



NATIONAL TRANSMISSION AND DISPATCH COMPANY



Electricity Beyond Borders

**SALIENT FEATURES
OF
POWER SYSTEM
IN
PAKISTAN**

PAKISTAN POWER SECTOR

Pre-Restructure Regime

WAPDA/NTDC/PEPCO

- Responsible for development of water & power resources
- Power wing comprised of a vertically integrated utility responsible for generation, transmission & distribution of electrical energy

- Provided services in whole of Pakistan except Karachi

Karachi Electric Supply Company (KESC)

- Vertically integrated utility responsible for generation, transmission & distribution of electrical energy
- Provides service in only district of Karachi

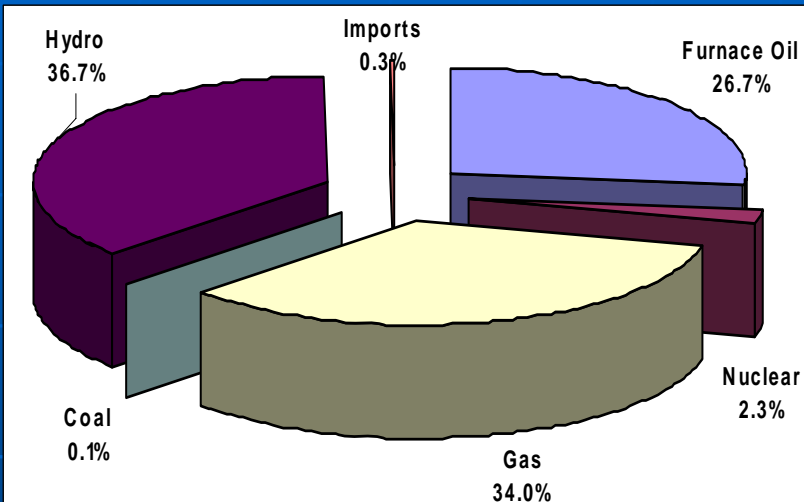
INSTALLED CAPACITY (Breakup)

NTDC System	
WAPDA Hydel	6444 MW
Thermal (GENCOs)	4500 MW
Nuclear (CHASHNUPP)	325 MW
IPPs	6097 MW
Sub Total (WAPDA System)	17366 MW
KESC System	
Thermal	1756 MW
Nuclear (KANUPP)	137 MW
IPPs	262 MW
Sub Total (KESC System)	2155 MW
Total Installed Capacity (Country)	19521 MW

ELECTRICITY GENERATION

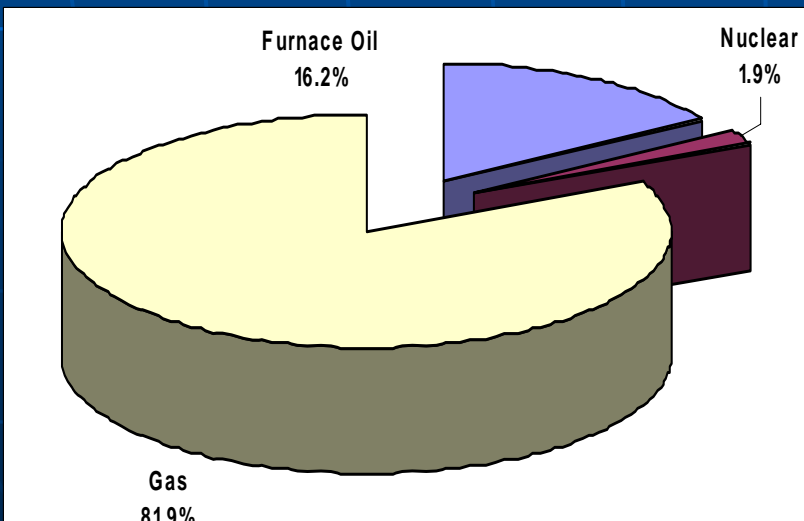
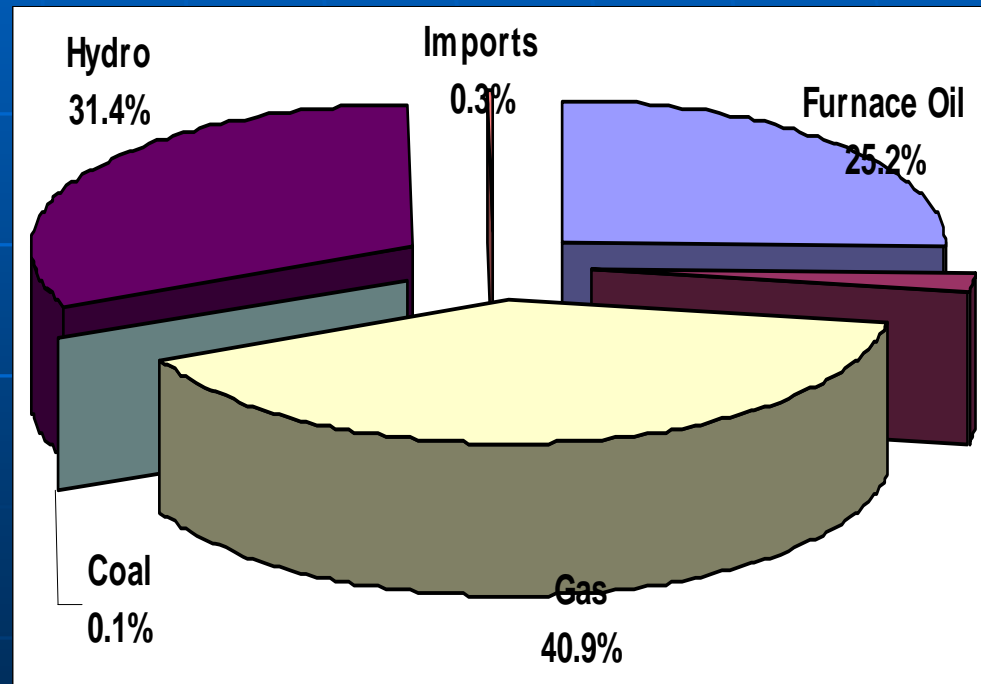
Source-Wise break up (Year 2006-07)

