loss Reduction

In view of the excessive system losses of Ex-WAPDA distribution companies (DISCOs) and KESC a well-planned loss reduction programme should be the top priority for these organizations. While some technical losses are justified and inevitable, there is an urgent need for reducing these losses substantially.

Although no metering is available in the system to measure the exact loss caused by power pilferage, a rough estimate is that it ranges between 6-8% for WAPDA and 15-20% for KESC primarily in the distribution system.

9.4 Technical Measures

Technical measures on the transmission side could comprise replacement of 33 kV and 66 kV lines with 132 kV lines, putting up new transmission lines and grid stations where required and installation of capacitor banks for grid stations.

Technical measures on the distribution side may consist of replacing old, dilapidated, over loaded and faulty distribution lines and transformers etc., installation of energy meters at each distribution transformer and LT Feeder, and replacing old, slow running and faulty meters.

9.5 Investment Requirements

A five-year (2003-2008) comprehensive system rehabilitation, improvement and expansion program costing Rs. 83.7 billion for their transmission and distribution system has been chalked out by WAPDA and sent to the Government for approval. The benefits arising out of this investment are estimated as Rs. 99 billion over a period of five years in addition to the system reliability.

EX WAPDA DISTRIBUTION COMPANIES

EXPECTED SAVING FROM SYSTEM AUGMENTATION PROGRAM (ELR, DOP & STG)

SUMMARY

Fiscal Year	Distribution (DOP & ELR)		Secondary Transmission & Grid		Total		Expected cumulative Saving
	Investment Rs. (Million)	Expected Saving (GWh)	Investment Rs. (Million)	Expected Saving (GWh)	Investment Rs. (Million)	Expected Saving (GWh)	Rs. (Million)
2003-04	5377	1352	16512	659	21889	2010	6031
2004-05	5685	1572	13297	509	18982	2080	12271
2005-06	6287	1870	9056	406	15342	2276	19097
2006-07	6603	2131	8390	442	14993	2573	26815
2007-08	7006	2290	5526	504	12532	2794	35196
Total	30957	9215	52781	2520	83737	11732	99410

EX WAPDA DISTRIBUTION COMPANIES

PHYSICAL TARGETS AND EXPECTED SAVINGS FROM SYSTEM AUGMENTATION PROGRAM

Rehabilitation & Energy Loss Reduction (R&ELR) Projects

Fiscal Year	TECHNICAL SCOPE						ADMINISTRATIVE SCOPE		Total Saving (GWh)	Total Cumulative Saving Rs. (Million)
	11 kV Capacitor Banks		HT Lines (Bif-Rec)		LT Lines (New & Rec)		Meters to be Replaced			
	(Qty) 450 (KVARH)	Saving (GWh)	(KM)	Saving (GWh)	(KM)	Saving (GWh)	(Nos)	Saving (GWh)		
2003-04	295	42	2605	188	1408	219	539503	189	638	1914
2004-05	289	52	2720	253	1400	267	481135	202	774	4236
2005-06	309	56	2921	329	1507	336	491123	242	963	7125
2006-07	287	60	2682	383	1514	401	480635	274	1118	10479
2007-08	273	63	2466	417	1526	414	479641	309	1203	14088
Total	1453	273	13395	1570	7356	1636	2472037	1216	4696	37842

EX WAPDA DISTRIBUTION COMPANIES

PHYSICAL TARGETS AND EXPECTED SAVINGS FROM SYSTEM AUGMENTATION PROGRAM

Rehabilitation & Energy Loss Reduction (R&ELR) Projects

Fiscal Year	TECHNICAL SCOPE						ADMINISTRATIVE SCOPE		Total Saving (GWh)	Total Cumulative Saving Rs. (Million)
	11 kV Capacitor Banks		HT Lines (Bif-Rec)		LT Lines (New & Rec)		Meters to be Replaced			
	(Qty) 450 (KVARH)	Saving (GWh)	(KM)	Saving (GWh)	(KM)	Saving (GWh)	(Nos)	Saving (GWh)		
2003-04	295	42	2605	188	1408	219	539503	189	638	1914
2004-05	289	52	2720	253	1400	267	481135	202	774	4236
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Total	1453	273	13395	1570	7356	1636	2472037	1216	4696	37842

EX WAPDA DISTRIBUTION COMPANIES

PHYSICAL TARGETS AND EXPECTED SAVINGS FROM SYSTEM AUGMENTATION PROGRAM

DISTRIBUTION OF POWER (DOP) 2003-08

Fiscal Year	TECHNICAL SCOPE						ADMINISTRATIVE SCOPE		Saving Through Monitoring & Surveillance	Saving	Total Saving	Total cumulative Saving
	11 kV Capacitor Banks		HT Lines (Bif-Rec)		LT Lines (New & Rec)		Meters to be Replaced					
	(Qty) 450 (KVARH)	Saving (GWh)	(KM)	Saving (GWh)	(KM)	Saving (GWh)	(Nos)	Saving (GWh)	(GWh)	(GWh)	(GWh)	Rs.(Million)
2003-04	52	4	1410	34	1220	65	228825	253	357	610	713	2138
2004-05	52	5	1473	35	1345	69	239402	290	399	689	798	4531
2005-06	52	6	1538	42	1432	80	246169	326	454	780	908	7255
2006-07	52	6	1605	51	1519	87	253135	363	507	870	1014	10297
2007-08	52	7	1672	54	1608	80	264310	402	544	946	1087	13557
Total	260	28	7698	216	7124	381	1231841	1634	2260	3895	4519	37777

