USAID
FROM THE AMERICAN PEOPLE

ENERGY SECTOR ASSESSMENT FOR USAID/PAKISTAN

ENERGY SECTOR ASSESSMENT FOR USAID/PAKISTAN

JUNE 2007

GORDON WEYNAND

ENERGY TEAM

OFFICE OF INFRASTRUCTURE & ENGINEERING

BUREAU FOR ECONOMIC GROWTH, AGRICULTURE, & TRADE

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

CONTENTS

EXECUTIVE SUMMARY

Maintaining and expanding energy services within Pakistan is crucial to the economic growth of the country. During the course of this assessment two critical needs have been identified: (1) providing more energy supplies through expansion AND conservation; and (2) increasing access to modern energy services to un-served regions and population groups. The two major challenges that must be overcome to satisfy these needs are: (a) aligning economic incentives through policies, regulations, subsidies, tariffs, prices, collections, and taxes to improve fiscal discipline and transparency, attract investment, and encourage energy conservation and efficiency improvements; and (b) creating sufficient capacity to empower stakeholders such as the Government of Pakistan, the private sector, NGOs, and energy consumers to both implement and respond to the incentives framework.

PURPOSE OF ASSESSMENT

Since re-opening its Pakistan Mission in 2002, USAID has targeted its programs (around $150 million/year) in the education, health, and economic growth areas. In addition it is providing budget support to the Government of Pakistan ($200 million/year) and is supporting rebuilding efforts in the zone damaged by the 2005 earthquake ($50 million/year). A just-announced FATA program to support development in the tribal areas is in the design stage ($150 million/year).

The Mission's Economic Growth program is coming to the end of its 2002-2007 five-year strategy and is examining the economic landscape of Pakistan to understand where to most strategically target its future programs and resources. In December 2006, EGAT's Economic Growth Office worked with Mission staff to begin the assessment process, and during this assessment, repeatedly encountered concerns that problems within Pakistan's energy sector were hampering the growth of Pakistan's economy. As a result, the Mission's Economic Growth team requested that EGAT's Office of Infrastructure & Engineering send out an energy expert in March 2007 to assess Pakistan's energy sector with an eye to answering three questions:

1. How is energy contributing or constraining Pakistan's economic growth?
2. What assistance needs to be provided to Pakistan's energy sector to foster economic growth?
3. What role should USAID play?

This report summarizes the findings of the EGAT's Energy Team's assessment with regards to the first two questions, the third question is answered in a stand alone SOW for a potential energy sector support program that was provided to the Mission.

THE ENERGY SITUATION IN PAKISTAN

ENERGY BASICS

Energy is the capacity for doing work. Thus, energy is a power flow over a period of time. Electrical energy is usually measured in kilowatt-hours (kWh) or Megawatt-hours (MWh or 1,000 kWh), while heat energy is usually measured in British Thermal Units (BTUs) or in joules. Power is the rate of flow of energy, and is measured in watts [Stoft 2002]. To give a concrete example, using a 100 watt light bulb to illuminate a room for 10 hours requires 100 watts of power to be provided for the 10 hours for a total energy consumption of 100 x 10 = 1,000 watt-hours or 1 kilowatt-hour (1 kilowatt = 1,000 watts).

To use energy to perform work, such as running an electric motor to mill grain into flour or using a truck to transport goods from one place to another, energy resources must often be converted from one form to another. For example, the energy of falling water can be passed through the fan blades of a turbine to turn a generator and produce electricity. Natural gas can be burned or combusted to produce hot gas that passes through a turbine to turn a generator and produce electricity. Similarly, coal or petroleum products such as fuel oil or furnace oil can be burned to heat a boiler that produces steam to drive a turbine/electrical generator set. Petroleum or crude oil can be refined into a variety of products (fuel oil, diesel fuel, gasoline, Liquefied Petroleum Gas or LPG, etc.) that can be burned in engines to power cars or trucks for transport, to cook food or to dry products, or to power motors that can drive generators to produce electricity. Firewood and dried dung can also be burned to produce heat for cooking. All of these energy conversions have varying levels of efficiency as no conversion from one form to another is ever 100% efficient.

Bringing energy to the location where it can be used to perform work is often necessary. Crude oil is transported by ships and pipelines to oil refineries, where it is converted into products that are further distributed by pipelines, trucks, or ships to end users. Electricity, once generated by falling water or burning oil, gas, or coal, is often transferred long distances through transmission lines and distribution systems to businesses, industries, schools, hospitals, and residences where it performs work (see Figure 1). As when converting one form of energy to another, some energy is also lost during transportation. In the electric sector, these losses are called ‘line losses’ and while some are due to technical factors such as line heating, theft of electricity also can contribute to losses.

Energy is central to the development of a country for several reasons (see Figure 2). First, without access to modern energy services, it is difficult to effectively provide modern health services (e.g., keep vaccines cooled properly), improve agricultural productivity through intensification or increased value-added product processing such as drying, get the full benefit of improved educational systems (e.g., lights for night study), support democratic governance through communication with citizens, or building an economic base that can participate in today’s globalized economy. As shown in Figure 3, access to electricity can be correlated to the number of people living in poverty. Of course, correlations do not equate to causality, but as documented in USAID’s 2006 report on ‘The Role of Energy in Development’, access to modern energy services can be a powerful enabler for economic and social development, while the lack

of access can be a major obstacle to successful development. Table 1 and Table 2 contain the executive summary from this report.

Providing enough energy to foster economic growth and social development is also critical to closing the 'gap'. According to Thomas Barnett (2003 and 2004), "disconnectedness defines danger," and to address disconnectedness, the U.S. strategy should center on "extending globalization in a fair and just manner." As he observes:

> "This new world must be defined by where globalization has truly taken root and where it has not. Show me where globalization is thick with network connectivity, financial transactions, liberal media flows, and collective security, and I will show you regions featuring stable governments, rising standards of living, and more deaths by suicide than murder. These parts of the world I call the Functioning Core, or Core. But show me where globalization is thinning or just plain absent, and I will show you regions plagued by politically repressive regimes, widespread poverty and disease, routine mass murder, and, most important, the chronic conflicts that incubate the next generation of global terrorists. These parts of the world I call the Non-Integrating Gap, or Gap.
>
> The only global future truly worth creating involves nothing less than eliminating the Gap altogether. America can only increase its security when it extends connectivity or expands globalization's reach, and by doing so, progressively reduces those trouble spots or off-grid locations where security problems and instability tend to concentrate."

FIGURE 1: TRANSPORTING ENERGY, IN THIS CASE ELECTRICITY, FROM ONE PLACE TO ANOTHER. [From: http://www.eia.doe.gov/basics/electricity_basics.html]

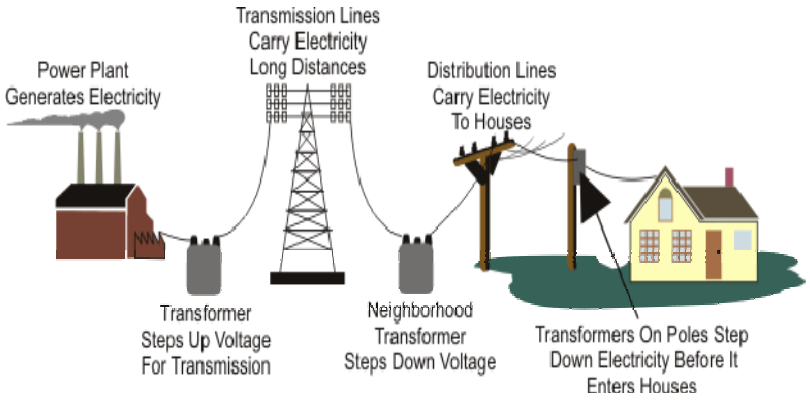


FIGURE 2: THE ROLE OF ENERGY IN DEVELOPMENT

There is a strong relationship between the provision of energy services and global social, economic, and political development.

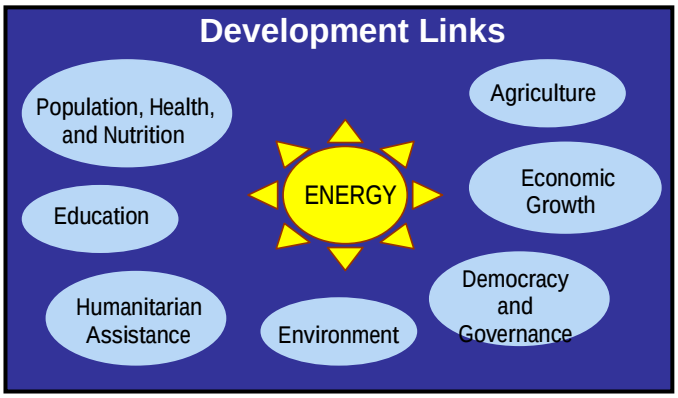
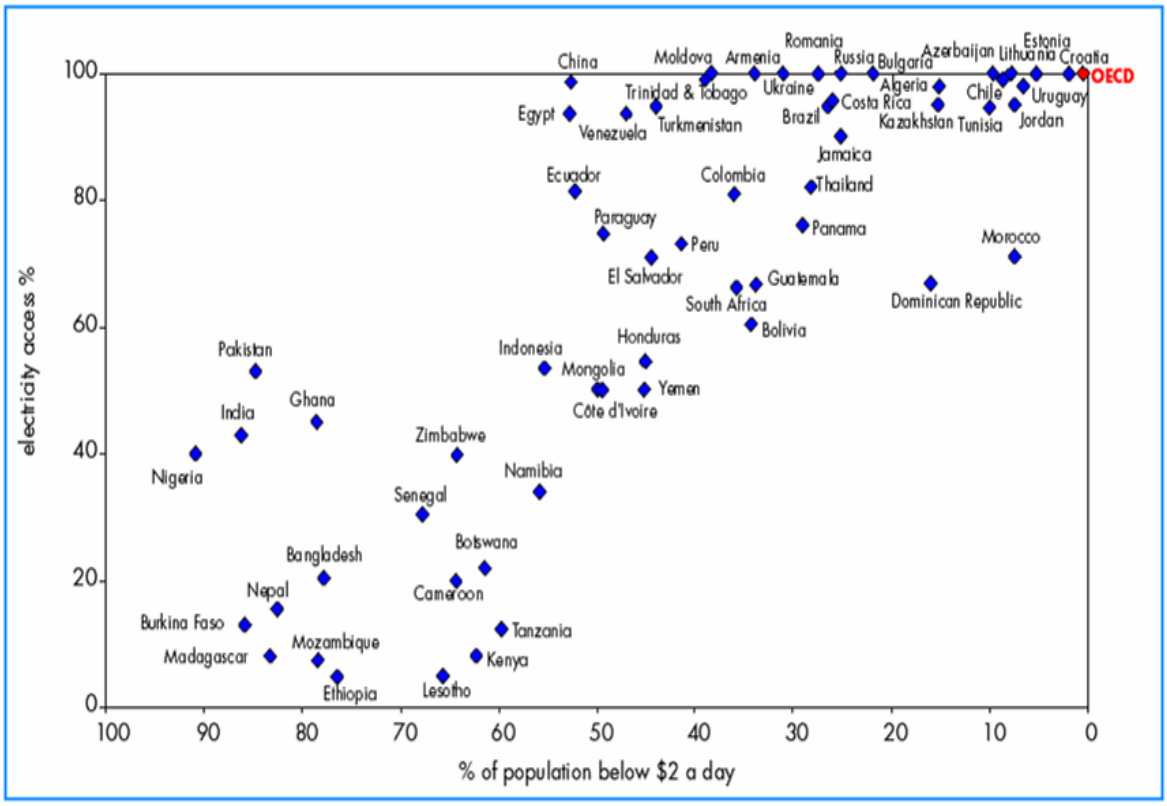


FIGURE 3: POVERTY ALLEVIATION AND ENERGY

The lack of electricity access is strongly correlated to the number of people living below $2 per day.