WAPDA (82225 GWh)



WAPDA + KESC

96725 GWh

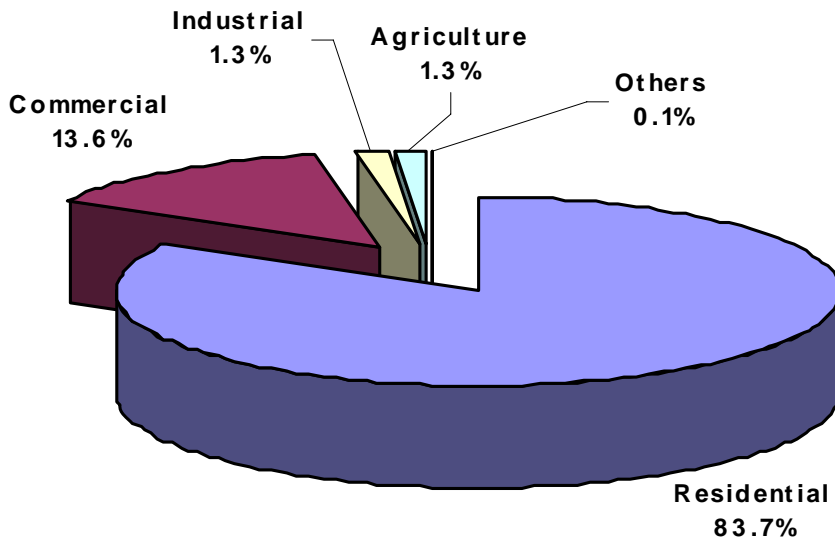


KESC (14500 GWh)