EX WAPDA DISTRIBUTION COMPANIES

PHYSICAL TARGETS AND EXPECTED SAVING FROM SYSTEM AUGMENTATION PROGRAM

Secondary Transmission & Grid (6th STG) 2003-08

Fiscal Year	Reconductoring/ Conversion of 33 & 66kV to 132kV		Capacitor Banks for Grid Station (One 132kV Capacitor Bank =24 MVAR & One 11 kV Capacitor Set = 0.6 MVAR)				Total Saving	Total cumulative Saving
	Length (Km)	Saving (GWh)	132kV Banks (MVAR)	Saving (GWh)	11kV Set (MVAR)	Saving (GWh)	(GWh)	Rs.(Million)
2003-04	1185	625	432	15	395	19	659	1977
2004-05	609	475	168	11	317	23	509	3504
2005-06	487	379	240	12	238	15	406	4722
2006-07	513	429	96	0	198	13	442	6048
2007-08	238	492	144	0	137	12	504	7560
Total	3032	2400	1080	38	1285	82	2520	23811

132KV AND 11 kV Capacitor Banks

Proposed for Grid Stations during 2003-08

Fiscal Year	Capacitor Banks for Grid Station (One 132 kV Capacitor Bank = 24 MVAR & One 11 kV Capacitor Set = 0.6 MVAR)						Total Investment	Total Saving	Total cumulative Saving
	132 kV Banks (MVAR)	Investment Rs.(Million)	Saving (GWH)	11 kV Set (MVAR)	Rs.(Million)	Saving (GWH)	Rs. (Million)	(GWh)	Rs.(Million)
2003-04	432	180	15	397	156	19	336	34	102
2004-05	168	96	11	317	90	23	186	34	204
2005-06	240	162	12	239	46	15	208	27	285
2006-07	96	125	0	198	81	13	206	13	324
2007-08	120	149	0	138	30	12	179	12	360
Total	1056	712	38	1289	403	82	1115	120	1275

9.6 Incremental Benefits of Investment for KESC

KESC has also launched a similar programme of system improvement for a 5-year period costing Rs. 13 billion. The details of the programme and the benefits accruing from the investment are estimated as under :

INVESTMENT IN KESC CAPITAL INVESTMENT THROUGH PC-I YEAR WISE EXPENDITURE					Million Rs
Description	2003	2004	2005	2006	Total
Generation	150	200	200	200	750
Distribution	440	1,016	1,369	1,366	4,191
Transmission	334	1,791	2,747	1,487	6,359
SCADA/Load Dispatch Centre	0	355	1,063	980	2,398
Total	2927	5366	7384	6039	13698

DETAILS OF THE PROJECTS		
1	Restructuring of Zones	22 Zones
2	Shifting of Industrial meters	30,500
3	Shifting Res & Commercial meters	720,000
4	Installation of meters on PMTs	5,825
5	System Improvement:	
	• Laying of 11 kV Feeders	120
	• Installation of new PMTs	3,000
	• Protection system on 11 kV feeders	300
	• Reinforcement of conductors (spans)	3,200
	• Installation of LT breakers on PMTs	5,825
6	Bus bar in multi storied buildings	160
7	Removal of Kundas	132,000
8	Induction of ariel bundle cable	12 KM
9	Addition/Replacement of power transmission lines	10
10	Addition of new grid stations & transmission lines	12
11	Enhancement of generation capacity	143 MW

The benefits accruing from the investment are estimated as under:

i) Enhancement in power generating capability as 143 MW.

The accruing benefits arising out of the investment of Rs. 750 million is in monetary terms estimated as Rs. 2100 million assuming setting-up of new simple cycle gas turbines.

ii) Reduction in transmission and distribution losses as 10%.

At current rates of generation and sale rate per kWh, it is estimated that for each one

percent reduction in losses a benefit of Rs. 500 million would accrue. Assuming an annual reduction in losses by 2%, the total cumulative benefits during five years would be Rs. 15 billion thus indicating that the payback period will be less than five years.

10 ELECTRIC POWER MARKET STRUCTURE

10.1 Background

In 1992, the Government of Pakistan launched a Strategic Plan for Restructuring and Privatization of the Pakistan Power Sector, with the following objectives:

i) Mobilize private resources for the development of the sector, without recourse to the Government's budget;

ii) Improve the power utilities' performance and efficiency, through corporatisation / commercialisation (in preparation for their eventual privatization), enhanced managerial autonomy and accountability, competition and profit incentives, etc.

iii) Introduce a transparent regulatory framework (particularly in setting electricity tariffs) to provide comfort to potential investors, while enabling the Government to maintain certain socially desirable activities such as "lifeline rates" for poor consumers and rural electrification programs.

The intention of GOP was to move ultimately towards the creation of a competitive power market in Pakistan. It was proposed to do so by first restructuring and then privatising the existing thermal power generation, power transmission and distribution functions and assets of WAPDA and KESC, and the creation of a fully autonomous regulatory authority NEPRA. WAPDA will revert to its original role as a development organization for water and hydropower resources and maintenance and operation of large dams, reservoirs and hydropower stations.

10.2 Unbundling of WAPDA

In pursuance of this program, WAPDA's power assets have been unbundled and incorporated into 14 separate companies, consisting of (i) 4 generation companies, (ii) the National Transmission & Dispatch Company (NTDC); and 9 distribution companies. (Already explained in Section 3.5 of this Report)

The WAPDA restructuring program and the transformation of power assets into autonomous corporatised entities have been led by the Pakistan Electric Power Company (PEPCO), which was originally established as a holding company, but later converted into a managing company for the purpose of completing the above restructuring, so that the corporatised companies continue to function in an integrated manner. PEPCO is pursuing a plan to establish their full autonomy by completing the transfer of employees, registration of assets, and transfer of liabilities.

NTDC would remain a state-owned entity responsible for dispatch, transmission, and system planning in the former WAPDA region.

10.3 Privatization of KESC and Ex-WAPDA DISCOs

Simultaneously, efforts are also afoot for the privatization of KESC, FESCO and PESCO through sale of its equity interest as well as management to a strategic buyer in order to check the constant drain on public exchequer through system losses.