Note: Some transition economies and the OECD average are included for comparison purposes.
Source: IEA analysis; income statistics from the World Bank's *World Development Indicators*, 2001.

TABLE 1: EXECUTIVE SUMMARY
From USAID's Energy and Development Report [2006a].

Access to modern energy,[1] especially in the lower income developing countries, is an important factor for achieving key aspects of the Millennium Development Goals and supporting the U.S. development and security agenda. Through review of the relevant literature and a first-order statistical analysis of existing data on energy access, human welfare and economic growth, this paper presents key correlations that demonstrate the role of modern energy access in human and macroeconomic development.[2] Linkages between energy and security and between energy and governance are more qualitative and indirect, but analyses and studies to date indicate that these relationships are also positive and significant.

IMPROVED QUALITY OF LIFE

- **Human Development Index (HDI).** The UN Human Development Index (HDI)[3] scores correlate strongly (76.0%)[4] with access to commercial energy and even more strongly (87.6%) to electricity. Most countries with per capita consumption levels below 500 kgoe or 1,000 kWh had HDI scores of less than 0.6. Figure ES-1 illustrates HDI sensitivity to commercial energy (on the left) and electricity consumption (on the right). When per capita commercial energy or electricity consumption is very low, small increases in such consumption can result in significant HDI increases. The HDI continues to improve through consumption levels of 4,000 kWh or 2,000 kgoe per capita.

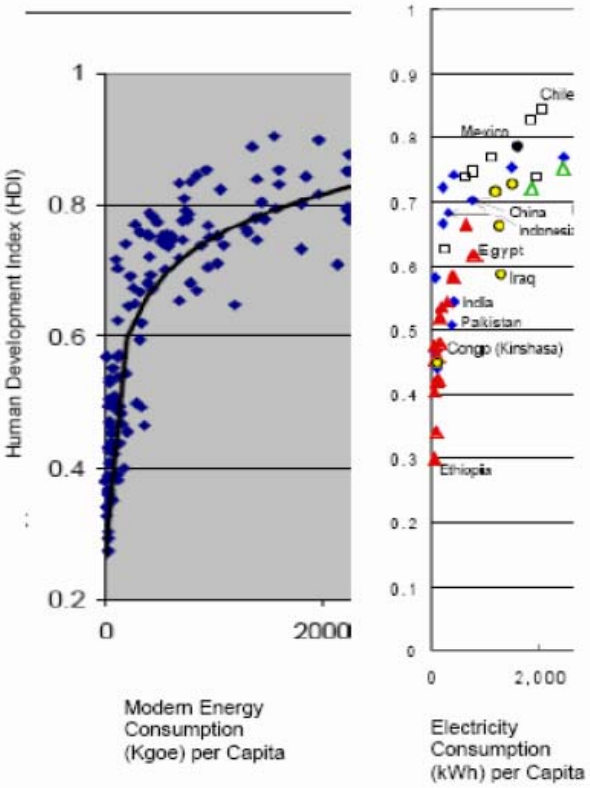


Figure ES-1: Commercial Energy and Electricity Consumption versus HDI

- **GDP and Income.** Increasing per capita electricity consumption has a 90 percent correlation with increasing per capita GDP. By relieving the burden of gathering traditional fuels (fuel wood, dung, agricultural residue) and allowing poor citizens to dedicate the time savings to income-generating opportunities and by facilitating the shift to mechanized agriculture and small commercial enterprises, modern energy sources allow the most vulnerable citizens to better provide for their households. An increase in per capita electricity consumption correlates strongly with a decrease in the percent of the population with incomes of less than $2 per day (83.0%) and less than $1 per day (86.6%).

- **Health.** Reduction in maternal mortality is significantly correlated (-84.5%) with electricity consumption. The correlation with infant mortality rates is somewhat weaker (-60.3%). Increases in life expectancy have a 65.7 percent correlation with increases in electricity consumption in low-income countries.

- **Education.** Education indicators link positively with modern energy services, with higher literacy and overall (male and female) school enrollment rates correlating to electricity access. Additionally, a positive

TABLE 2: EXECUTIVE SUMMARY (CONTINUED)

From USAID's Energy and Development Report [2006a].

correlation (65%) occurs between primary education enrollment and completion rates for girls and increases in per capita electricity consumption. The correlation is strongest in low-income developing countries.

MACROECONOMIC DEVELOPMENT

- Export diversification has been found to correlate positively with infrastructure development in Africa. Additional analyses of economic growth in Bolivia, Colombia, Mexico, and Venezuela demonstrated that a 10 percent increase in infrastructure stocks was associated with a 1.5 percent increase in GDP.
- In the agriculture sector, increasing value added per worker is tied to both electricity access (83.4%) and commercial energy use (80.8%). Because agricultural production and processing are often the largest employers in rural areas, this relationship has important implications for lifting the world's rural poor beyond subsistence farming and out of poverty.
- Extending electricity access to previously un-served and under-served areas facilitates development of cottage industries and generates employment that may help mitigate rural-urban migration. Bangladesh's rural electrification program increased the total number of rural industrial consumers by 3,200 percent (from only 23 in 1983 to 73,827 in 2002) while the average number of industrial connections per cooperative rose by 550 percent (from 2 in 1983 to 1,102 in 2002).

GOVERNANCE AND SECURITY

The International Energy Agency (IEA) estimates that a $10/barrel oil-price increase results in an average loss in GDP of 0.8 percent in the oil-importing developing economies of Asia. A World Bank/ Energy Sector Management Assistance Program (ESMAP) study[5] showed that the GDP of the lowest income net oil-importing countries were the most vulnerable to significant increases in oil prices. Table ES-1 summarizes the effect of 33 percent and 72 percent oil-price increases on GDP—2003 to 2004 and 2003 to 2005, respectively—and indicates that declines in GDP could range from 1 to 3 percent depending on the specific circumstances of the countries' economies. The study also showed a strong correlation between the external debt ratio and the net oil-import/GDP ratio, indicating that the most indebted countries are also those with economies that are most vulnerable to rises in oil price (oil vulnerability).

Table ES-1: Impact of Higher Oil Prices on Net Oil-Importing Countries Grouped by Per Capita Income as a Percentage of GDP (2003 base)

Per capita income range	*Oil vulnerability*	*Effect of 33% price rise on GDP*	*Effect of 72% price rise on GDP*
< US$200	0.044	1.4	3.0
US$200 - US$300	0.028	0.9	1.9
US$300 - US$1000	0.034	1.1	2.3
> US$1000	0.030	1.0	2.1
All countries	0.032	1.1	2.2

Energy sector reform often introduces civic participation, transparency, and accountability to developing-country citizens. By promoting public discussion, creating mechanisms for consumer input, and establishing sector regulation characterized by transparency and political independence, energy sector reform introduces the concepts of governance and civic participation.

Collectively, the correlations between modern energy and human welfare, balanced and sustained economic growth, governance and security demonstrate the need for critical attention to energy access for developing economies and their citizens. The analyses presented in this paper clearly demonstrate the essential role of modern energy in supporting the U.S. Director of Foreign Assistance's objective of "peaceful societies where healthy and well-educated people are free to provide for themselves and their families."[6]

ENERGY AND GENDER

Lack of access to modern energy services places a disproportionate burden on women, and also affects the welfare of children. TABLE 3 below summarizes how energy contributes to achieving the Millennium Development Goals and, in the process, significantly improves the well-being of women and children. For more information on this topic, refer to USAID's Energy and Gender report (2005).

TABLE 3: A SNAPSHOT OF ENERGY'S LINKAGES TO THE MILLENNIUM DEVELOPMENT GOALS

From USAID's Energy and Development Report [2006a].

MDG	Energy Linkages
1. Eradicate extreme poverty and hunger	Employment generation, increased industrial development, agricultural processing, refrigeration and transport of crops
2. Achieve universal primary education	Lighting, television, and communications can help improve the delivery of education services and attract teachers to isolated rural areas. Relieve physical labor so young girls have time to attend school.
3. Promote gender equality and empower women	Women are responsible for most household cooking and water boiling activities. This takes time away from other productive activities as well as from educational and social participation.
4. Reduce child mortality	Diseases and illness resulting from unboiled water and indoor air pollution from traditional fuels and stoves directly contribute to infant and child disease and mortality.
5. Improve maternal health	Women are disproportionately affected by indoor air pollution and water- and food-borne illnesses. Daily drudgery and physical burden of fuel collection and transport contribute to poor maternal health conditions, especially in rural areas.
6. Combat HIV/AIDS, malaria, and other diseases	Electricity for communication can spread important public health information. Health care facilities require illumination, refrigeration, and sterilization to deliver health services.
7. Ensure environmental sustainability	Cleaner energy systems and improved energy efficiency are needed to address all detrimental effects of energy production, distribution and consumption. National and local policies are needed to ensure the mitigation of environmental impacts associated with the use of fossil and non-sustainable fuel supplies.
8. Develop a global partnership for development	Partnerships are essential for increasing energy access and supply to help meet the MDGs.

