



Pakistan Electricity Market and Infrastructure

**Workshop on Regional Electricity Cooperation
within Central and South Asia**

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Pakistan

A Country Profile

- Population: 155 Million
- Per capita income: US\$ 847
- GDP growth rate: 6.6%
- Industry growth rate: 8.6%
- Literacy: 53%
- Population below poverty line: 24%
- Households with electricity: 64%
- Households with natural gas: 18%



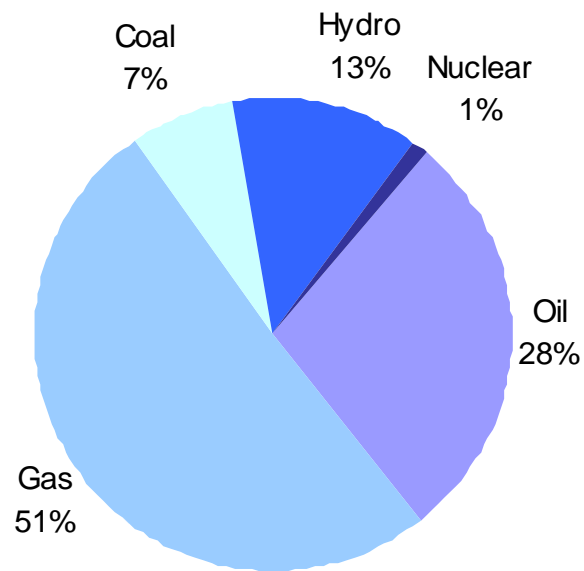
Source: Pakistan Economic Survey 2005-06