A Central Power Procurement Agency (CPPA) is to be established within NTDC, which will be responsible for the purchase of wholesale electricity from generation companies including existing as well as future IPPs, dispatch, and settlement. NEPRA has issued a License to NTDC on a single buyer plus concept wherein July 1, 2009 has been set as the date of introduction of a wholesale market structure with a cut off date as July 2012. Accordingly any bulk power consumer or a distribution company will be permitted to enter into a long-term electricity purchase agreement with any power producer.

The unbundling of the Power Sector and sale by the GOP of its entities offer tremendous opportunities for the private sector investors, technical operators and lenders to look for very attractive returns in the Power Sector. There would also be opportunities for Bulk Power Consumers to procure competitive power supply by entering into long-term agreements with the power generation companies and paying wheeling charges to the NTDC or to a DISCO in case of its involvement.

11. REVIEW OF GOP POLICIES

11.1 Policy for Power Generation Projects 2002

The Government of Pakistan announced Policies in 1995 and 1998 after the expiry of the 1994 Power Policy to attract private sector investment in the power generation. However, these Policies failed to attract the private sector investors. The GOP felt it necessary to create an environment and offer attractive incentives to the private sector investors to set up power generation projects based on indigenous fuels.

Therefore, the GOP announced a Policy for Power Generation Projects, 2002 providing attractive incentives for power generation based on indigenous resources. Some of the fiscal concessions offered are:

Custom duty at rate of 5% on the import of plant and equipment not manufactured locally.

No levy of sales tax.

Exemption from income tax including turnover tax and withholding tax.

Exemption from provincial/local duties and taxes.

PPIB has issued Letters of Interest (LOIs) for the following projects with cumulative capacity of 1810 MW until May 30, 2004, and is considering a number of other Projects for which LOIs would be issued soon: Source: (www.ppib.gov.pk)

- 123 MW Jarwar Project
- 150 MW Western Electric Power Project
- 400 MW Balloki Power Project
- 97 MW Kotli Hydro Power Project
- 150 MW Fauji Korangi Power Project
- 740 MW Munda Multipurpose Power Project
- 150 MW Intergen Power Project.

In accordance with the Policy, PPIB has also received Performance Guarantees for US$ 1.81 Million according to PPIB sources.

In addition to the above Projects, the Security Package Agreements were signed for 79 MW New Bong Escape Hydropower Project on April 16, 2004 wherein a long term PPA was signed between the Sponsors and NTDC/WAPDA.

11.2 Risk Coverage Available Under Security Package

The Policy has offered a comprehensive risk coverage mechanism to all the stakeholders in the form a Security Package.

The security, which will be available to the Sponsors, investors, lenders and GOP to secure their commitments to the Project, financial and otherwise, is termed as the "Security Package". This Security Package comprises a set of agreements and contracts that bind and safeguard the interests of the Investors, Construction and O&M Contractors, GOP, NTDC/WAPDA or KESC as the case may be and the Sponsors to perform those tasks and duties that collectively will lead to the successful implementation and operations of the project.

The Security Package comprises of the following principal documents:

No	Name of the Document	Agreements Between the Sponsors and;
1	Implementation Agreement	GOP
2	Power Purchase Agreement	NTDC/WAPDA or KESC
3	Fuel Supply Agreement	Fuel Supplier
4	Construction Contract	TKC/EPC Contractor
5	Operations and Maintenance Contract	Operator
6	Escrow Agreement	Escrow Agent/Lenders
7	Shareholders' Agreement	Investors
8	Trust Deed	Trustee
9	Loan Agreements	Lenders
10	Insurance Policies	Insurance Companies
11	Land Title/Lease(s) etc.	Land Owner(s)

11.3 Salient Features of the Security Package

Following are the salient features of the security package:

(a) Model Implementation Agreement (IA), Power Purchase Agreement (PPA) and Fuel Supply Agreement (FSA) have been prepared for private power projects to eliminate the need for protracted negotiations.

(b) The GOP will:

(i) Guarantee the contractual obligations of its entities, namely NTDC/WAPDA or KESC and Provincial Governments even though some or all of the utilities may be privatised during the term of various agreements.

(ii) Provide protection against specified "political" risks

(iii) Provide protection against changes in taxes and duties regime.

(iv) Ensure the convertibility of Pakistan Rupee into US Dollars at the then-prevailing exchange rates and the remit-ability of foreign exchange to cover necessary payments related to the projects, including debt service and the payment of dividends; however, the tariff components will be adjusted and indexed as per the terms of the executed PPA against exchange rate variation, inflation, etc.

11.4 Negotiations on Tariff and Issuance of LOS

The following mechanism for negotiations of Tariff and its approval has been laid out in the Policy:

PPIB will be notified by NTDC/WAPDA or KESC as the case may be, in case of successful tariff negotiations between the NTDC/WAPDA or KESC and the Sponsors. The Sponsors will file the application with NEPRA for tariff approval. After NEPRA's approval, PPIB will issue the LOS against delivery of the Performance Guarantee at the rate of US$ 5000 per MW in favour of PPIB, valid upto three months beyond the Financial Closing date specified in the LOS.

11.5 Privatisation Policy

The declared Policy of the GOP is to privatise all the public sector assets of power sector except the Hydropower generation and the assets of NTDC.

The GOP through the Privatisation Commission has already initiated the process for the strategic sales of the Karachi Electric Supply Corporation (KESC), Jamshoro Power Generation Company, Faisalabad Electric Supply Company (FESCO) and Peshawar Electric Supply Company (PESCO). The other corporatised entities of WAPDA would be offered for sale to the strategic investors in a phased manner.

11.6 Donor Uplift Programmes

The International Development Association (IDA) is contemplating a credit of $ 50 million for the Public Sector Capacity Building Project to support the government's ongoing economic reform programme.

It envisages training and professional development of over 500 public servants; capacity enhancement in key ministries/agencies; and strengthening of the key

regulatory agencies in power, oil and gas and telecommunications. NEPRA is also a beneficiary of this program.

The World Bank was very active in the past for arranging soft term loans for the power sector including Private Sector Energy Development Fund (PSEDF), Rural Electrification Project and Power Sector Development Loan.