Source: Adapted from *Energizing the Millennium Development Goals: A Guide to Energy's Role in Reducing Poverty*, United Nations Development Programme, 2005.

PAKISTAN'S ENERGY RESOURCES

Pakistan's conventional and renewable energy resources are summarized in TABLE 4.

TABLE 4: PAKISTAN'S ENERGY RESOURCES

Energy Type	Resource	Source
Oil	300 million barrels proved reserves	EIA (2006)
Natural Gas	28 trillion cubic feet proved reserves	EIA (2006)
Coal	3,362 million short tons of proven recoverable reserves	EIA (2006)
Hydroelectricity	46,000 MW identified potential	GOP (2005)
Uranium	236 tons used for nuclear power generation since 1980	GOP (2005)
Wind and Solar	Estimates of utility-grade and community-level resources forthcoming from NREL study (June 2007)	
Biomass (wood, dung, agricultural residues)	No estimate available	

In 2005-2006, Pakistan's economy required energy supplies of 57.855 million tons of oil equivalent (MTOE) as shown in Table 5 and in Figure 4. Table 6 shows how Pakistan's use of energy compares to other countries around the world and the region.

TABLE 5: COMMERCIAL ENERGY SUPPLIES 2005-06

[Hydrocarbon Development Institute 2006]

Energy Type	Supplied (MTOE)	Average Annual Growth Rate Since 2000
Oil	16.412	-3.2%
Natural Gas	29.188	9.7%
LPG (Liquefied Petroleum Gas)	0.246	11.4%
Coal	4.050	15.0%
Hydroelectricity	7.366	12.4%
Nuclear Electricity	0.593	4.5%
TOTAL	**57.855**	**5.4%**

FIGURE 4: PAKISTAN'S COMMERCIAL ENERGY SUPPLY MIX IN 2005 [EIA 2006].

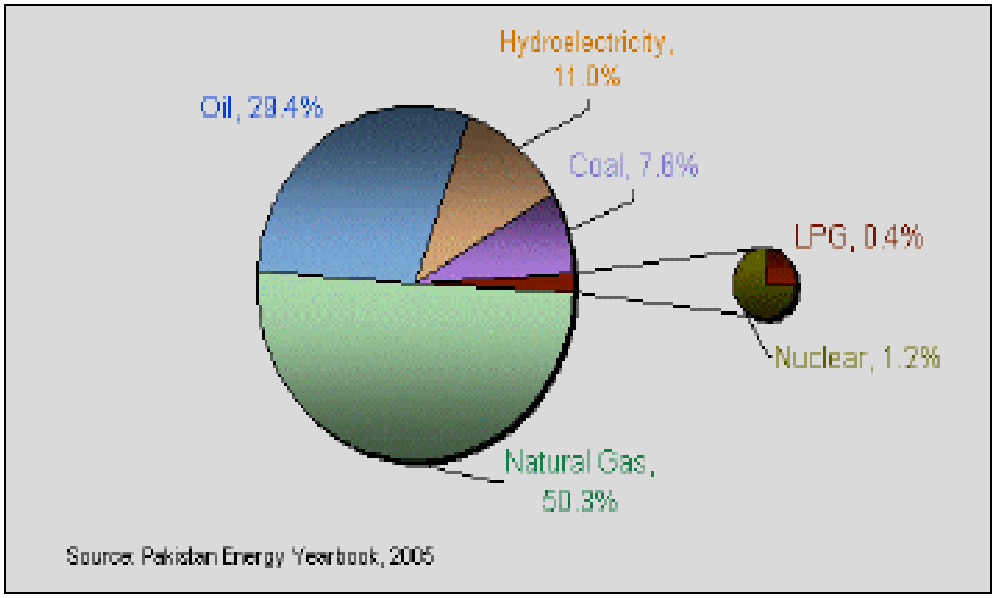


TABLE 6: PAKISTAN ENERGY USE IN COMPARISON TO OTHER COUNTRIES [GOP 2005]

World and Regional Energy Comparison (Year 2004, 1995 USD)

	World	Pakistan	India	Bangladesh	China	Malaysia
Population (Million)	6,393	159	1,086	141	1,300	25.6
Per Capita GDP (PPP)	8,200	2,100	2,200	1,900	5,000	9,000
Per Capita Primary Energy Supply (TOE)	1.55	0.30	0.32	0.11	0.91	2.17
Per Capita Electricity Generation (kWh)	2,657	581	561	145	1,484	3,500
Import Dependence	n.a.	24%	18%	21%	1%	-53% (exporter)

Source

1. British Petroleum – Statistical Review of the World Energy
2. World Fact Book 2004

To provide its economy with the necessary energy supplies, Pakistan's indigenous energy resources as currently developed were insufficient, and significant supplies of energy had to be imported as shown in Table 7.

TABLE 7: PAKISTAN'S ENERGY IMPORT BALANCE IN 2004 [GOP 2005].

	Demand	Supply	Deficit
Oil (MT)	15.7	2.7 (Local Crude)	**13** Imported (7.8 Crude) (5.2 Products)
Gas (MMCFD)	2,880	3,086*	
Coal (Millions of Tons)	6.1	3.3 (Local)	**2.8** Imported
Electricity (Megawatts)	Peak Demand: 13,021 Firm Capability: 13,850		

*Difference transmission and distribution losses.

In addition to these commercial forms of modern energy, the World Energy Council has estimated in 2000 that about one-third of Pakistan's energy needs are met by non-commercial sources of energy such as firewood, charcoal, and cow dung [World Energy Council 2000]. In 2006, ESMAP estimated the percentages of households meeting their energy needs using non-commercial and commercial sources of energy and this data is shown in Table 8. The poor generally meet their energy needs through free biomass (wood, dung, agricultural wastes) and kerosene, particularly in rural areas. In 2007, Winrock International estimated the household expenditures on energy in rural and urban areas as shown in Table 9.

The reason that Pakistan's population uses extensive quantities of non-commercial forms of energy is that a significant portion of the population lacks access to modern forms of energy such as electricity. This shortfall can be seen in Table 10, where access to electricity is shown for Pakistan and other countries in South and Central Asia. In 2006, the Asian Development Bank estimated that 45% of Pakistan's population lacked access to electricity [ADB 2006a].

Within Pakistan, the electricity consumption varies by province and by economic group. These consumption patterns are exhibited in Table 11.

In 2004-2005, annual consumption of electricity in the residential sector was about 1,920 kWh per customer, while annual consumption by each industrial customer was 73,379 kWh. Commercial customers consumed an average of 1,614 kWh per year per customer while agricultural customers consumed 33,344 kWh per year per customer. These figures are for the ex-WAPDA distribution companies – the customers in the KESC service area used more per customer on an annual basis [NEPRA 2006b].

TABLE 8: PERCENTAGE OF HOUSEHOLDS USING DIFFERENT ENERGY SOURCES [ESMAP 2006].

Area and Survey Year	Biomass	Wood	Dung	Ag. Residue*	Electricity	Kerosene	Natural Gas	LPG
National								
1994	78	63	29	21	68	64	15	4.1
1997	77	63	27	22	78	51	17.7	5.3
1999	77	63	31	20	73	45	17.4	8.6
2001	77	58	31	26	77	39	20	8.1
Urban								
1994	36	32	8.9	3.6	95	33	51	6.4
1997	31	29	7.1	3.3	97	26	57	7.3
1999	31	27	9.1	3.7	94	24	56	10.2
2001	31	25	8.8	5.2	96	14	62	8.1
Rural								
1994	96	76	37	28	58	77	0.5	3.1
1997	97	77	35	29	70	62	1.2	4.5
1999	95	77	39	27	65	54	1.8	8.0
2001	95	71	39	34	69	49	3.3	8.1

*Agricultural residue refers to bagasse, cotton sticks, sawdust, shrubs, weeds, tobacco sticks, and so on, used for fuel purposes

TABLE 9: AVERAGE MONTHLY EXPENDITURE IN RUPEES ON ENERGY IN PAKISTANI HOUSEHOLDS [WINROCK 2007]

Energy	Pakistan	Urban	Rural
Average Monthly Expenditure	713	904	622
Firewood	22.1%	7.5%	32.1%
Kerosene	2.8%	0.8%	4.2%
Charcoal	0.1%	0.0%	0.1%
Coal	0.1%	0.0%	0.2%
Dung cakes	3.6%	0.8%	5.5%
Natural Gas	9.1%	20.3%	1.4%
LPG	3.8%	3.6%	3.9%
Electricity	50.4%	63.1%	41.7%
Candles	2.0%	1.7%	2.3%
Agriculture residues	4.5%	0.7%	7.1%
Accessories (bulbs etc)	1.5%	1.5%	1.6%

TABLE 10: ACCESS TO ELECTRICITY RATES AND POPULATION FIGURES

[World Development Indicators Database, September 2005]

	Household electrification rates (%)	Total Population (2005 est., millions)	Population with electricity (millions)	Population without electricity (millions)
Central Asia				
Kazakhstan	100%	14.8	14.8	0.0
Kyrgyzstan	100%	5.3	5.3	0.0
Tajikistan	97%	6.5	6.3	0.2
Turkmenistan	100%	4.8	4.8	0.0
Uzbekistan	100%	26.6	26.6	0.0
Central Asia total		**58**	**57.8 (99.7%)**	**0.2 (0.3%)**
South Asia				
Afghanistan	2.0	29.9	0.6	29.3
Bangladesh	26.3	141.8	37.3	104.5
Bhutan	30.0	2.2	0.7	1.5
India	44.4	1103.4	489.9	613.5
Maldives	100.0	0.3	0.3	0.0
Nepal	25.9	27.1	7.0	20.1
Pakistan	53.0	157.9	83.7	74.2
Sri Lanka	65.5	20.7	13.6	7.1
South Asia total		**1483.3**	**633.0 (40%)**	**850.3 (60%)**

TABLE 11: PROVINCE-WIDE ELECTRICITY CONSUMPTION (IN GWH OR MILLIONS OF KWH) BY ECONOMIC GROUP

Consumer	Punjab*	Sindh	NWFP**	Balochistan	KESC	Total	%
Domestic	16664	1858	5081	378	3508	**27489**	**44.9**
Commercial	2483	269	361	81	888	**4082**	**6.7**
Industrial	13169	1027	1276	95	3023	**18590**	**30.3**
Agriculture	3054	587	444	2840	66	**6991**	**11.4**
Public Lights	146	61	17	4	78	**306**	**0.5**
Bulk Supply	1319	192	436	93	694	**2734**	**4.5**
Others	862	8	14	0	159	**1043**	**1.7**
Total	**37697**	**4002**	**7629**	**3491**	**8416**	**61235**	**100**
% of Total	**61.56**	**6.54**	**12.46**	**5.70**	**13.74**	**100**	

* Includes Islamabad Capital Territory
** Includes FATA

ECONOMIC GROWTH IN PAKISTAN AND THE NEED FOR MORE ENERGY

Over the last three years, Pakistan has sustained an economic growth rate of 7.6% per year, which is well above its average annual growth rate of 3.9% for the previous 10-year period [Merrill Lynch 2007]. However, to sustain this growth rate into the future will require that Pakistan obtain increasing supplies of energy. In 2005, the Government of Pakistan has estimated the increase in energy supplies needed to support different annual economic growth rates and these are shown in Figure 5. Thus, to maintain growth rates in the 7-8% range, energy supplies by 2010 will need to increase some 40-46% or grow to around 79 MTOE (MTOE = million tons of oil equivalent). By 2015, energy supplies will need to increase some 96-115% to around 120 MTOE. These estimates must be compared to the 2005-06 energy supplies of 57.8 MTOE and would imply a significant need for additional energy supplies to keep up with and support Pakistan's economic growth.