Energy Map of Pakistan

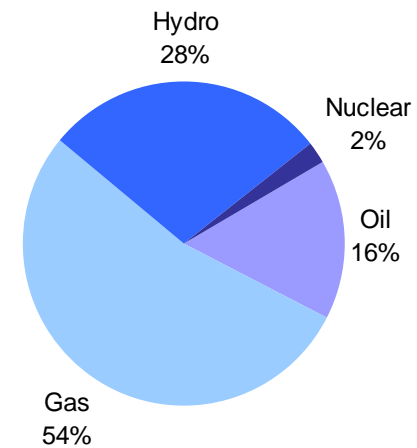
Energy Map of Pakistan

Primary Energy Supply – 2006

Total Primary Energy Supply
58 Million TOE

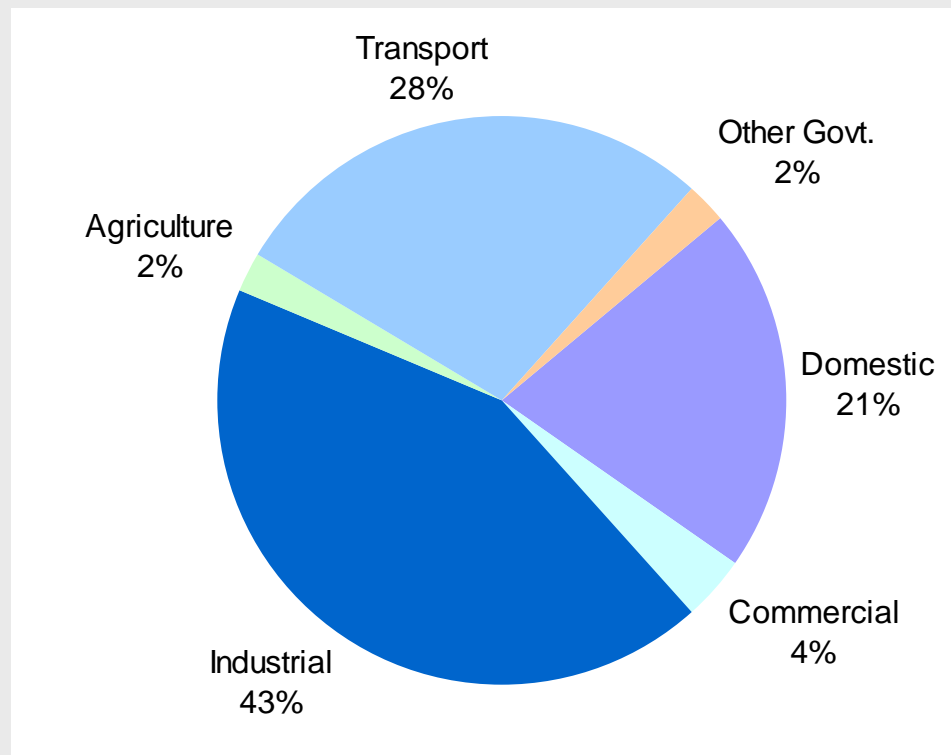


Energy Supply for Power Generation
26 Million TOE



Sector-wise Energy Consumption – 2006

Final Energy Consumption: 34 Million TOE



Energy Sector Policy Objectives

- **Adequate, affordable, and environment-friendly energy supply to meet the needs of an expanding economy**
- **Security of energy supply**
 - Diverse energy mix
 - Maximum indigenous resource utilization
- **Long-term viability of energy sector**
 - Appropriate distribution of responsibilities (policy formulation, regulation, ownership, and management)
 - Rational industry structure (government role, public-private partnership, exclusive private ownership)
 - Sustainable pricing regime (cost-of-service, transparent and targeted subsidies)

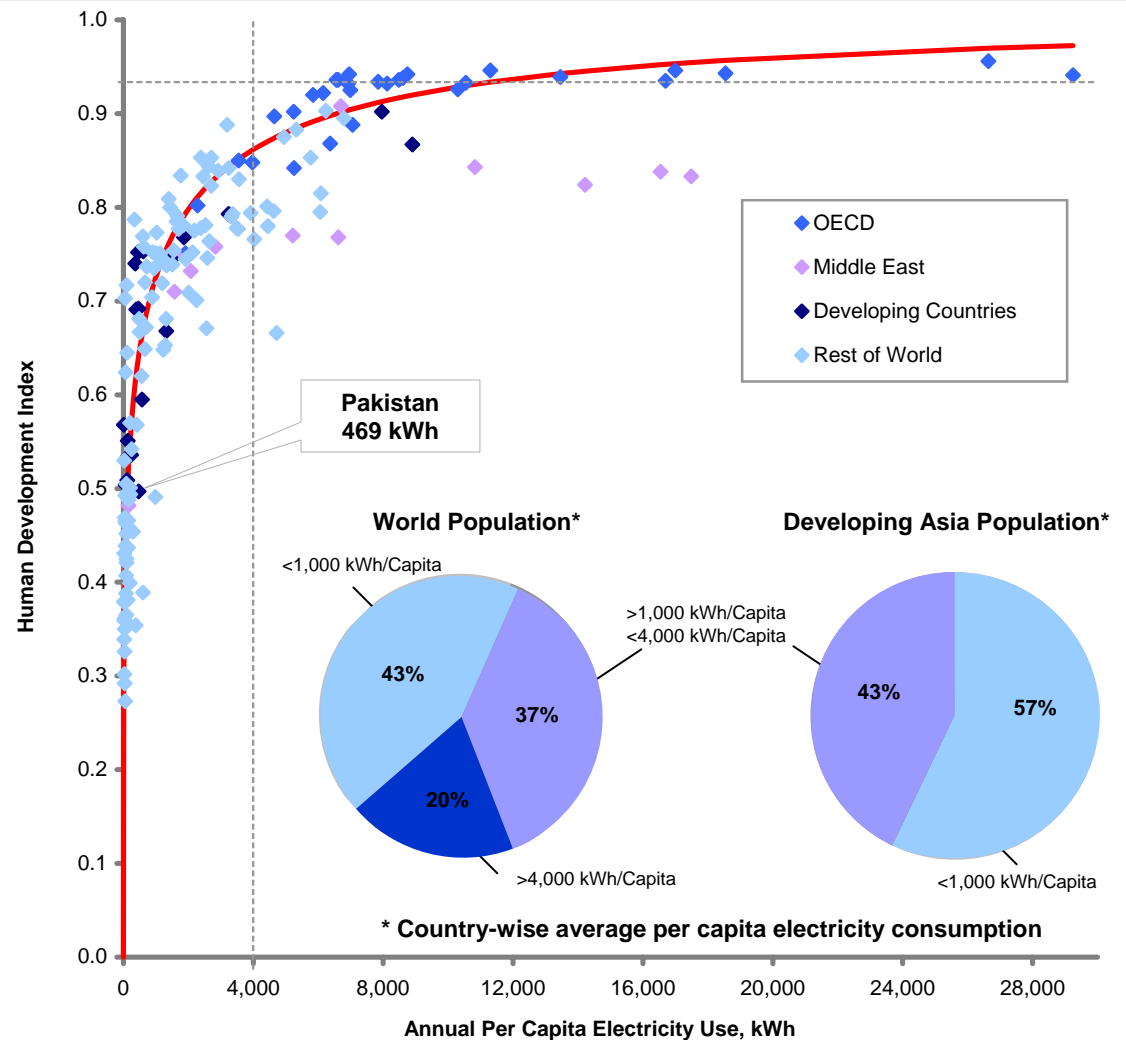
Projected Indigenous Energy Supply and Deficit