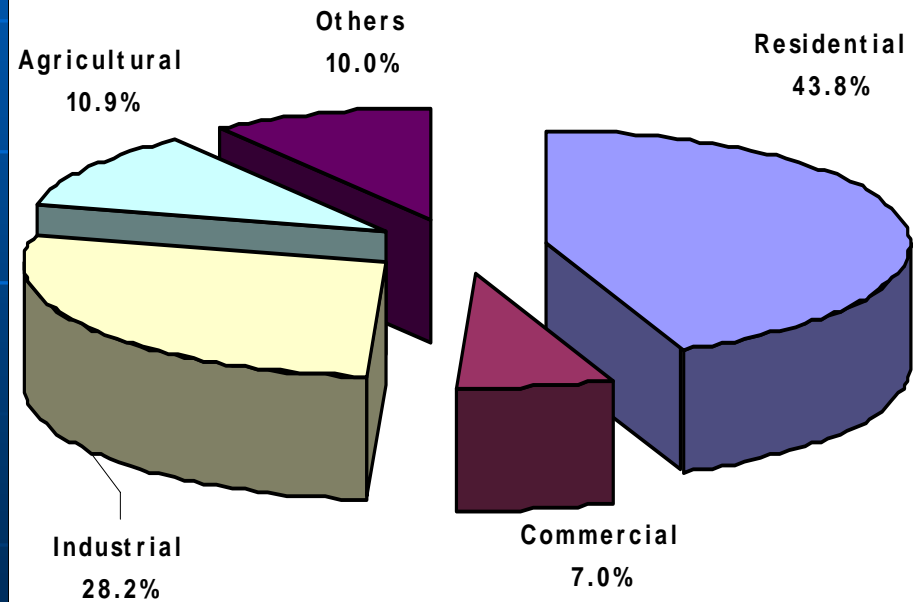
Consumers Profile & Consumption Pattern

Consumers Profile

Total 18.9 Million



Consumption Pattern



TRANSMISSION SYSTEM

Voltage	Sub Stations				Transmission Lines (circuit km)	
	WAPDA		KESC		WAPDA	KESC
	No.	MVA	No.	MVA		
500 kV	11	14132	-	-	4743	-
220 kV	26	12350	6	2500	7488	276
132 kV	467	21132	40	3459	32437	604
66/33 kV	195	2712	6	215	7552	219
Total	699	50326	52	6174	52220	1099

EXISTING GENERATING CAPACITY

Type of Generation	Installed Capacity (MW)	Derated/ Dependable Capacity (MW)	Availability (MW)	
			Summer	Winter
WAPDA Hydro	6444	6444	6250	2300*
GENCOs + Rental	4825	4023	2780	3620**
IPPs (incl Nuclear)	6097	5511	4950	5180* *
Total	17366	15978	13980	11100

* Hydro availability based on 5 years average

** Excludes 10% Forced Outages for GENCOs & 6.0% for IPPs

Historical Demand

(2002 – 2007)

YEAR	WAPDA ⁺		KESC		COUNTRY**	
	MW	G.R.	MW	G.R.	MW	G.R.
2001-02	10109	4.02%	1885	1.34%	11875	3.59%
2002-03	10481	3.68%	1885	0.00%	12244	3.11%
2003-04	11078	5.70%	2073	9.97%	13021	6.35%
2004-05	12035	8.64%	2197	5.98%	14091	8.22%
2005-06	13212	9.78%	2223	1.18%	15282	8.45%
2006-07	15138*	14.6%	2349	5.7%	17314	13.33%

+ WAPDA computed demand; excludes export to KESC

* Excludes 700 MW export to KESC

** Assuming 1% diversity between WAPDA & KESC Power Demands

Actual surplus/deficit (MW)

2006-07	Demand	Capability	Surplus/ deficit
July	14238	13543	-707
Aug.	14013	13616	-397
Sept.	13976	12947	-1029
Oct	13717	13971	254
Nov.	12073	12537	464
Dec	11743	10897	-846
Jan	12093	11039	-1054
Feb	11590	12552	962
March	12311	1171	-1140
April	13843	13002	-841
May	14650	13567	-1083
June	15838	13292	-2546

Supply-Demand Position Peak Load Day Of Year 2006-07

During the year 2006-07, the maximum computed demand was experienced on June 11, 2007 and the power supply/demand position at peak time of the day was as follows:

Hydro	5325 MW
GENCOs Thermal	2656 MW
IPPs	5203 MW
Rental	108 MW
Recorded Peak Demand	13292 MW
Load Management	2546 MW
Total Computed Peak Demand	15838 MW
Export to KESC	700 MW
WAPDA Demand without KESC export	15138 MW

LOAD FORECAST

Year	Projected at GOP Medium Term Development Framework (MTDF) load forecast growth rates	
	MW	G.R
2006-07*	15138 *	
2007-08	16273	7.5%
2008-09	17624	8.3%
2009-10	19193	8.9%
<i>A.C.G.R. (2006-2010)</i>		8.2%
2010-11	20920	9.0%
2011-12	22970	9.8%
2012-13	25175	9.6%
2013-14	27340	8.6%
2014-15	29582	8.2%
<i>ACGR. (2010-2015)</i>		9.1%

LOAD FORECAST

Year	Projected at GOP Medium Term Development Framework (MTDF) load forecast growth rates	
	MW	G.R
2015-16	31801	7.5%
2016-17	34090	7.2%
2017-18	36545	7.2%
2018-19	39176	7.2%
2019-20	42075	7.4%
ACGR. (2015-2025)		7.3%
2020-21	45273	7.6%
2021-22	48850	7.9%
2022-23	52855	8.2%
2023-24	57295	8.4%
2024-25	62165	8.5%
ACGR. (2020-2025)		8.1%

* Actual on 11th June, 2007.