12. ELECTRICITY IN THE CONTEXT OF OVERALL ENERGY USE

The tables below indicate annual Energy Consumption by sources and consumption of Petroleum Products and Gas in Pakistan for the last ten years.

Table 12 (A)
Annual Energy Consumption

	Petroleum Products		Gas		Electricity		Coal	
Fiscal Year	(000 tones)	% Change	(mmcft)	% Change	(GWh)	% Change	(000 M.T)	% Change
1993-94	13,225	10.1	550,769	7.7	37867	3.4	3,534	8.2
1994-95	13,960	5.6	546,788	-0.7	40456	6.8	3,043	-13.9
1995-96	15,601	11.8	582,868	6.6	42648	5.4	3,638	19.6
1996-97	15,606	0	597,799	2.6	44078	3.4	3,553	-2.3
1997-98	16,624	6.5	607,890	1.7	45646	3.6	3,159	-11.1
1998-99	16,647	0.1	635,832	4.6	43207	-5.3	3,461	9.6
1999-00	17,768	6.7	714,744	12.4	45518	5.3	3,168	-8.5
2000-01	17,648	-0.7	777,610	8.8	48480	6.5	3,095	-2.3
2001-02	16,960	-3.9	824,604	6	50322	3.8	3,492	12.8
2002-03	16,452	-3.0	872,265	5.78	54397	8.1	3,769	7.9

Source: Hydrocarbon Institute of Pakistan

Table 12 (B)
ANNUAL ENERGY CONSUMPTION BY SOURCE IN (PERCENTAGE)

Source	1997-98	1998 - 99	1999 - 2000	2000 - 01	2001 - 02	2002 - 03
Oil	46.9%	47.7%	47.3%	45.9%	43.3%	41.3%
Gas	31.3%	31.0%	32.0%	32.2%	33.5%	34.6%
Coal	5.4%	5.7%	5.0%	5.1%	5.8%	6.4%
Electricity	15.5%	14.6%	14.7%	15.7%	16.1%	16.4%
LPG	0.9%	1.0%	1.0%	1.1%	1.3%	1.3%

Source: Hydrocarbon Institute of Pakistan

Table 12 (C) Consumption of Petroleum Products

											(000 tonnes)	
Year	House hold	% Change	Industry	% Change	Agri.	% Change	Transport	% Change	Power	% Change	Other Govt.	% Change
1993-94	590	-5.1	1,653	11.7	308	7.3	6,414	5	3,902	23.6	357	0
1994-95	585	-0.8	1,889	14.3	269	-12.7	6,646	3.6	4,215	8	355	-0.6
1995-96	596	1.9	2,416	27.9	250	-7	7,136	7.4	4,786	13.5	417	17.5
1996-97	510	-14.4	2,141	-11.4	269	7.6	7,172	0.5	5,110	6.8	404	-3.2
1997-98	499	-2.2	2,081	-2.8	245	-8.9	7,364	2.7	6,054	18.5	381	-5.7
1998-99	493	-1.2	2,140	2.8	249	1.6	7,864	6.8	5,526	-8.7	376	-1.3
1999-00	477	-3.2	2,116	-1.1	293	17.8	8,308	5.6	6,228	12.7	346	-8
2000-01	451	-5.5	1,924	-9.1	255	-13	8,158	-1.8	6,488	4.2	372	7.5
2001-02	335	-25.7	1,612	-16.2	226	-11.4	8,019	-1.7	6,305	-208	464	2407
2002-03	283	-15.5	1,604	-0.5	197	-12.8	8,082	0.78	6,020	-4.5	266	-42.7

Source: Hydrocarbon Institute of Pakistan

Table 12 (D) Consumption of Petroleum Products

					(Percentage Share)	
Year	House holds	Industry	Agriculture	Transport	Power	Other Govt
1993-94	4.5	12.5	2.3	48.5	29.5	2.7
1994-95	4.2	13.5	1.9	47.6	30.2	2.5
1995-96	3.8	15.5	1.6	45.7	30.7	2.7
1996-97	3.3	13.7	1.7	45.9	32.7	2.6
1997-98	3	12.5	1.5	44.3	36.4	2.3
1998-99	2.9	12.9	1.5	47.2	33.2	2.3
1999-00	2.7	11.9	1.6	46.8	35	1.9
2000-01	2.6	10.9	1.4	46.2	36.8	2.1
2001-02	2	9.5	1.4	47.3	37.2	2.7
2002-03	1.7	9.7	1.2	49.1	36.6	1.6

Source: Hydrocarbon Institute of Pakistan

Table 12 (E) Consumption of Gas (Billion CFT)

		Change		Change		Change		Change		Change		Change
1993-94	82	7.9	15	7.1	10	-16.7	144	21	198	5.9	101	-1.9
1994-95	97	18.3	16	6.7	7	-30	142	-1.4	181	-8.6	104	3
1995-96	110	13.4	17	6.3	8	14.3	150	5.6	186	2.8	111	6.7
1996-97	115	4.5	18	5.9	9	12.5	150	0	194	4.3	110	-0.9
1997-98	134	16.5	19	5.6	12	33.3	148	-1.3	179	-7.7	115	4.5
1998-99	131	-2.2	21	10.5	8	-33.3	167	12.8	184	2.8	121	5.2
1999-00	139	6.1	22	4.6	9	12.8	177	6	230	25	135	11.6
2000-01	141	1.4	21	-4.5	8	-11.1	175	-1.1	288	25	139	3
2001-02	144	2.1	22	4.8	7	-12.5	178	1.1	315	9.4	151	8.6
2002-03	154	6.9	23	4.5	3.4	-51.2	181	1.7	336	6.7	165	9.3

Source: Hydrocarbon Institute of Pakistan

Table 12 (F) Consumption of Gas (Percentage Share)