	FY06	FY15	FY25
Oil	3	4	2
Gas	29	34	19
Coal	2	5	13
Hydel	7	13	29
Renewable and Nuclear	1	3	12
Total Indigenous Supply	41	61	75
Total Energy Requirement	58	114	211
Deficit	17	53	136
Deficit as % of Energy Requirement	29%	46%	64%

Source: Pakistan Energy Yearbook: 2006
 Medium-Term Development Framework: 2005-10, Planning Commission, Government of Pakistan adjusted to GDP growth rate of 7%.

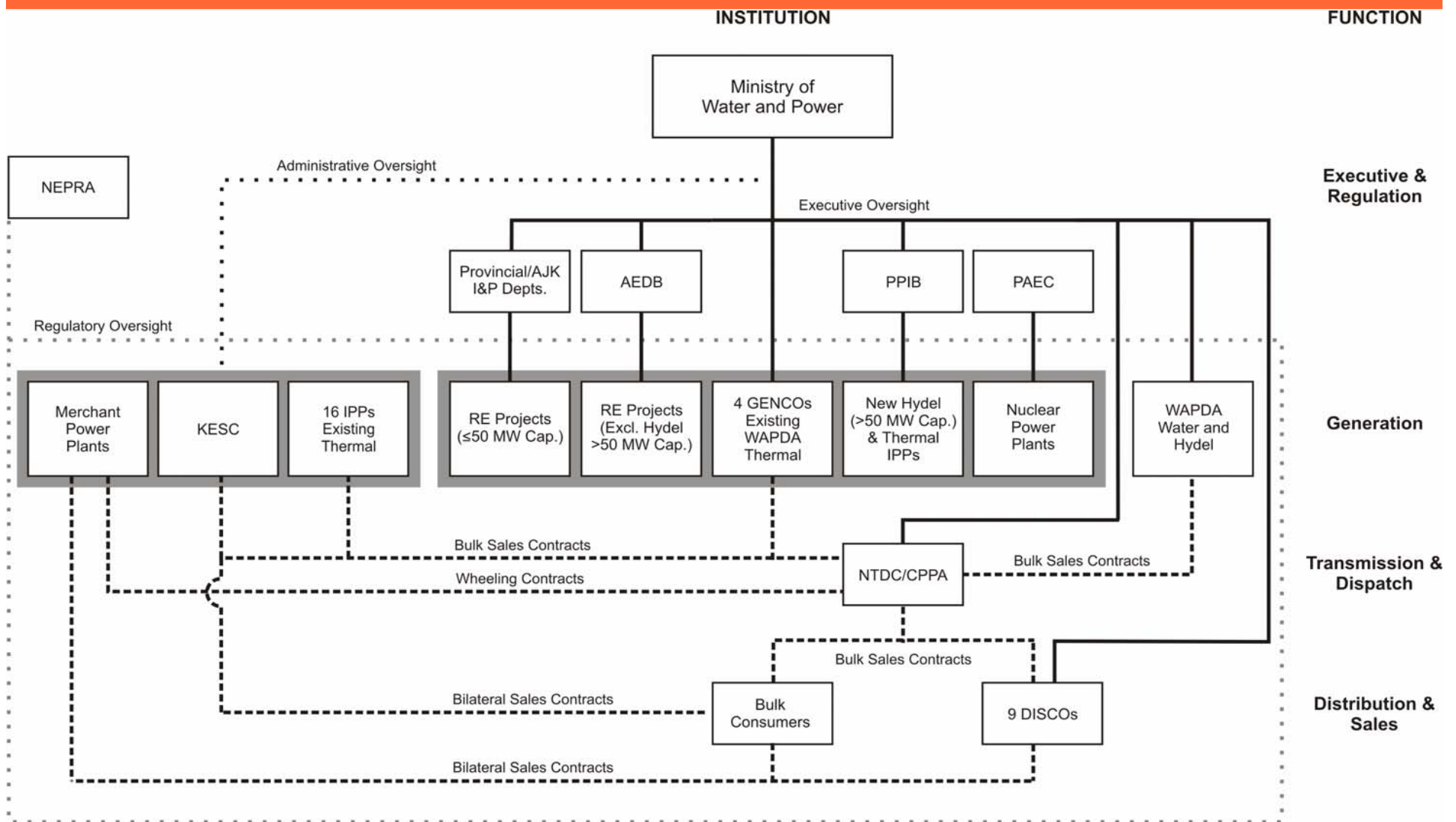
Energy Threshold for Sustainable Human Development