From 2000 to 2005, Pakistan spent $3.3 billion a year for imported oil, which represented 22-25% of all imports. For the first nine months of FY 2006 (which ends June 30, 2006), the import bill is $4.6 billion and is expected to exceed $6 billion by the end of the fiscal year. These oil imports place a heavy burden on foreign exchange reserves [Asian Development Bank 2006a]. Even with increased domestic production of energy, Pakistan's energy import bill can be projected to rise as it economy continues to grow and require more energy.

Merrill Lynch estimates that every one percent of GDP growth in Pakistan requires an increase in electricity supply of 1.25%. Thus, a GDP growth rate of 7% per year will require an increase in electricity supplies of 8.8% (or 1.25 x 7%) [Merrill Lynch 2007]. At present, the Asian Development Bank estimates that electricity demand exceeds supply by 20% during peak winter and summer periods, and that around 2,000 MW per year will need to be added (at a cost of about $6 billion/year) to keep up with a GDP growth rate of 6-8% [Asian Development Bank 2006b]. The Government's commitment to provide access to electricity to the 45% of the population currently unserved also keeps demand for electricity supplies increasing.

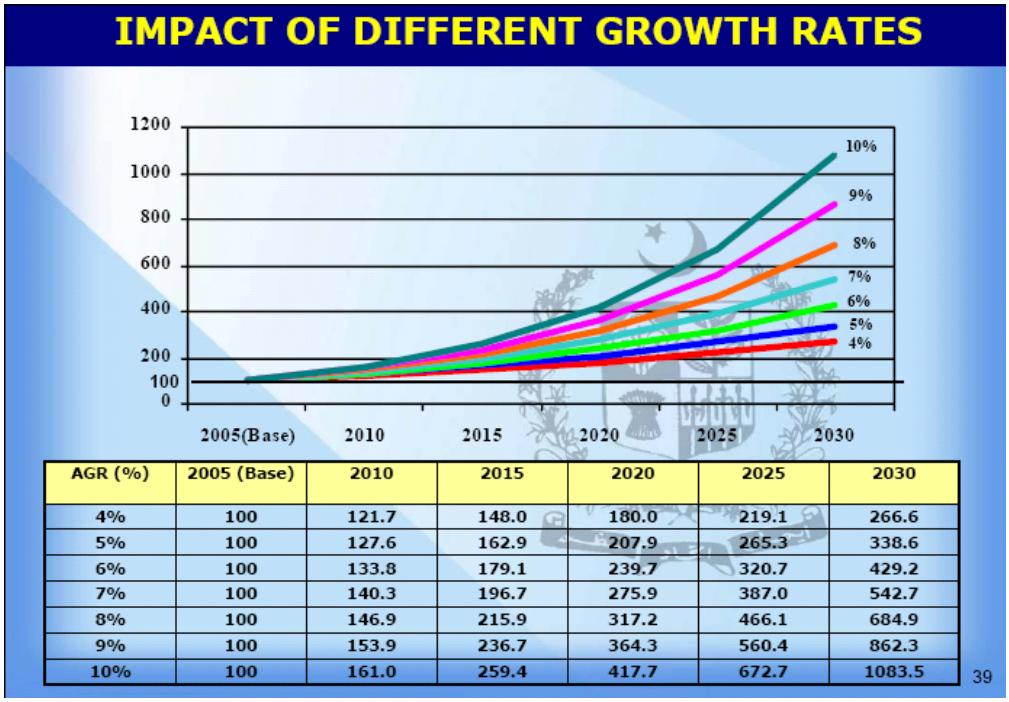
The Water and Power Development Authority (WAPDA) has surveyed the villages currently not receiving electricity services, and has determined that 7,874 villages are so far from the electricity grid that they can only economically receive electricity services through some form of decentralized generation such as wind, solar, or small hydro power systems. Electrifying these villages has been made the responsibility of the Alternative Energy Development Board (AEDB), while WAPDA and its successors are striving to provide service to the many rural villages still not connected to the electricity grid [NEPRA 2006b]. Of the 7,874 villages mentioned above, approximately 1/8 lie in the Sindh Province and the remaining 7/8 in the Balochistan province.

The Energy Information Administration (EIA) [2006] summarizes the situation in the Pakistan electricity sector as follows:

> "Pakistan had 20.4 gigawatts (GW) of installed electric generating capacity in 2004. Conventional thermal plants using oil, natural gas, and coal account for about 66 percent of Pakistan's capacity, with hydroelectricity making up 32% percent and nuclear 2%. The Pakistani government estimates that by 2010, Pakistan will have to increase its generating capacity by more than 50% to meet increasing demand. In 2004, Pakistan generated 80.2 billion kilowatt hours (BkWh) of electricity while consuming 74.5 BkWh. Pakistan's total power generating capacity has increased rapidly in recent years, due largely to foreign investment, leading to a partial alleviation of the power shortages Pakistan often faces in peak seasons. However, much of Pakistan's rural areas do not have access to electric power and about half the population is not connected to the national grid. Rotating blackouts ("load shedding") are also necessary in some areas. In addition, transmission losses are about 30%, due to poor quality infrastructure and a significant amount of power theft."

Part of the reason for Pakistan's expanding appetite for energy is that its overall economy requires large amounts of energy to produce one unit of Gross Domestic Product (GDP), a measure known as 'energy intensity'. Figure 6 shows how the energy intensity of Pakistan's economy compares to the world average and to selected countries in the region and elsewhere.

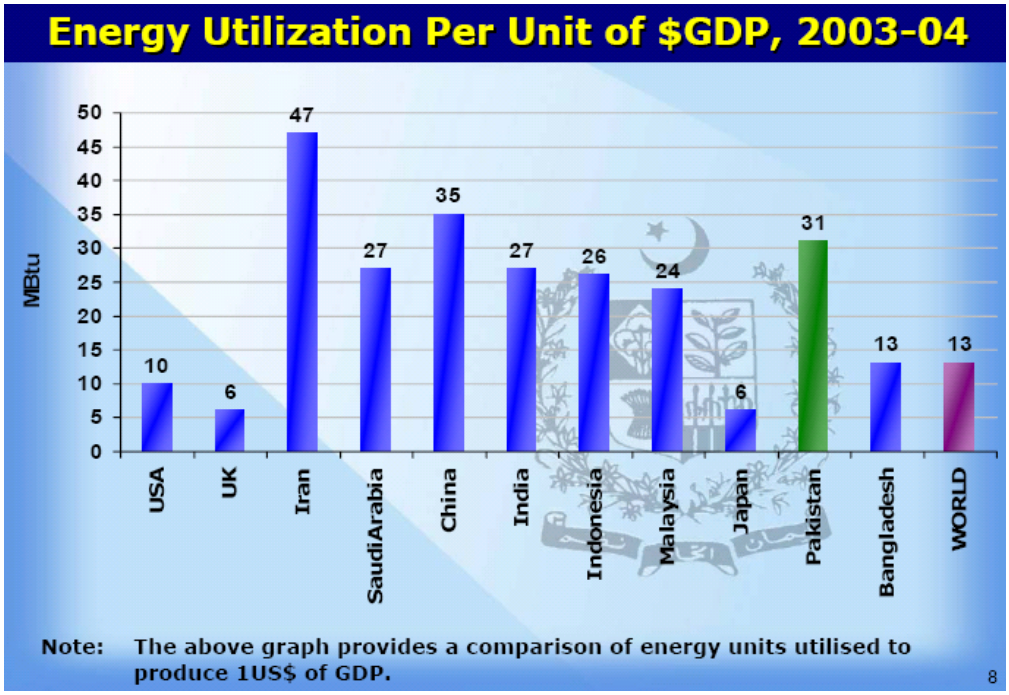
FIGURE 5: ESTIMATED INCREASES IN ENERGY SUPPLY NEEDED TO SUSTAIN DIFFERENT RATES OF ECONOMIC GROWTH IN PAKISTAN [GOP 2005].



AGR (%)	2005 (Base)	2010	2015	2020	2025	2030
4%	100	121.7	148.0	180.0	219.1	266.6
5%	100	127.6	162.9	207.9	265.3	338.6
6%	100	133.8	179.1	239.7	320.7	429.2
7%	100	140.3	196.7	275.9	387.0	542.7
8%	100	146.9	215.9	317.2	466.1	684.9
9%	100	153.9	236.7	364.3	560.4	862.3
10%	100	161.0	259.4	417.7	672.7	1083.5

39

FIGURE 6: THE ENERGY INTENSITY OF PAKISTAN'S ECONOMY RELATIVE TO OTHER COUNTRIES [GOP 2005].



The energy intensity of an economy is heavily influenced by the effective price of energy. Effective energy prices create incentives for consumers to conserve energy and for businesses to upgrade equipment and practices to create more products with less energy. In Pakistan, energy prices have been set to meet social goals instead of economic goals, with extensive cross-subsidies between industry and domestic consumers (see Table 12 and Table13).