Year	House holds	Commercial	Cement	Fertilizer	Power	Industrial
1993-94	14.9	2.8	1.8	26.2	35.9	18.3
1994-95	17.8	2.9	1.2	25.9	33.1	19
1995-96	18.9	2.9	1.3	25.8	32	19.1
1996-97	19.3	3.1	1.5	25.2	32.4	18.4
1997-98	22.1	3.1	2	24.3	29.4	18.9
1998-99	20.7	3.4	1.3	26.3	28.9	19.1
1999-00	19.6	3	1.2	24.8	32.2	18.9
2000-01	18.2	2.7	1.2	22.8	37.2	17.9
2001-02	17.6	2.7	0.9	21.7	38.5	18.5
2002-03	17.8	2.7	0.4	21	39	19.1

Source: Hydrocarbon Institute of Pakistan

12.1 Energy Sources

The following energy sources are being utilised for power generation in the country:-

12.2 Gas

The share of power generation on gas in the financial year ending June 30, 2003 was 36.4 % of the total generation and its share was 51.5 % of the thermal generation. However, due to the supply demand scenario of Gas in the country, the supply of gas to the proposed new generation would be sufficient until the year 2009 at the most likely gas demand, while at high gas demand scenario there would be gas supply constraints starting from the year 2005.

12.3 Coal

The share of coal in the overall commercial energy requirements of the country at the time of Pakistan's independence was about 60 percent but with the advent of natural gas in 1952,the utilization had gradually reduced. Currently, the share of coal in the overall energy mix is less than 5 percent. Owing to discovery of large coalfield having 175 billion tons resource potential at Thar, the government has decided to enhance the share of coal in the overall energy mix from 5 percent to 20 percent by the end of decade. With the pragmatic government policies, the cement industry is in the process of switching over to the indigenous coal from furnace oil that would save 50 percent foreign exchange being spent on import of coal. It would also generate demand of about 2.5 million tons coal/annum in the country by 2005. Almost all the energy consumed in the cement industry is now being generated by a mix of imported and indigenous coal.

12.3.1 Coal Based Power

Pakistan has very large coal resources in its Sindh Province, which can be utilized for power generation. Coal is a cheaper fuel, which is used extensively for power generation in countries like China, USA and Australia. Generating electricity from indigenous coal can considerably reduce the cost of power generation. In the Tharparkar area of the Sindh Province the Thar coal reserve is estimated to be of the order of 175 billion tons by GSP. The Thar coal (on as received basis) is low in sulphur (1.16%), high in moisture (46.8%), low in ash (6.24%) and has a heating value of 5,774 BTU/lb. Presently a Chinese firm is conducting feasibility to determine its mineability and utilization for power generation. It is expected that Thar coal will take at least 5 to 6 years for development, mining and utilization for power generation as the exploitation of Thar coal reserves is hampered by non-availability of basic infrastructure like roads, water supply and electricity etc. in the coal field.

On the other hand, the Lakhra coal deposit of Sindh Province is fully developed and US firms confirmed its suitability for power generation. At present WAPDA is operating 3x50 MW power plant based on Lakhra coal using Fludised Bed Combustion Technology provided by China. The plant is situated at Khanot near Lakhra coalfields. WAPDA is facing several problems in operating the plant, like boiler tubes leakage and air pollution due to poor quality of equipment and supply of coal below the design specifications. Coal is supplied to the plant from Lakhra coal-mine of PMDC and LCDC. Presently two units are in operation with de-rated capacity of 42 MW each and the third unit is at standby position.

12.4 Nuclear Energy

Pakistan Atomic Energy Commission (PAEC) is operating two nuclear power plants, Chashma Nuclear Power Plant (CHASNUPP) at Kundian near Chashma in District Mianwali with an installed capacity of 300 MW and Karachi Nuclear Power Plant (KANUPP) with a capacity of 137 MW. The generated electricity is sold to WAPDA and KESC respectively.

The cost of Chashma Nuclear Power Plant was Rs. 31,018.5 Million or US$ 1130 Million at the exchange rate of Rs. 26 per US $ with the foreign exchange component of Rs. 15,754.2 Million. The total cost per MW was US$ 3.98 Million.

The estimated cost for 360 MW Chashma-II extension is around US$ 600 Million.

12.5 Renewable Energy Sources

There are many remote and sparsely populated areas in the country where it is not economically feasible to supply power over long transmission lines. It will be more practical and economical to install small wind or solar energy units for local supply of electricity to such areas. Though not inherently cheaper, this energy would be less costly due to avoidance of large expenditure on transmission lines and heavy transmission losses.

The province of Balochistan and the Northern Areas have a large potential of generating wind and solar energy for local use.

The other renewable sources such as Biomass and Geothermal can be exploited for power generation.

12.6 Furnace Oil use for Power Generation, its Imports and Local Production

In the year ending June 2003, 32% of the total generation was on furnace oil. The local production during the year was 3.1 Million Tonnes, while 4.34 Million Tonnes were imported. Approximately 6 Million Tonnes of furnace oil was consumed for power generation

13. CHALLENGES AND SOLUTIONS FOR THE POWER INDUSTRY

13.1 Challenges

Pakistan's power sector is in crises due to high operating losses. According to the latest World Bank's figures, the losses are equivalent to 1.4% of GDP, which is 75% of education, 200% of health budget of the country and would pay for 2-3 million household connections.

The other problems include high tariffs and low reliability, which is hurting the industrial consumers affecting their competitiveness as the electricity outages alone cost the industries almost 6% of their annual revenues.

As the new investments in the power sector can not keep pace with demand, therefore, more shortages and outages are expected by the year 2007.

The projected 5-year cash needs of Ex-WAPDA Companies alone are estimated to be around Rs. 400 Billion, while the cash requirements for KESC are estimated to be around Rs 14 Billion. Therefore, a total sum of Rs.414 Billion would be required in the power sector of the country. The real challenge is to raise this amount of investment badly needed in the sector.

Pakistan has taken a number of key reform steps in the corporatisation of the power sector entities over the recent years thus creating a potentially strong base for sector recovery. The challenge now is to capitalize on this base by perusing the short-term remedial actions while building a strong medium term strategy.