Country	Annual Per Capita Elec. Use, kWh	HDI
South Asian Countries:		
Bangladesh	119	0.51
Sri Lanka	366	0.74
India	569	0.59
Pakistan	469	0.50
Central Asian States:		
Kazakhstan	4,030	0.77
Tajikistan	2,559	0.67
Azerbaijan	2,579	0.75
Kyrgyzstan	2,252	0.71
Turkmenistan	2,126	0.75
Uzbekistan	2,008	0.71



Source: Human Development Report, 2006, UNDP

Power Sector Institutional Framework



Note: Provincial/AJK I&P Depts. also responsible for non-RE projects of ≤50 MW capacity. KESC is a vertically-integrated utility engaged in power generation and distribution.

Regulatory Arrangements

- **Power tariff is determined by NEPRA in accordance with guidelines provided by federal government**
- **NTDC is responsible for network planning and market operations. NTDC has the following subsidiary organizations:**
 - Central Power Purchase Agency (CPPA) for purchase and sale of power;
 - Transmission Network Operator (TNO) for construction and operation of transmission network;
 - National Power Control Centre (NPCC)/System Operator (SO) for dispatch and demand and supply balancing management; and
 - Contracts Registrar and Central Power Exchange Administrator (CRPEA) proposed for the registration, monitoring and dispute resolution of bilateral power purchase contracts

Power Map of Pakistan

Power Map of Pakistan

Physical Infrastructure

Power Infrastructure	
Generation, MW	19,550
Transmission, Circuit km	
500 kV	4,480
220 kV	7,270
132 kV	29,850
No. of Grid Stations	
500 kV	10
220 kV	29
132 kV	468
Distribution, km	
11 kV Lines	239,360

Source: Power System Statistics (31st Issue), 2006, for WAPDA.
The Karachi Electric Supply Corporation Limited, 94th Annual Report. Breakdown of grid stations estimated.