The Government of Pakistan has heavily subsidized the energy sector, and plans to provide over $710 billion in FY 2007 to subsidize the electric power sector [Merrill Lynch 2007]. The government's subsidies, when combined with extensive technical and non-technical (i.e., theft) losses in the power sector due to underinvestment and poor fiscal discipline, lower the effective prices of electricity and reduce the incentives to improve the efficiency of providing goods and services to the economy.

TABLE 12: PAKISTAN'S NATURAL GAS PRICES COMPARED TO OTHER COUNTRIES

Natural Gas Prices in US$ Per MCF [GOP 2005].

Country	Domestic	Industrial
Iran	0.21	0.41
Saudi Arabia	0.75	0.75
Pakistan	**1.15**	**3.01**
Bangladesh	2.04	2.39
India Old System	2.58	2.58
Slovak Republic	2.95	2.74
India New Fields	4.00	–
Turkey	6.79	5.47
United Kingdom	7.31	3.50
United States	7.44	3.42
Canada	7.98	2.70
Australia	8.39	3.42
Germany	9.41	4.74
France	10.63	4.50
Italy	16.10	3.57
Japan	32.61	11.41

TABLE 13: PAKISTAN'S ELECTRICITY PRICES COMPARED TO OTHER COUNTRIES

Price of Electric Power Sold by Country (USD) [GOP 2005].

		Pakistan*	Korea	USA	Spain	Mexico	United Kingdom	Japan	Germany	France
1998	Industry	.088	.039	.045	.057	.038	.065	.128	.067	.047
	Households	.056	.069	.083	.155	.055	.121	.187	.159	.129
1999	Industry	.090	.046	.039	.049	.042	.064	.143	.057	.044
	Households	.061	.081	.082	.141	.059	.117	.213	.152	.121
2000	Industry	.082	.052	.046	.043	.051	.055	.143	.041	.036
	Households	.057	.084	.082	.117	.068	.107	.214	.121	.102
2001	Industry	.074	.048	.050	.041	.053	.051	.127	.044	.035
	Households	.053	.070	.085	.109	.075	.101	.188	.124	.098
2002	Industry	.073	.047	.048	.048	.056	.052	.115	.049	.037
	Households	.056	.070	.084	.114	.092	.105	.174	.136	.105
2003	Industry	.080	.051	.049	–	.062	.055	–	–	.045
	Households	.061	.074	.087	–	.091	.166	–	–	.127

Source: KEEI-Energy Statistical Database

*WAPDA Power System Statistics (28th Issue)

CURRENT ACTORS AND ACTIVITIES

PAKISTAN'S ENERGY INSTITUTIONS

The Energy Information Administration (EIA) [2006] and Merrill Lynch [2007] have done excellent summaries of Pakistan's energy institutions and these are presented in Table 14. Merrill Lynch [2007] has also prepared two excellent diagrams – one summarizes the interactions of organizations in the electric power sector while the other shows how the power and fuel organizations in Pakistan relate to each other. These diagrams are shown in Figure 7 and Figure 8, respectively.

TABLE 14: SUMMARY OF ORGANIZATIONS INVOLVED IN PAKISTAN'S ENERGY SECTOR.

Oil Sector – Upstream Policy and Regulation [EIA 2006]
Pakistan's Ministry of Petroleum and Natural Resources regulates the country's oil sector. The Ministry grants oil concessions by open tender and by private negotiation. To encourage oil sector investment, the Ministry has offered various tax and royalty payment incentives to oil companies. Pakistan's three largest national oil companies (NOCs), include the Oil and Gas Development Corporation Limited (OGDCL), Pakistan Petroleum Limited (PPL) and Pakistan State Oil (PSO). All three operate under joint ventures and partnerships with various international oil companies (IOCs) and other domestic firms. Major IOCs operating in Pakistan include BP (UK), Eni (Italy), OMV (Australia), Orient Petroleum Inc (OPI, Canada), Petronas (Malaysia), and Tullow (Ireland).
Oil Sector – Downstream [EIA 2006]
Pakistan has five refineries, with total refining capacity of just under 270,000 bbl/d. The largest of the refineries is the Pak-Arab refinery Complex (PARCO), which became operational in late 2000, with 95,000 bbl/d of refining capacity. In July 2004, Bosicor Pakistan Limited (BPL) began commercial operations at its Mouza Kund plant, near Karachi. The 30,000-bbl/d refinery is supplied with shipments of crude oil from Qatar. The plant allowed Pakistan to become a supplier of naphtha, which constitutes 20 percent of the output. The plant produces about 10,000 bbl/d of fuel oil, 6,000 bbl/d of diesel, and 5,500 bbl/d of naphtha, among other products. PSO has a supply contract to purchase the entire output of BPL's products for the next 10 years. In June 2006, Kuwait agreed to fund a $1.2 billion oil refinery, which would have a planned capacity of 100,000 bbl/d. The refinery would be located at Port Qasim in Karachi. The Oil & Gas Regulatory Authority (OGRA) regulates petroleum product distribution, including compressed natural gas for vehicles, setting safety standards and equalizing prices across the country. The Pakistan State Oil company has some 3,800 retail outlets across the country, as do many major international oil companies (IOCs), such as Shell.

Natural Gas Sector [EIA 2006]

Pakistan's state-owned PPL and OGDCL produce around 30% and 25%, respectively, of the country's natural gas. The two companies are the country's largest natural gas producers. OMV is the largest foreign natural gas producer (17% of total country's production) in Pakistan. Additional foreign operators include BP, Eni, and BHP Billiton. The Pakistani government has enacted numerous policies to encourage private sector leadership of natural gas development, including privatization of state-run businesses, regulation that encourages competition and tax incentives geared towards increasing exploration and production.

Electric Power Sector [Merrill Lynch 2007]

Pakistan's power sector is dominated by two vertically integrated giants – the state-owned WAPDA (Water and Power Development Authority) and KESC (Karachi Electric Supply Corporation). Until the recent privatization of KESC, electricity transmission and distribution has been the sole preserve of the state as these two entities control national electricity distribution and generate almost 70% of the country's power.

KESC supplies electricity to the city of Karachi and WAPDA, to the rest of the country. Both operate independently of each other, except for a 220KV double circuit link and two 132KV links. While transmission and distribution falls solely to these two entities, the third and increasingly relevant source of power is the IPPs. The IPPs have a joint capacity of 5.83GW and produce 30% of Pakistan's electricity which is sold to and distributed by WAPDA.

As Pakistan's largest power producer, WAPDA controls 58% or 11.3GW of the nation's total installed capacity of 19.4GW. Split into the water and power wings, WAPDA has a monopoly over hydro generation and controls about 38% of thermal power generated in Pakistan. As the sole purchaser of power from the IPPs, WAPDA's stability has been the main factor deciding the cash flows of IPPs.

WAPDA's responsibility covers the development and use of water resources for both hydropower generation and irrigation-related activities. To introduce a competitive environment and attract private-sector participation, its operations were restructured via vertical disintegration in 2000. WAPDA continues to control the Water Wing but the Power Wing now functions as a detached, integrated electric power utility. Under the WAPDA Act, WAPDA was unbundled into 12 separate units:

1. Eight distribution companies (DISCOS), formed from existing area electricity boards.
2. Three thermal generation (GENCO) companies, formed from WAPDA's 11 thermal generation plants.
3. The National transmission and Dispatch Company (NTDC), formed from the National Grid Company which will operate the transmission system and control dispatch.

The medium to long-term objective is to privatize the public power producing and distributing companies. However, the envisaged privatization of these independent generating and distributing companies is proving difficult, because they often operate at a loss due to unpaid bills and sub-marginal electricity tariffs. For the time being, hydropower will continue to be excluded from the privatization process and will therefore remain in WAPDA's possession.

The National electric Power regulatory Authority (NERPA) was created under the NERPA Act in 1997. NERPA's main purpose is to ensure fair competition and consumer protection. Its primary responsibilities include the issue of licenses for power production, transmission and distribution (including the stipulation of licensing fees), specification of electricity tariffs, both with regard to remuneration of producers (NTDC purchase price) and consumer pricing. In addition, NERPA is responsible for approving the tariffs negotiated in connection with bilateral agreements between individual power producers and the NTDC, distribution companies and major customers. It also defines the licensing requirements and can impose fines for non-compliance with the relevant regulations.

Private Power and Infrastructure Board (PPIB) [Merrill Lynch 2007]

The PPIB, a state-owned consulting institution, was formed in 1994 with a view to improving investment incentives in the Pakistani power sector. The board is intended to serve as a one-stop facility to investors in Pakistan's private power sector. It acts on behalf of the government, providing advice and guidance for the implementation of power plant projects.

Its main task is to negotiate the implementation agreement and provide support in negotiating fuel supply agreements and power purchase agreements. The PPIB also provides guarantees to private investors for the performance of government entities (such as WAPDA), monitors litigation and international arbitration for and on behalf of the government and assists the regulatory authority in determining and approving tariffs for new private power projects.

FIGURE 7: INTERACTIONS BETWEEN THE ORGANIZATIONS WITHIN PAKISTAN'S ELECTRIC POWER INDUSTRY [MERRILL LYNCH 2007].