13.2 Proposed Solutions

The following actions can begin to turn the sector around:-

i) Reduction in costs by making more gas available, tackling technical losses in generation, transmission and distribution and improving collections.

ii) Better Governance by introducing corporate governance methodologies.

iii) Coordinated Planning and financing investments.

iv) Rationalizing the tariff and subsidies. The tariffs should cover the costs.

v) Stay committed to the reform process and loss reduction programmes.

The unbundling of WAPDA was a major step, however, WAPDA successors still require a clear mandate to focus on commercial performance and better consumer services. The financial and operational independence is necessary for the corporatised entities to meet the challenges and the mandate given to them.

ANNEXURE-A

MONTHLY VARIATION OF HYDEL GENERATING CAPABILITY

SR NO.	MONTH	TARBELA (MW)	MANGLA (MW)	WARSAK (MW)	CHASHMA* (MW)	SMALL** HYDELS (MW)	TOTAL (MW)
1.	July	2894	1150	150	100	78	4372
2.	August	3338	1150	150	100	78	4816
3.	September	3524	1150	160	130	87	5051
4.	October	3238	1150	177	130	87	4782
5.	November	2662	1130	155	125	77	4149
6.	December	2488	1020	143	112	65	3828
7.	January	1930	940	151	83	50	3154
8.	February	2194	750	182	88	63	3278
9.	March	1690	680	182	83	77	2712
10.	April	1428	890	195	83	87	2683
11.	May	1242	1060	180	85	87	2654
12.	June	1874	1130	190	85	87	3366

YEARLY AVERAGE GENERATING CAPABILITY 44845/12 = 3737 MW

Note: The hydel capability is for 14 units at Tarbela and 10 units at Mangla.

* Reasonable estimates based on the hydrology data

** Including 30 MW Jagran Hydroelectric IPP

ANNEXURE-B

EXISTING INSTALLED CAPACITY AND GENERATING CAPABILITY
(AS OF JUNE 2003)

SR NO	NAME OF STATION	INSTALLED CAPACITY (MW)	GENERATING CAPABILITY	
			MAX (MW)	MIN (MW)
	WAPDA HYDEL UNITS			
1.	Tarbela	3478	3691	1129
2.	Mangla	1000	1020	517
3.	Warsak	240	195	114
4.	Chashma	184	130	83
5.	Dargai	20		
6.	Malakand	20		
7.	Chichoki Malian	13	68	29
8.	Shadiwal	13		
9.	Nandipur	14		
10.	Kurram Garhi	4		
11.	Renala	1		
12	Rasul	22		
13	Jagran (IPP)	30	30	30
	TOTAL HYDEL - WAPDA	**5039**	**5134**	**1902**

ANNEXURE-B (Continued)

SR NO.	NAME OF STATION	INSTALLED CAPACITY (MW)	GENERATING CAPABILITY (MW)
	THERMAL UNITS		
	GENCO-I		
1.	Jamshoro	850	695
2.	Kotri	174	130
	Sub-Total (GENCO-I)	**1024**	**825**
1.	Lakhra (Coal) Power Generation Company	**150**	**120**
	GENCO-II		
1.	Guddu ST 1-4	640	430
2.	Guddu 5-13	1015	760
	Sub-Total (GENCO-II)	**1655**	**1190**
	GENCO-III		
1.	Muzaffargarh	1350	1300
2.	Multan	130	100
3.	GTPS Faisalabad	244	175
4.	Faisalabad ST	132	100
	Sub-total (GENCO-III)	**1856**	**1675**
	TOTAL GENCOs	**4685**	**3810**
TOTAL THERMAL - WAPDA		**4685**	**3810**

ANNEXURE-B (Continued)

SR NO.	NAME OF STATION	INSTALLED CAPACITY (MW)	GENERATING CAPABILITY (MW)
	IPPs WAPDA		
1.	KAPCO	1638	1342
2.	HUBCO	1292	1200
3.	KEL	131	120
4.	AES LALPIR	362	351
5.	AES PAKGEN	365	344
6.	SEPCOL	117	112
7.	HCPC QUETTA	140	129
8.	UCH	586	548
9.	ROUSCH	412	350
10.	FKP	157	150
11.	SABA	134	123
12.	JAPAN	135	107
13.	LIBERTY	235	207
14.	ALTERN	11	10
15.	CHASHMA NUCLEAR	325	300
Total IPPs WAPDA		**6040**	**5393**
Total WAPDA SYSTEM		**15764**	
ISOLATED SYSTEMS			
1.	PASNI	18	12
2.	PANJGOOR	38	26
GRAND TOTAL WAPDA		**15820**	

ANNEXURE-B (Continued)

NAME OF STATION	INSTALLED CAPACITY (MW)	GENERATING CAPABILITY (MW)
KESC		
Korangi Thermal Power Station	316	195
Korangi Town Gas Turbine Station	80	72
SITE Gas Turbine Power Station	100	72
Bin Qasim Power Station	1260	1085
TOTAL	**1756**	**1424**
IPPs KESC		
Gul Ahmed	136	114
Tapal	126	113
TOTAL	**262**	**227**
TOTAL KESC	2018	1651
KANNUPP (NUCLEAR)	137	60
TOTAL KESC SYSTEM	**2155**	**1711**
TOTAL THERMAL	**12936**	**10952**
TOTAL COUNTRY	**17975**	

