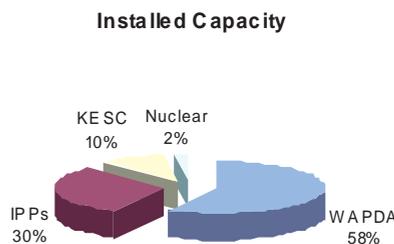


POWER GENERATION INDUSTRY

Sector Update - February 2011

Power generation business can be broadly categorized into three phases i.e. generation, transmission and distribution. Over the years, power sector in Pakistan has evolved into a public private partnership with several Independent Power Producers (IPPs) entering the market. In the public sector, there is one major player namely; WAPDA. Karachi Electric Supply Company (KESC), previously a public sector entity, is now majority owned by the private sector. The federal ministry of water and power is the principal organ that introduces policies while National Electric Power Regulatory Authority (NEPRA) is the body that issues licenses, prepares tariff structure, maintain standards etc. Considering the shortage of energy in Pakistan, the GoP formed the Private Power and Infrastructure Board (PPIB) in 1994 to facilitate the private sector in power generation. The board looks into the agreements pertaining to Implementation, Power Purchase, Fuel Supply, Gas Supply etc. It also acts as a liaison between the GoP and international agencies.

The installed capacity of electricity in Pakistan is 19,786 MW. WAPDA has the largest share while IPPs collectively are the other major players in the sector. The market share in terms of installed capacity is depicted below:



However, actual power generation varies and is dependant on a number of factors such as plant efficiency, availability of water & fuel and other technical factors.

In Pakistan, a total of 10,484 MW was produced during FY09. WAPDA (51.6%) was the largest producer while other major contributors were KESC (9%), HUBCO (9.5%), KAPCO (8.5%), Uch (4.8%) and Rousch (3.7%). The demand of electricity is far greater than the supply and the shortfall varies across the year primarily due to weather conditions. The table below compares the installed capacity to the actual production. Power generation over the last two years has depicted a declining trend amid reduction in supply from hydel sources. Moreover, production from nuclear facility at CHASNUPP was notably curtailed on account of technical issues.

While cost effectiveness is a function of plant efficiency, it is equally important to maintain a balanced energy mix. Globally, electricity is largely produced from coal due its cost efficiency as compared to other fossil fuels. However, due to its pollutant properties and hazardous effects for the environment, the world community is getting more inclined towards gas and renewable energy sources.

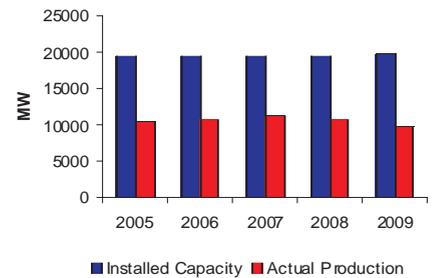
Hydel is considered to be the cheapest source of power generation while oil based electricity is one of the most expensive which also exerts significant pressure on the economy by magnifying import bill. However, the diminishing capacity of dams and deficiency of gas in the country has led to increasing reliance on furnace oil. Over

the years, the proportion of oil in the energy mix has increased whereas generation, particularly from gas, has been declining sharply. The trend in the energy mix is depicted in the presentation below:

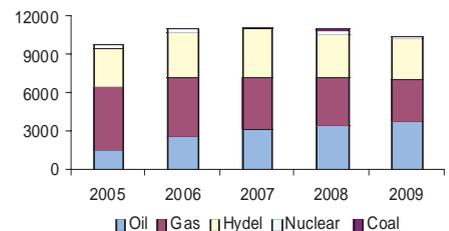
Sector-wise, electricity is largely consumed in the domestic sector where the charged rates are among the lowest while the industrial sector is the second largest consumer. The consumption pattern depicted steady growth for 5 years till 2007. However, there was a notable slowdown in power consumption during 2008 whereas negative growth was posted in 2009. The table below presents the consumption pattern in the last five years:

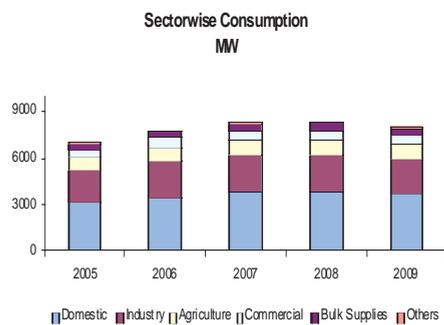
The decline in consumption was largely a function of reduction in power generation during the last two years. Moreover, there is considerable difference

Installed versus Actual



Generation by Source MW





Pakistan due to poor management and deteriorating infrastructure.

There are 24 IPPs commissioned in Pakistan having an installed capacity of 7,678 MW. However, dependable capacity from these power units is around 7100 MW. Under the power policy 2002, the GoP guarantees performance obligations to companies including power purchase, fuel supply etc while also providing protection against any political or tax/duty change. Moreover, the tariff components are structured in such a way that it hedges the IPPs against any adverse exchange rate variations. Any change in fuel price is also adjusted with the power purchaser. As per PPIB, there are around 27 IPPs expected to come online during next 7 years with a total capacity of over 8000 MW.