Summary of future Generation Plan (2007-08 to 2011-12)

Year	Thermal			Hydro		Total MW
	Public Sector	IPPs*	Nuclear	Public Sector	IPPs	
2007-08				81		81
2008-09	300	1179		323		1802
2009-10	250	1693		96		2039
2010-11		194	325	83	184	786
2011-12		3675		106	417	4198

*IPPs which are likely to be implemented

SUMMARY OF POWER BALANCES (MW)

WITHOUT SUPPLY & DEMAND SIDE MEASURES

Based on Load Demand of 11th June-07 projected at GOP MTD Load Forecast Growth Rates

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2007-08					-2176	-2553	-3049	-2414	-2408	-2453	-2736	-2941
2008-09	-3370	-3332	-3428	-3209	-3177	-3171	-3971	-3301	-3316	-3334	-3293	-3250
2009-10	-3108	-2935	-2533	-1474	-1400	-1448	-1990	-1530	-1399	-1400	-1437	-1459
2010-11	916	940	889	922	943	949	929	961	917	982	885	925
2011-12	908	924	846	926	871	926	936	910	904	913	840	896

Above figures take into account 700 MW power export to KESC upto June 2011, 160 MW demand of BPC Tawarqi Steel from Jan. 2009 and Capacity Improvement due to Rehabilitation of GENCO's Plants. These figures correspond to Peak demand.

HYDROPOWER PROJECTS READY FOR IMPLEMENTATION (PUBLIC SECTOR)

PROJECT	LOCATION	LIVE STORAGE (MAF)	CAPACITY (MW)	ENERGY (GWh)	Estimated Cost (\$ in Billion)	YEAR OF COMPLETION
Diamer Basha Dam	NWFP/NA	6.3	4500	16700	8.5	2015-16
Kala Bagh	Punjab	6.1	3600	14400	6.1	2015-16
Munda	NWFP	0.7	660	2699	1.05	2012-13
Akhori	Punjab	7.0	600	2189	4.4	2016-17
Kurram Tangi	NWFP	0.6	83	383	0.32	2010-11
Total:		20.7	9443	36371	20.37	2016-17

**INTER CONNECTION
WITH
NEIGHBOURING
COUNTRIES**

Regional Geographical Map



Import of Power from Iran

- Agreement signed in Nov 2002
- Voltage of inter connection
 - Jachigur (Iran) - Mand (Pakistan) : 132 kV
 - Taftan 20 kV
 - Mushkhel 20 kV
- Maximum Power Demand
 - For Mand 30 MW
 - For Taftan/Mushkhel 1 MW
- Price
 - Price of electricity per kWh US\$ 0.03
 - (for 3 years)
 - Min monthly invoicing US\$ 210,000

PAKISTAN POWER SECTOR FUTURE PERSPECTIVE

- **System Expansion commensurate with increasing demand**
- **Exploit Maximum Hydro Potential**
 - Large Hydro on Indus & Tributaries (15000 MW)
 - Hydro on other Rivers (6000 MW)
 - Small Hydro Schemes on Canals (600 MW)
- **Exploit Maximum Indigenous Coal Potential**
 - Coal in the South (6000-8000 MW)
- **Enhance Gas Based Power Generation**
- **Exploit Renewable Energy Resources**
- **Expansion of EHV Transmission System to transport power from hydro & coal resources to the load centres**

Regional Energy Cooperation

- Pakistan supports every initiative for regional cooperation in Energy Sector
- Pakistan supports establishment of a regional grid of South Asian Countries so as to maximize the utilization of available resources
- Pakistan respects cooperation which is beneficial to all the participating countries

Reforms-Objective of Reforms

- To provide:
 - Maximum safety (equipment/staff)
 - Maximum security, stability and reliability
 - Stable voltage and frequency
 - Minimum cost
- To attract investment without sovereign guarantees
- Introduce competition and privatization
- Free trade of electricity between cross border countries
- Exchange program/knowledge

Interconnection Possibilities

Central Asian Countries	Interconnection Already Exists
South Asian Countries	Need to be Connected

Note:

The Interconnection feasibility is possible both synchronous and asynchronous due to same voltage level and frequency.

Detail study/feasibility need to be performed.

Legal and regulatory Framework

The following need to be done:

- Compatible Grid Code for interconnected countries.
- Reliability assurance
 - Electrical reliability
 - Political reliability
- Risk factor analysis
- Financing

ISSUES

- Principal Agreement between all countries.
- Formulation of legal and regulated Authority compatible with the Regulatory framework of each country.
- Pricing regime acceptable to all.
- Reliability assurance
- IFIs initiative.
- portioning/Sectioning of transmission Line domain.
- Selection of voltage (AC or DC)
- Defining road map.
- Deciding quantum of energy to be traded, direction of flow (one way or two way) and seasonal load pattern.

THANK YOU