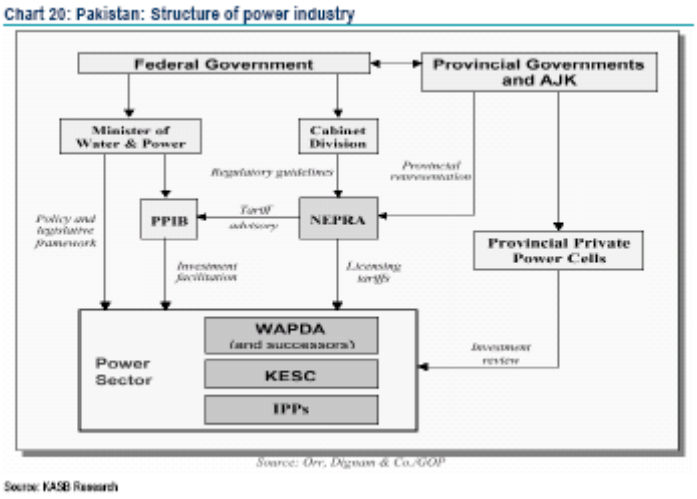
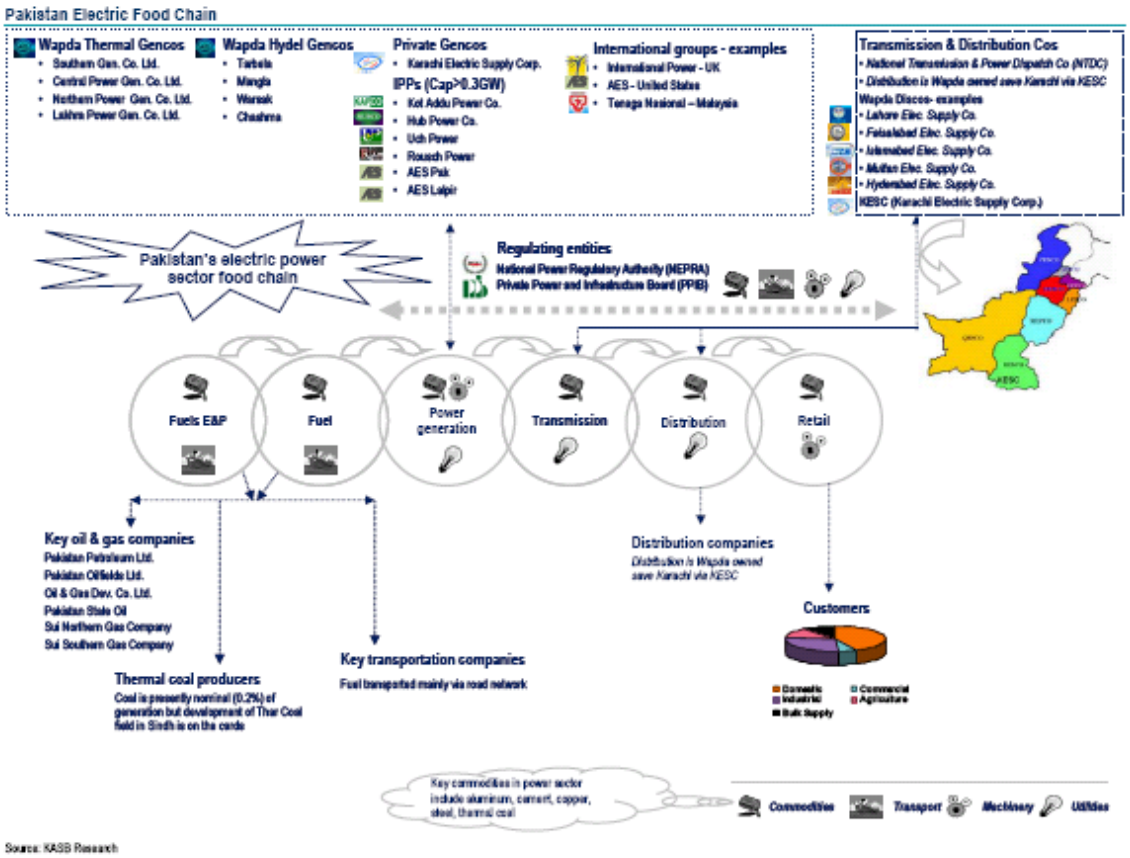


FIGURE 8: INTERACTIONS OF PAKISTAN ELECTRICITY AND FUEL COMPANIES WITH CONSUMERS [MERRILL LYNCH 2007].



When WAPDA was unbundled, eight different distribution companies were formed to distribute power directly to residential, commercial, industrial, and agricultural consumers. These distribution companies and the areas they serve are summarized in Table 15.

TABLE 15: DISTRIBUTION COMPANY SERVICE AREAS

Ex-WAPDA Distribution Companies' Service Areas [NEPRA 2006B].

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 (though PESCO stats often include FATA/PATA areas, which are now to be served by a Tribal Areas Electric Supply Company (TESCO))
Hyderabad Electric Supply Company (HESCO)	Whole province of Sindh, except Karachi and part of Thatta district where Karachi Electric Supply Company (KESC) is responsible for distribution of power
Quetta Electric Supply Company (QESCO)	Whole province of Balochistan, except Lasbela where Karachi Electric Supply Company (KESC) is responsible for distribution of power

Two other Pakistan energy institutions of note are the Alternative Energy development Board (AEDB) and the SAARC Energy Center. Realizing the significant potential for renewable energy sources to provide cleaner power and fuels for economic growth, the Government of Pakistan created the AEDB in May 2003 to act as the central national body on the subject of renewable energy. The main objective of the AEDB is to facilitate, promote, and encourage development of renewable energy in Pakistan. The AEDB has also been charged with providing electricity services to the 7,874 villages in the Sindh and Balochistan provinces that lie too far from the national electricity grid to be economically served [NEPRA 2006b].

In October 2005 at the 13th Summit, the South Asian Association for Regional Cooperation (SAARC) endorsed the creation of a SAARC Energy Center to be located in Islamabad, Pakistan. The goals of the Center are to strengthen South Asia's capacity to collectively address regional and global energy issues, to facilitate energy trade within the SAARC region, and to enhance more efficient use of energy within the region [SAARC Energy Center 2007].

USG AGENCIES, MULTILATERAL AND BILATERAL DONORS ACTIVE IN THE ENERGY SECTOR

USAID/Pakistan had a very large energy assistance program in the 1980s and early 1990s. Among some of the program's most notable activities were:

1. Partnering with the USGS to assess the coal resource base in the Thar Basin;
2. Partnering with the World Bank and others to establish the Private Sector Energy Development Fund, which bought down the risk of private sector firms building power generation plants in Pakistan;
3. Working with the Government of Pakistan and other donors on the 1994 Energy Policy that permitted private sector investors, in the form of Independent Power Producers, to build and operate electricity generation facilities in Pakistan;
4. Establishing technical training centers to provide power engineers to build, operate, and maintain the nation's electric power system run by the Water and Power Development Authority; and
5. Creating ENERCON, a national energy conservation body.

Since Pakistan joined the South Asia Initiative in Energy (SARI/E), this regional USAID program housed in New Delhi has provided technical assistance on Pakistan's LNG import policy, provided small grants for solar lamps and solar-powered pumps in Balochistan, support for establishing the SAARC Energy Center in Islamabad, and the preparation of a wind and solar atlas for Pakistan. In 2007, while USAID/Pakistan re-considers its role in Pakistan's energy sector, the following USG agencies and multilateral and bilateral institutions are actively engaged in the sector:

Secretary Rice, during her visit to Central Asia in October 2005, defined a new "Energy Corridor" Initiative to facilitate inter-regional cooperation and integration of energy infrastructure between Central and South Asia, with Afghanistan as the geographic "bridge" country (see Figure 9). This initiative recognizes the historical changes that have taken place since 2001, as well as the energy resources and emerging needs of the two regions. The **Department of State** is taking the lead within the USG on coordinating activities with the World Bank and the Asian Development Bank to explore exporting 1,000 MW of electricity from Tajikistan to Pakistan as one of the first concrete projects. As part of the economic partnership between the US and Pakistan announced during President Bush's visit to the country in March 2006, the **US Department of Energy** has initiated a bilateral dialogue on energy. Working groups dealing with fossil fuels, renewables, and energy efficiency have been formed. The **Overseas Private Investment Corporation** (OPIC) and the **US Trade & Development Agency** (TDA) have also been active recently in Pakistan in the energy sector.

The **World Bank** (WB) has historically been involved in all segments of Pakistan's power sector, financing specific investment projects as well as supporting the reform program. In 2005, at the request of the Government of Pakistan, the WB began preparing a $200 million loan for an Electricity Distribution and Transmission Improvement Project. The Project will consist of three main components: (a) strengthening electricity distribution networks to reduce losses and improve supply at four of the distribution companies ($130 million); (b) strengthening the electricity transmission network to reduce bottlenecks and improve system reliability and quality ($55 million); and (c) technical assistance for project implementation, capacity building, investment planning and financing, and sector reform ($15 million) [World Bank 2006].

The **Asian Development Bank** (ADB) is currently the major investor in Pakistan's electricity sector, with a $3.5 billion pipeline of loans and three major new investment loans. The first project is the Power Transmission Enhancement Investment Program, which will loan up to a maximum of $800 million for transmission line enhancement through development of new power transmission infrastructure and rehabilitation of existing power transmission infrastructure. The output will be the increased number of customers hooked up to the national grid, reduction in technical and non-technical losses, and improved financial viability of the new power sector entities [Asian Development Bank 2006a]. A map of the potential transmission line investments is shown in Figure 10.

The second ADB project is the Renewable Energy Development Sector Investment Program, which will loan up to $510 million to support the development of renewable energy resources in Pakistan. The program combines investments in new generating capacity across four provinces with nonphysical interventions in policy reform, capacity development, fiduciary oversight and governance, regulatory and legal frameworks, and knowledge management. The program will start with run-of-the-river small hydro plants in Punjab and NWFP. After project preparation, policy reform, and institutional changes in Balochistan and Sindh, investments in wind, solar, and biomass projects will be made [Asian Development Bank 2006b]. A map of the potential renewable energy investments is shown in Figure 11.

The third ADB project is the Private Participation in Infrastructure Program which seeks to increase private sector investment in infrastructure such as power, transport, and water, and thereby promote economic growth and reduce poverty. The program will loan up to a maximum of $600 million [Asian Development Bank 2006c].

The **Government of Japan**, operating through JBIC, is considering financing the modernization of the national power dispatch center is concert with the ADB's transmission loan. Japan has also expressed interest in rural electrification [World Bank 2006].

Germany, operating through KfW, has financed some projects to strengthen the transmission system and has been looking into small and medium hydropower plants. Through GTZ, Germany has been supporting capacity building at the Alternative Energy Development Board and has been active in promoting small to medium hydropower development through compiling and carrying out analytical studies [ADB 2006 b].

The **UN Development Programme** (UNDP) has also been supporting the strengthening of the Alternative Energy Development Board and has just completed a barrier-removal project for the development of wind power. It supports the development of renewable energy technologies and energy efficient housing through new projects for disseminating success stories in the fields of energy conservation and renewable technology, training of women in the use of home appliances, and promotion of LPG in the Northern Areas and in Azad Jammu and Kashmir [Asian Development Bank 2006b].

The **Canadian International Development Agency** (CIDA) provided support to WAPDA to rehabilitate the Warsak Hydroelectric Power Station. CIDA also provided assistance to strengthen capacity at the Ministry of Petroleum & Natural Resources and for the development of sound policies and regulatory frameworks to encourage private sector investment, as well as to enforce effective environmental protection and sound management and conservation of hydrocarbon resources [Asian Development Bank 2006b].

The **Dutch**, in the form of the NGO SNV, have been looking into supporting the deployment of biogas systems in rural areas to utilize livestock waste. SNV recently completed a study with Winrock International and the UNDP [Winrock 2007].