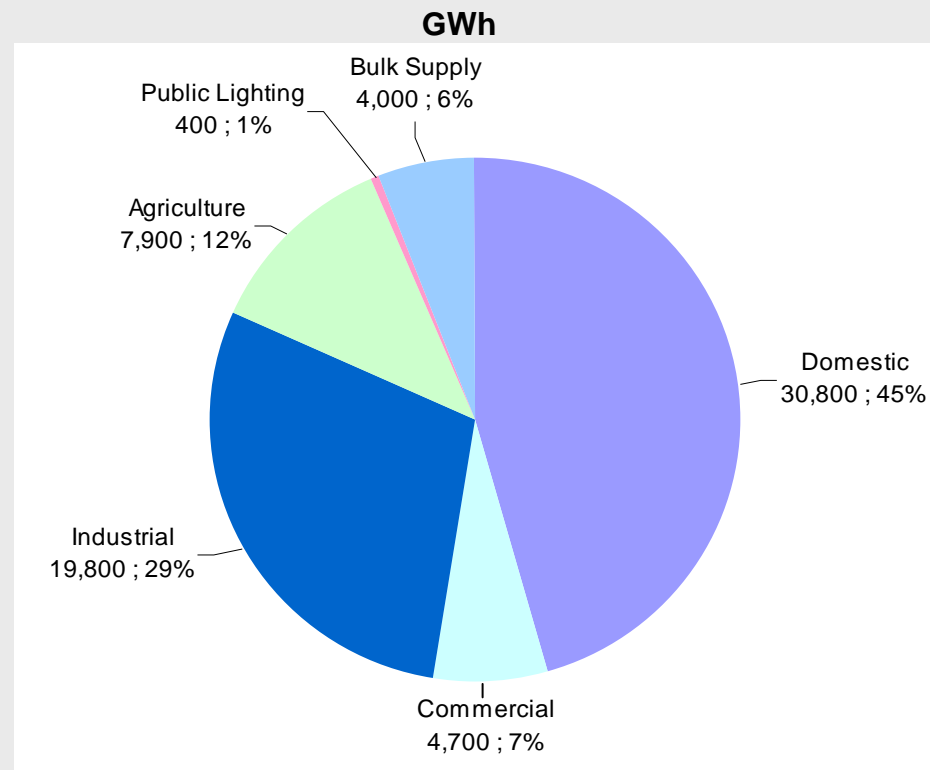
Electricity Demand

Total Electricity Demand¹: 67,600 GWh

Avg. Growth Rate for FY2004-06: 8.7%

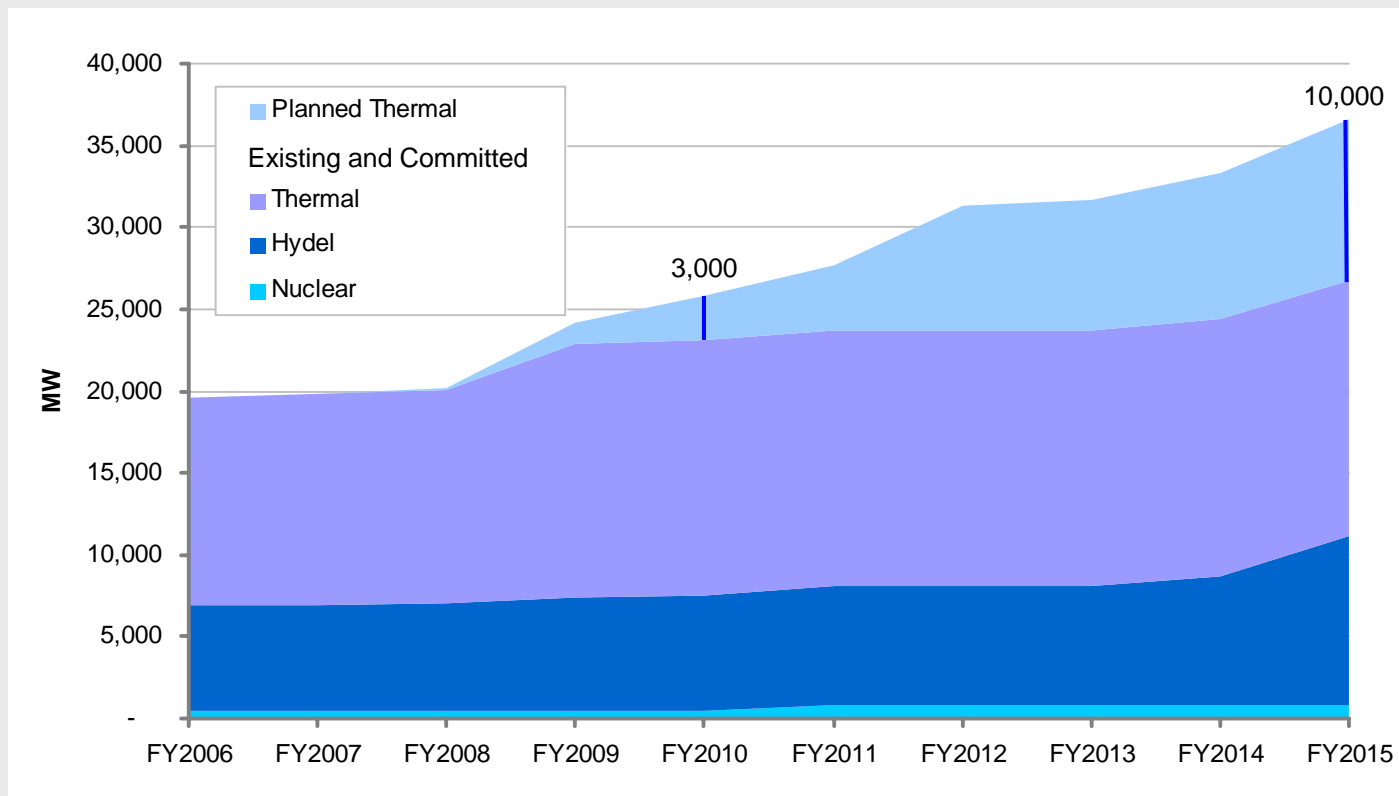
Number of Consumers²

Consumer Category	FY2006
Domestic	14,837,500
Commercial	2,477,800
Industrial	244,200
Agriculture	222,400
Public Lighting	6,700
Bulk Supply & Others	4,600



Source: 1. Pakistan Energy Yearbook, 2006
2. Power System Statistics (31st Issue), 2006

Forecast of Power Demand and Supply



Source: Pakistan Water & Power Development Authority (WAPDA), 3 March 2007.
The Karachi Electric Supply Corporation Limited (KESC), February, 2007

Electricity Tariffs

Consumer Tariff

Sectors	Tariff (¢/kWh)
Domestic	2.3 - 11.4
Commercial	11.2 - 11.9
Industrial	5.6 - 8.6
Agriculture	4.6 - 8.4
Bulk Supply	7.3 - 8.5
Average	6.7

Current Generation Tariff on Gas for new IPPs: 5 - 6 ¢/kWh

Central Asia – South Asia Regional Energy Market (CASAREM) Project

- **Export of 1,000 MW initially, on a seasonal basis, from the Kyrgyzstan and Tajikistan in Central Asia, to Afghanistan and Pakistan in South Asia**
- **Pakistan has expressed interest in increasing imports, over the medium term, beyond the initial 1,000 MW, on a year-round basis**
- **The project will:**
 - support Pakistan's strategy of increasing power supply to meet its economic growth targets;
 - enable Kyrgyzstan and Tajikistan to earn revenues through the increased utilization of their hydroelectric resources; and
 - enable Afghanistan to earn transit fees and have access to an additional source of electricity

CASAREM Project Risks

- **Political risks (lack of government commitment, sabotage)**
- **Legal and regulatory risks (inability to enforce contracts, changes in laws or regulations)**
- **Commercial risks (failure of suppliers and buyers to meet their contracted obligations)**
- **Technical risks (high mountains, rugged terrain, high level of technical losses)**

CASAREM Project Status