ANNEXURE-C

Summary of Capital Costs and Tariffs for Commissioned IPPs

		Capacity Gross (MW)	Capacity Net (MW)	Technology	Fuel	Total Cost US$ Million	Total Cost Per MW (Net) US$ Million	Revised Levelised Tariff at 60% Plant Factor Cents/KWh
1	2	3	4	5	6	7	8	9
1.	Fauji Kabirwala Power Project	157	144	Combined Cycle	Low BTU Natural Gas	170.0	1.181	5.14
2.	Hibibullah Coastal, Quetta	140	123	Combined Cycle	Natural Gas	155.521	1.264	5.17
3.	Liberty Power Project	235	211	Combined Cycle	Natural Gas	258.8	1.227	4.70
4.	Uch Power Project	586	548	Combined Cycle	Low BTU Natural Gas	630.5	1.150	5.13
5.	Rousch Power Project	412	358	Combined Cycle	Furnace Oil (RFO)	500.7	1.399	5.19
6.	AES Lalpir	362	337	Steam Turbines	Furnace Oil (RFO)	344.0	1.021	5.91*
7.	AES Pakgen	365	337	Steam Turbines	Furnace Oil (RFO)	364.3	1.081	5.91*
8.	Saba Power Company	114	109	Steam Turbines	Furnace Oil (RFO)	151.0	1.385	5.08
9.	Gul Ahmed, Karachi	136.17	125	Diesel Engines	Furnace Oil (RFO)	138.0	1.104	5.91*
10.	Tapal Energy, Karachi	126	119.5	Diesel Engines	Furnace Oil (RFO)	129.7	1.085	5.91*
11.	Japan Power	120	107	Diesel Engines	Furnace Oil (RFO)	123.24	1.152	4.30
12.	Kohinoor Energy	131.44	120	Diesel Engines	Furnace Oil (RFO)	138.6	1.155	5.91*
13.	Southern Electric	115.2	112.05	Diesel Engines	Furnace Oil (RFO)	119.491	1.066	5.20
14.	Hub Power Company	1292	1200	Steam Turbines	Furnace Oil (RFO)	1711.0	1.425	5.60

ANNEXURE-D

Costs of Power Plants in Various Countries

COSTS OF COMBINED CYCLE POWER PLANTS

Key Data	
Order year	1998
Output	720 MW
Plant type	CCGT
Location	Harrisberg, Pennsylvania, USA
Estimated investment	$330 million
Completion	2001
Key Players	
Sponsor	AES Corp
Lead equipment supplier	Siemens Westinghouse
Plant Details	
Gas Turbines	2 x 235 MW, W501G
Steam units	1 x 230
Fuel	Natural gas, distillate oil back-up
COST/kW	US$ 458

BALLYLUMFORD CCGT PLANT, NORTHERN IRELAND

Key Data	
Output	600MW
Plant type	Combined Cycle Gas Turbine
Location	Ballylumford, Northern Ireland
Start of operations	End of Q2 2003
Estimated investment	200 million, $ 300 million
Key Players	
Plant owner	Premier Power Ltd
Gas supply	Centrica
Project management	PB Power
Contractor	Ansaldo Energia
Retaining wall	Shotcrete Soilnail retaining wall constructed by Gunform International Ltd. (sprayed concrete with two layers of reinforcing bar and soil nail anchors)
Plant Details	
Gas turbines	Two Siemens V94.2 gas turbines and one Siemens V64.3A gas turbine combined cycle unit
Expected thermal efficiency	**54%**
Fall-back efficiency	35% for 'open cycle' operation
Fuel	North Sea natural gas primary, low sulphur distillate liquid backup
Electricity generation	15kV and 18kV medium voltage, stepped up to 275/110kV for underground transmission
Existing plant capacity	Six generating units with a capacity of 1,057MW
COST/kW	US$ 500

BETHLEHEM ENERGY CENTER	
Key Data	
Order year	2002
Output	750 MW
Plant type	Combined Cycle Gas Turbine (CCGT)
Fuel	Natural gas-fired
Secondary Fuel	Low-sulphur distillate oil
Location	Bethlehem, New York State, USA
Estimated investment	$400 million
Completion	2nd quarter 2005
Key Players	
Owner	PSEG Power New York Inc
Turbine Supplier	GE Power Systems
Electrical contracting	SM Electric
Civil contracting	J. Fletcher Creamer
Heat recovery steam generators	Foster Wheeler Energy Corporation
Cooling towers	Hamon Inc.
Electrical material supplies	Turtle & Hughes
Condensers	Holtec International
Engineering, procurement, and construction services	Duke/Fluor Daniel
Plant Details	
Turbine details	GE Model 7 gas turbines
Turbine Type	Steam
COST/kW	US$ 533

BUGOK	
Key Data	
Order year	1997
Output	550 MW
Plant type	CCGT
Location	Bugok, South Korea
Estimated investment	$300 million
Completion	2000/2001
Key Players	
Sponsor	LG Energy Company
Lead equipment suppliers	Siemens, Hanjung
Plant Details	
Gas units	2 x 175 MW
Steam units	1 x 175 MW
Fuel	Natural gas
COST/kW	US$ 545

MEGHNAGHAT 450MW CCGT PLANT	
Key Data	
Output	450MW
Plant type	Combined Cycle Gas Turbine (CCGT)
Location	Meghnaghat, Bangladesh
Estimated investment	$300 million
Completion	November 2002
Key Players	
Sponsor	The plant was built by AES Corp, and has since been sold to CDC Globeleq
Lead contractor	Hyundai Engineering and Construction
Loans	Asian Development Bank and other lenders including IDCOL (Infrastructure Development Company Limited)
Hydraulic model study	DHI (Danish Hydraulic Institute)/ SWMC (Surface Water Modelling Centre)
Advice, financing	PricewaterhouseCoopers Securities, Slaughter & May
Arrangement, financing	ANZ (Australia and New Zealand Banking Group Limited)
Lender's engineering services	S&L, Chicago
Power purchase agreement	Bangladesh Power Development Board (BPDB)
Plant Details	
Gas turbine	Supplied by Ansaldo
Hyundai Heat Recovery Steam Generators (HRSGs)	Supplied by Hyundai
Fuel	Natural gas
COST/kW	US$ 667

WANG NOI	
Key Data	
Order year	1994
Output	1,902 MW
Plant type	CCGT
Location	Wang Noi, Thailand
Estimated investment	$1 billion
Completion	1998
Key Players	
Sponsor	Electricity Generating Authority of Thailand
Lead equipment suppliers	Mitsubishi Heavy Industries
Plant Details	
Steam units	2 x 205 MW, 1 x 156 MW
Gas Units	4 x 223 MW, 2 x 222 MW
Fuel	Natural gas
COST/kW	US$ 526