FIGURE 9: MAP OF "ENERGY CORRIDOR" FROM CENTRAL ASIA TO SOUTH ASIA

FIGURE 10: TRANSMISSION IMPROVEMENT INVESTMENT PROGRAM MAP [ADB 2006A].

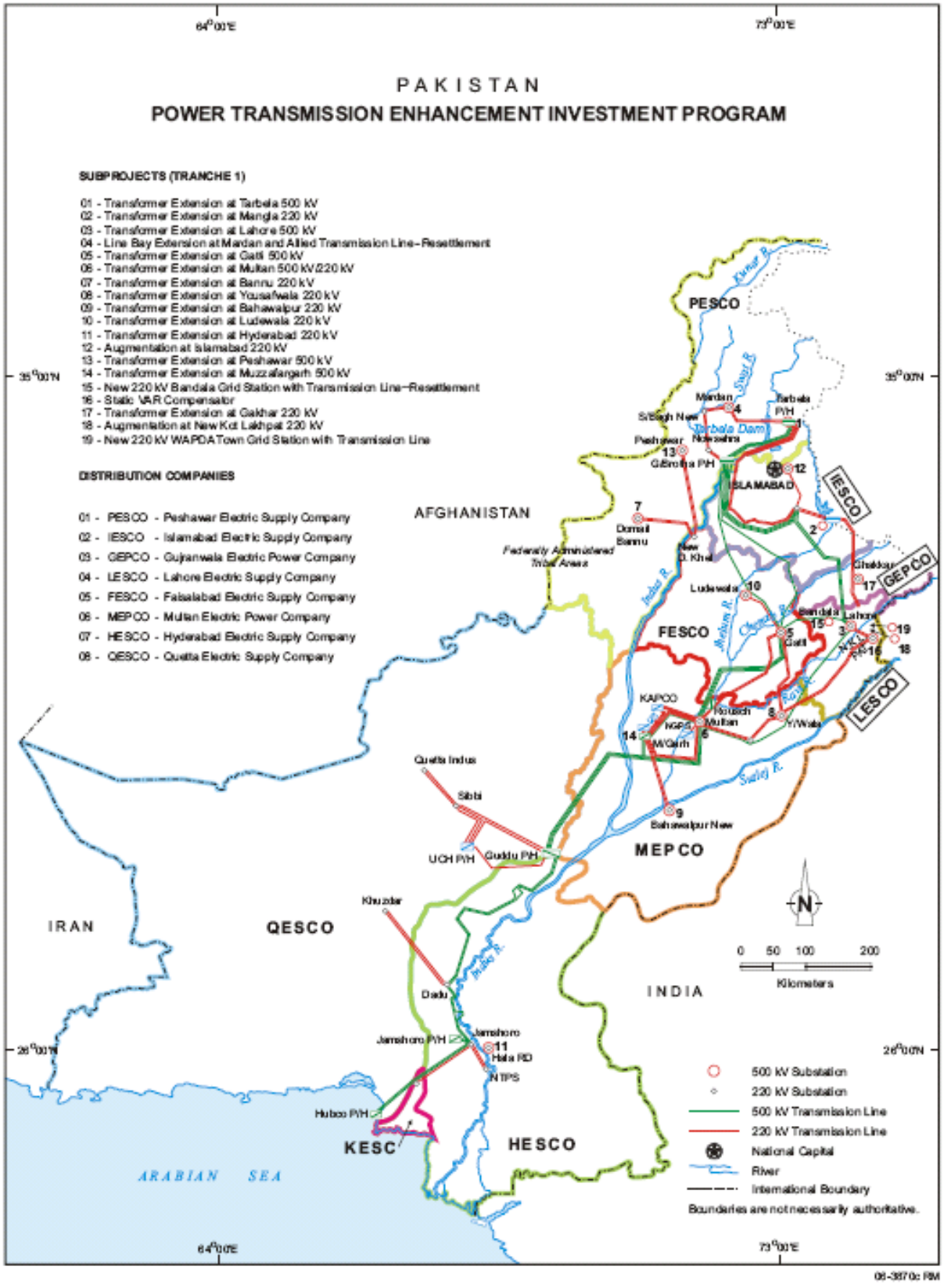
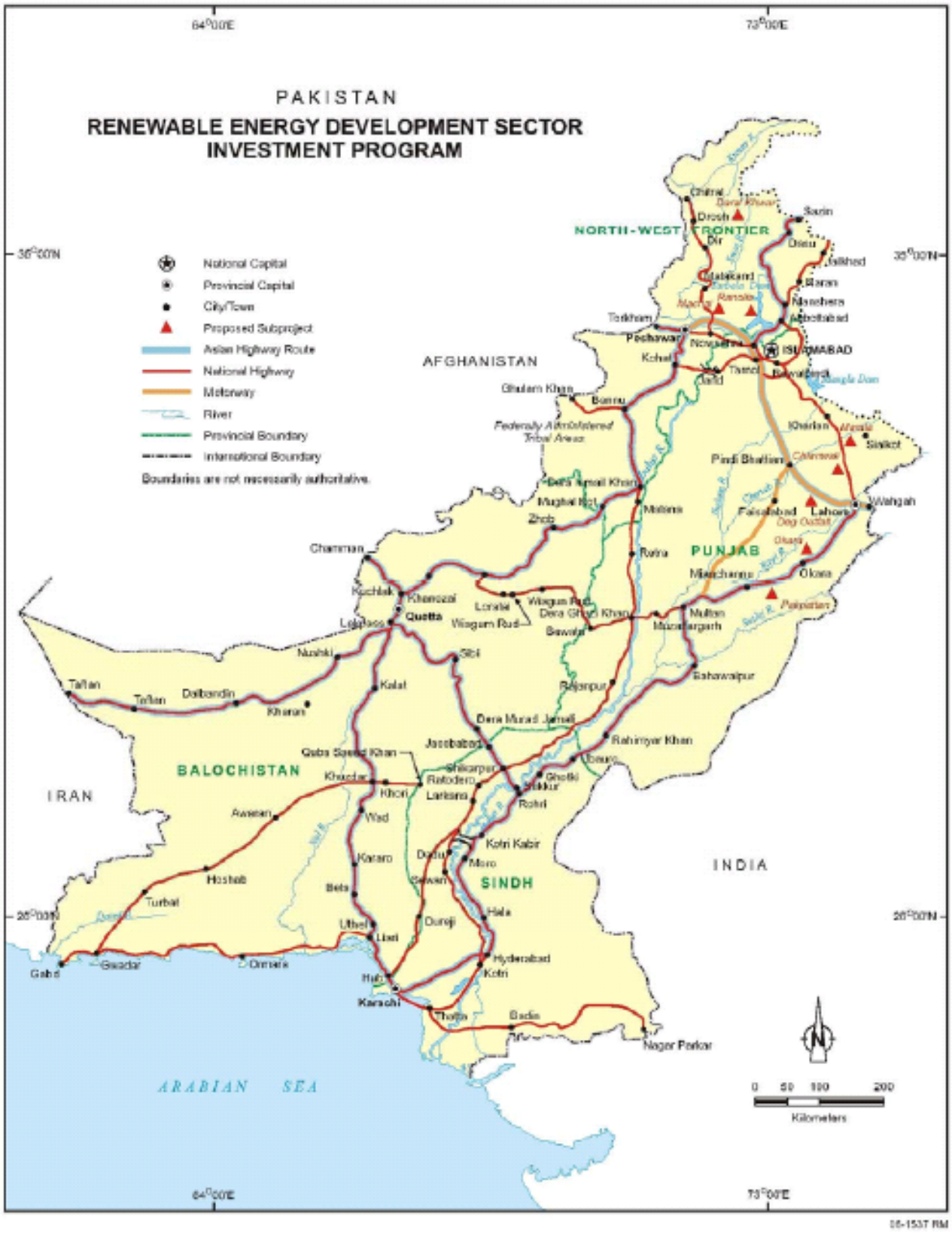


FIGURE 11: ADB RENEWABLE ENERGY INVESTMENT PROGRAM MAP [ADB 2006B].



KEY ENERGY ISSUES TO ADDRESS & ASSISTANCE NEEDS

In reviewing the results of the many conversations and data sources (see Annex for list of discussions and sources), maintaining and expanding energy services within Pakistan is crucial to the economic growth of the country. The two critical needs that have been identified are: (1) providing more energy supplies through expansion AND conservation; and (2) increasing access to modern energy services to un-served regions and population groups. The two major challenges that must be overcome to satisfy these needs are: (a) aligning economic incentives through policies, regulations, subsidies, tariffs, prices, collections, and taxes to improve fiscal discipline and transparency, attract investment, and encourage energy conservation and efficiency improvements; and (b) creating sufficient capacity to empower stakeholders such as the Government of Pakistan, the private sector, NGOs, and energy consumers to both implement and respond to the incentives framework.

FIRST NEED: INCREASED ENERGY SUPPLIES

It is widely accepted by all parties that Pakistan is entering a period where energy demand is exceeding readily available supply. Electricity supplies are already falling behind demand during peak periods which is leading to rolling blackouts. Domestic oil supplies do not satisfy the demand, so imports are rising. Domestic gas supplies, which are being drawn down faster than they are being replenished, are already in short supply during the winter. As a consequence of these developments, the Government of Pakistan drafted an Energy Security Strategy in 2005 [GOP 2005] and is striving to implement it. However, in conversations with the government, the effectiveness of the planning process and the soundness of the analytical underpinnings of the strategy are unclear.