■ Phase I

- World Bank assisting with Commercial Assessment through an institutional, financial, risk mitigation, and legal framework study
- Asian Development Bank assisting with Techno-Economic Assessment which will: (i) assess the availability and cost of power supply options in Kyrgyzstan and Tajikistan; (ii) assess the need for power in Pakistan and the cost of alternatives to power import; (iii) identify technical risks and propose mitigation measures; and (iv) conduct an environmental and social assessment

■ Phase II

- Project Design
- Financial Technical Evaluation
- Compliance with Safeguard Policies

Pakistan's Gas Import Projects

■ IPI Gas Pipeline Project

- The project will have an initial capacity of 60 MMcmd to be shared equally between Pakistan and India, which will increase to 150 MMcmd in the second phase
- Agreement has been reached with Iran on the gas price at Pak-Iran border
- Discussions on the transportation cost and transit fees with India are at an advanced stage
- Decisions on project structure have been taken
- Iran, Pakistan and India have agreed to finalize Inter Governmental Framework Agreement and Gas Sales and Purchase Agreement, by mid 2007

Potential for Regional Cooperation under the Energy Charter Treaty

- **Pakistan will need to rely on imported energy to meet the deficits in the country and to meet the requirements of a growing economy**
- **Electricity imported through regional grids can compete in a market that will be supplied increasingly by power plants operating on imported fossil fuels**
- **Policy and regulatory frameworks for bulk purchase of electricity are operational and provide a basis for formulation of project structure and agreements for import of electricity**
- **Pakistan has made considerable progress in setting up cross-border energy trade and energy import projects which will facilitate early implementation of projects for import of electricity**