URUGUAIANA	
Key Data	
Order year	1997
Output	600 MW
Plant type	CCGT
Location	Rio Grande de Sul, Brazil
Estimated investment	$300 million
Completion	2000
Key Players	
Sponsor	AES
Lead equipment suppliers	Westinghouse
Other Parties	
EPC	Black & Veatch
Finance	Inter-American Development Bank (IADB)
Plant Details	
501F gas turbines	2 x 176 MW
Secondary steam turbine	1 x 78 MW
COST/kW	US$ 500

TERMOELECTRICA DE MEXICALI	
Key Data	
Start year	2001
Plant type	Combined Cycle Gas Turbine (CCGT)
Location	Mexicali, Mexico
Estimated investment	$350 million
End Year	2003
Key Players	
Sponsor	Sempra Energy
Lead equipment supplier	ICA Fluor Daniel
Plant Details	
Output	600 MW
COST/kW	US$ 583

COSTS OF CONVENTIONAL STEAM POWER PLANTS

GHAZLAN II	
Key Data	
Order year	1996
Output	2,400 MW
Plant type	Conventional thermal
Location	Ras Tanura, Saudi Arabia
Estimated investment	$2.7 billion
Completion	2002
Key Players	
Sponsor	Saudi Consolidated Electricity Company - East
Lead equipment suppliers	Mitsubishi Heavy Industries
Other Parties	
Construction	Bechtel
Consultancy	Merz and McLellan, Saud Consult
Operation and service	Mitsubishi Heavy Industries
Finance	Bank Syndicate
Plant Details	
Steam units	4 x 600 MW
Fuel	Fuel gas / crude oil
COST/kW	US $ 1125

RIYADH	
Key Data	
Order year	1994/95
Output	2,000 MW
Plant type	Conventional thermal/CCGT
Location	Riyadh, Saudi Arabia
Estimated investment	$2 billion
Completion	2001
Key Players	
Sponsor	Saudi Consolidated Electricity Company - Central Region
Lead equipment suppliers	GE
Other Parties	
Engineering	Raytheon
Construction	Belleli
Process control	Foxboro
Other	Binladin Group
COST/kW	US$ 1000

COSTS OF COAL BASED CONVENTIONAL THERMAL	
Key Data	
Order year	1999
Output	2,100MW
Plant type	Conventional thermal
Location	Perek, Malaysia
Cost	$1.8 billion
Completion	2003
Key Players	
Sponsor	Tenaga Janamanjung Sdn Bhd
Lead equipment suppliers	ABB Alstom Power
Erection and installation works	Jurong Engineering Ltd. (JEL)
Civil works	Peremba
Finance	HSBC
Plant Details	
Steam units	3 x 700MW
Fuel	Coal
COST/kW	US $ 857

COSTS OF NUCLEAR POWER PLANTS	
Key Data	
Order year	1999
Output	3,000 MW
Plant type	Nuclear
Location	Akkuyu, Southern Turkey
Estimated investiment	$3 billion
Completion	2006
Key Players	
Sponsor	TEAS
Lead equipment suppliers	To be decided
Plant Details	
Option 1	4 x 700 MW
Option 2	2 x 1,400 MW
COST/kW	US $ 1000

YONGGWANG UNITS 5 AND 6	
Key Data	
Order year	1995
Output	2,000 MW
Plant type	Nuclear
Location	Yonggwang, South Korea
Estimated investment	$4 billion
Completion	2002
Key Players	
Sponsor	Korea Electric Power Corporation
Lead equipment suppliers	Hanjung / ABB / GE
Other Parties	
Construction	Hyundai Engineering & Construction / Daelim
Consultancy	Sargent & Lundy
Plant Details	
Steam units	2 x 1,000 MW
COST/kW	US $ 2000

LUNGMEN	
Key Data	
Order year	1996
Output	2,700 MW
Plant type	Nuclear
Location	Yenliao, Taiwan
Estimated investment	$6.5 billion
Completion	2004 (unit 1) / 2005 (unit 2)
Key Players	
Sponsor	Taiwan Power
Lead equipment suppliers	GE
Other Parties	
Reactor subcontractors	Toshiba / Hitachi
Steam turbines	Mitsubishi Heavy Industries
Plant Details	
Steam units	2 x 1,350 MW
COST/kW	US $ 2407

SHINPO	
Key Data	
Order year	1996
Output	2,000 MW
Plant type	Nuclear
Location	Shinpo, North Korea
Estimated investment	$4.5 billion
Completion	N/A
Key Players	
Sponsor	Korean Peninsula Energy Development Organisation
Lead equipment suppliers	Hanjung
Other Parties	
Project management	Korea Electric Power Corporation
Reactor, steam generator	Hanjung
Construction	Hyundai Engineering & Construction / Dong Ah / Daewoo / Hanjung
Consultancy	Duke Engineering & Service
Plant Details	
Steam units	2 x 1,000 MW
COST/kW	US $ 2250

COST OF DIESEL ENGINES COMBINED CYCLE

WASA PILOT	
Key Data	
Order year	1996
Output	38 MW
Plant type	Diesel engine combined cycle
Location	Vaasa, Finland
Estimated investiment	$35 million
Completion	1998
Key Players	
Sponsor	Wartsila Diesel Oy, Etela-Pohjanmaan Voima Oy, Vaasan Sahko Oy and ABB Power Oy
Lead equipment suppliers	Wartsila Diesel Oy and ABB Power Oy
Other Parties	
Finance	c. FIM 40 million given by Finnish Ministry of Trade and Industry and by the Thermie programme of the EU
Plant Details	
Diesel engines	2 x 17 MW 12V46 units
Steam units	1 x 5 MW
Fuel	Heavy fuel oil
COST/kW	US$ 910