In recent years, the issue of circular debt has undermined the operating capacity of the power sector. The problem emanated when distribution companies started to default on their payments to upstream companies, thereby creating a cash flow crunch. The phenomenon has a multiplier effect as other stakeholders in the value chain i.e. power producers, oil & gas marketing companies, refineries and exploration & production companies all suffer on account of stuck up payments. The government has endeavored to clear the payment cycle by raising debt on an occasion but such solutions have turned out to be temporary and the issue still persists. Consequently, it has created liquidity constraints in the power sector while forcing companies to leverage their position. In the absence of any nearby solution, the debt on books can increase to a level where access to further borrowings may become difficult.

Production Profile

The most basic fossil fuel fired power generation unit is a steam turbine where fuel burns to heat water in a boiler and produce steam. The steam then in turn rotates a turbine to produce electricity. These types of units usually have an efficiency of 33% to 35%. Gas turbines and combustion engines are also used to generate electricity. Gas units, instead of generating steam to turn a turbine, use hot gases from fossil fuel (particularly natural gas and furnace oil) to turn a turbine. Gas turbines usually have a short start-up time, thereby making them popular in peak load hours. However, they are relatively

less efficient than steam units. The most efficient power plant is a combined cycle unit. It includes both a gas turbine and a steam unit all in one. In combined cycle plants, the hot air from the exhaust of a gas turbine is diverted towards the boiler to generate steam which, in turn, rotates the turbine to produce electricity. Hence, the efficient use of heat in a combined cycle makes it relatively more popular while such plants can achieve a thermal efficiency of over 50%.

KAPCO has a combined cycle plant having a name-plate capacity of 1600 MW. However, dependable capacity of the plant is 1386 MW. The power complex at Kot Addu uses 10 gas and 5 steam turbines. While each gas turbine produces electricity, heated air exhaust from a combination of two gas turbines, in turn, feeds a steam turbine. All turbines are manufactured by renowned international companies including Siemens, Fiat, Alstom and ABB.

The turbines have the capacity to run on gas, however, Low Sulphur Furnace Oil (LSFO) is used when gas is not available. There are two turbines which operate on High Speed Diesel (HSD). To operate at full capacity, 309 MMcf/d gas is required while up to 5,069 M. Tons of LSFO/day can be consumed if gas is not available. Moreover, required amount of HSD to run two Italian made turbines is 1300k liters per day. Over the years, gas shortage has forced KAPCO to rely extensively on LSFO. The following graph presents the electricity generation by fuel:

The year 2010 continued to be difficult due to irregular fuel supply amid liquidity constraints on accounts of delayed payments from WADPA. Consequently, the impact was visible in net plant output that remained low for the second consecutive year. The table below depicts the plant output/efficiency statistics during the last five years:

	2006	2007	2008	2009	2010
Complex Thermal Efficiency	43.1%	43%	43.2%	43.3%	42.9%
Plant Utilization	80%	81%	85%	76%	83%
Load Factor	70.5%	69.6%	75.2%	64.2%	66.1%
Availability	87.7%	86%	88%	84.8%	79.2%
Net Output GWh	8,292	8,183	8,863	7,545	7,767

Jahangir Kothari Parade (Lady Lloyd Pier)

Inspired by Her Excellency, The Honorable Lady Lloyd, this promenade pier and pavillion was constructed at a cost of 3 Lakhs and donated to the public of Karachi by Jahangir Kothari to whose genrosity and public spirit the gift is due. Foundation stone laid on January 5, 1920. Opened by Her Excellency, The Honorable Lady Lloyd on March 21, 1921.

Dome: A roof or vault, usually hemispherical in form. Until the 19th century, domes were constructed of masonry, of wood, or of combinations of the two, frequently reinforced with iron chains around the base to counteract the outward thrust of the structure.

Origins: The dome seems to have developed as roofing for circular mud-brick huts in ancient Mesopotamia about 6000 years ago. In the 14th century B.C. the Mycenaean Greeks built tombs roofed with steep corbeled domes in the shape of pointed beehives (tholos tombs).

Otherwise, the dome was not important in ancient Greek architecture. The Romans developed the masonry dome in its purest form, culminating in a temple built by the emperor Hadrian. Set on a massive circular drum the coffered dome forms a perfect hemisphere on the interior, with a large oculus (eye) in its center to admit light.



Jahangir Kothari
Parade

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KARACHI

VIS House - 128/C, 25th lane off Khayaban-e-Ittehad
D. H. A. Phase VII, Karachi - Pakistan

LAHORE

VIS House - 61-A/1, Street # 17
Cavalry Ground, Lahore - Pakistan

Tel: (92-21) 35311861-70 Fax: (92-21) 35311872-73
Website: www.jcrvis.com.pk