Key activities being undertaken by the government to increase electricity supplies using both public and private investment include:

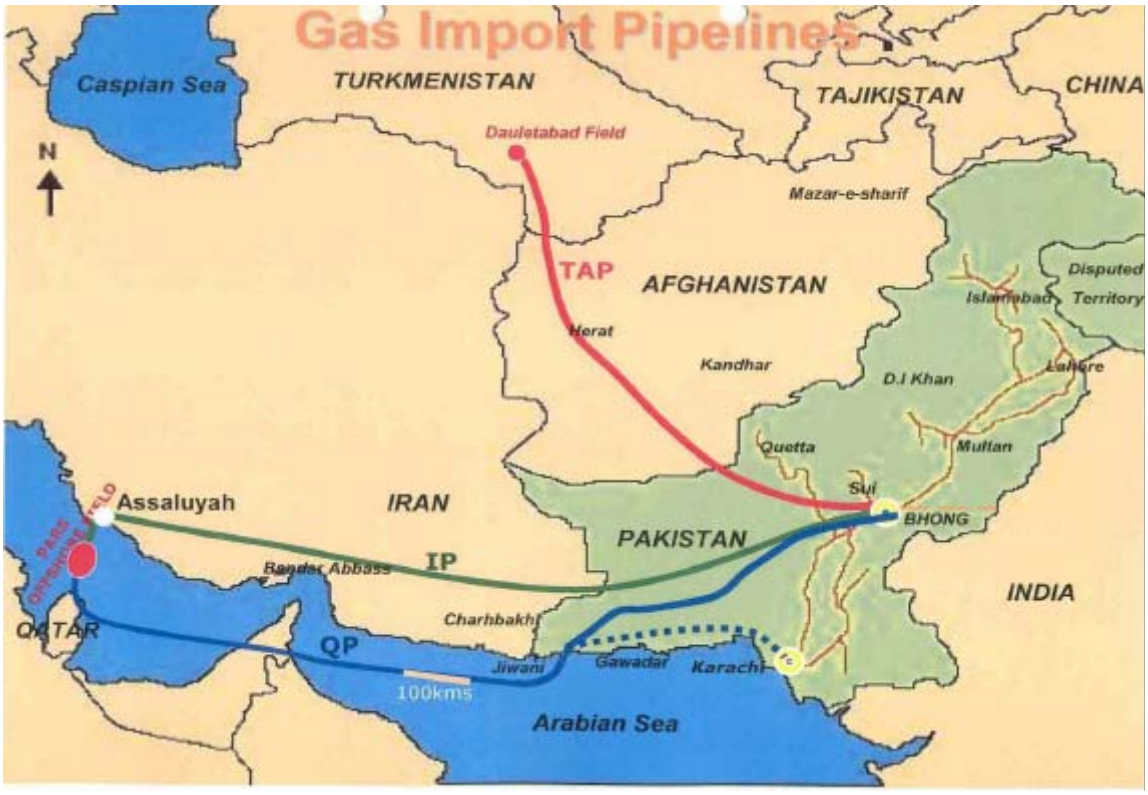
- Encouraging the construction of conventional hydroelectric, oil-fired, nuclear, and coal-fired facilities to generate additional electricity;
- Encouraging the development of the country's small hydro, wind, solar, and biomass resources through a recently-adopted Renewable Energy Development Policy, which hopes to build upon the US-prepared wind and solar maps that will be released in June 2007;
- Encouraging the exploration and development of domestic oil & gas resources through a new draft Petroleum Development Policy, and through an updated scientific assessment of the discovered and undiscovered resource potential of the country;
- Exploring the potential for developing the country's coal resources and exploiting them for power generation and petrochemical use; and
- Diversifying imported gas supplies through possible pipelines to bring gas from Turkmenistan, Qatar, or Iran to Pakistan (see Figure 12), as well as encouraging imports of Liquefied Natural Gas (LNG) through its newly-adopted LNG Import Policy; and
- Expanding imports of electricity from Iran and participating in the WB/ADB study of bringing 1,000 MW of electricity from Tajikistan to Pakistan.

However, even with all of these efforts, Pakistan's economy will probably suffer from inadequate energy supplies at least through 2010 given the long lead time for constructing the necessary facilities [ADB 2006a]. Given this reality, the Government of Pakistan has recognized the need to focus on reducing peak demand through load management at the distribution company level,

encouraging energy conservation through workshops such as the April 2 one held by NEPRA and MWP in Islamabad and improving energy efficiency in the long-term. Since everyone's focus for decades has been on increasing supplies, there are no estimates on how much energy might be saved through conservation, but given the high energy intensity of Pakistan's economy, the potential must be large.

One area where the government is taking action is on obtaining loans to rehabilitate the transmission and distribution networks to reduce technical losses and improve the efficiency of operations, all of which will save energy. Hopefully these efforts will be combined with strong measures to reduce non-technical losses (i.e., theft) which will also contribute to improved efficiency. WAPDA's total system losses were 25% in 2005; while KESC's total losses in 2005 were 34% [NEPRA 2006b]. Well-maintained and operated systems generally have overall losses of 8-9%.

FIGURE 12: NATURAL GAS IMPORT PIPELINES UNDER CONSIDERATION BY PAKISTAN [GOP 2005].



SECOND NEED: EXPANDED ACCESS TO MODERN ENERGY SERVICES

As mentioned previously, only 53% of Pakistan's population has access to electricity (see Table 9), and on the order of one-third of the country's energy needs are met by non-commercial sources of energy [WEC 2000; ESMAP 2006]. To expand access to energy services, the Government of Pakistan has launched the following programs:

- Rural electrification of villages close to the grid is being carried out by WAPDA and its successor distribution companies.

- Bringing energy services to the 7,874 villages too far from the grid has been assigned to the Alternative Energy Development Board (AEDB), which is harnessing renewable energy to introduce these services.

Both of these programs are proceeding apace, but it will still be years before every person in Pakistan has access to modern energy services given the rugged terrain, the shortages of electricity, and limited government financial resources.

FIRST CHALLENGE: ALIGNING THE ECONOMIC INCENTIVES IN THE ENERGY SECTOR

Pakistan has a proven track record of encouraging private sector participation and investment in both developing its oil & gas resources and building, owning, and operating power generation facilities to supply energy to the economy. To encourage this investment, the government has issued a number of energy development incentive policies. Examples include the Private Power Development Policy, the Petroleum Development Policy, the LNG Import Policy, and the Renewable Energy Development Policy. These policies provided a variety of guarantees, risk insurance, and tax breaks to private sector investors. What is unclear is if the government's energy planning process has been comprehensive enough to encompass all of the energy subsectors (oil, gas, power renewables, etc.) and of sufficient analytical rigor to focus the policy and incentive process on the desired goals to be achieved.

On the consumption side, the government has controlled prices and provided appropriate subsidies to keep energy affordable to the population and to encourage the use of cleaner domestic fuels (e.g., using compressed natural gas for vehicles). While the social intentions of the government are good, the resulting patchwork of price and tariff controls and cross-subsidies, tax breaks and tax burdens, and untargeted subsidies have resulted in a lack of transparency in the energy sector, an erosion of fiscal discipline in the sector, an increased financial burden on the government, and the encouragement of behavior that wastes instead of conserves energy. These problems are aggravated by the 'cycle of debt' between state enterprises, where debts are swapped back and forth instead of actual funds to cover energy sales.

To take one example, industrial customers pay higher electricity tariffs to subsidize lower tariffs for residential users. Since industrial customers are larger and more concentrated, it is easier for distribution companies to collect funds from them while avoiding the social backlash that would come from pressing distributed residential customers to pay their bills. Since the government keeps tariffs below the cost of service to begin with, and provides subsidies to cover the operating losses of the distribution companies, a situation has developed where the distribution companies have weak incentives to increase collections and reduce non-technical losses, thereby increasing their self-financing capabilities and reducing government subsidies.

These high tariffs, when combined with unreliable power supplies (e.g., blackouts plus poor frequency control), encourage industries to install their own power supplies such as diesel generators. The high operating costs of these generators raises the cost of the industry's products, which erodes their competitiveness within the region. A reported 42% of manufacturing businesses in Pakistan use costly captive power units, compared with 16% in the People's Republic of China. Regional benchmarking studies show that enterprises in Karachi lose more than 6% of their sales revenues because of power outages, while the equivalent figure for enterprises in Guangzhou and Shanghai is less than 2% [ADB 2006c]. In Sialkot,

some industries have avoided purchasing advanced manufacturing equipment because of the poor power quality, which damages the equipment, thus losing the opportunity to increase production and employment and improve energy efficiency and competitiveness.

In Balochistan, electricity tariffs for agricultural consumers using electric pumpsets to bring up ground water for irrigation are set very low to assist farmers to remain in business. Unfortunately, the unintended consequence of this policy is that the pumps are used excessively, wasting both electricity and precious water supplies in an arid region.

SECOND CHALLENGE: CAPACITY BUILDING TO EMPOWER STAKEHOLDERS

As in most countries, the Government of Pakistan at the national and provincial level has taken the lead in the energy sector. However, in discussions with the people of Pakistan both inside and outside of the government, there is a broad recognition that the government institutions lack technical and managerial capacity to carry out policies and programs in the most effective manner. Some specific capacity weaknesses that have been raised are:

- The ability to perform system-wide planning in the electricity and energy sector as a whole, both in terms of technical analysis and ability to develop and implement plans of action.
- The ability to analyze project proposals to determine if the tariffs, costs, and contracts being proposed are reasonable, particularly for hydroelectric, coal, and wind projects where the country has less experience.
- The ability to manage the electric generation, transmission, and distribution companies created by the unbundling of WAPDA as commercial enterprises, with a focus on improving customer service and reducing losses.
- The ability to expand access to un-served and under-served population groups in the most financially-sound and consumer-driven manner. For example, illegal connections in Karachi need to be rationalized to improve service and safety, and to reduce technical and non-technical losses, but the community outreach and negotiation ability appears to be lacking within the utility. Similarly, electrifying villages with renewable energy presents unique opportunities and challenges for community organizations to maintain and own the systems while fostering private sector development opportunities.
- The ability to compile and financially analyze the various economic incentive programs and to develop a more targeted approach that will satisfy both the social and economic goals of the government.
- The ability to assess the existing resource base of the oil & gas resources of the country to internationally accepted standards.
- The ability to assess the coal resources to determine if their development is economically and technically justified and feasible.
- The ability to identify the most pragmatic energy conservation and load management options, and to encourage their widespread adoption, as well as to develop policies and incentives to encourage improved energy efficiency over the mid- to long-term.

While many participants in the discussion focused only on the capacity of government institutions, the capabilities of the private sector, local governments, and NGOs were also seen as in need of improvement. Some of the observations made were:

- The private sector lacks knowledge on how to improve its energy efficiency and reduce energy costs. While the furniture industry has been exploring solar kilns as a way to save energy and cut costs, they are probably an exception rather than the rule.
- The private sector lacks the skills analyze what is the most efficient captive power system to purchase and operate, as well as lacking the knowledge to explore options under existing government policies to sell captive power back to the utility (i.e., net metering) or to invest in power generation facilities such as small hydro or wind facilities that could produce power that the local utility would transmit to the industrial user (i.e., power wheeling plus generator to consumer contracting).
- Local governments lack the capacity to monitor the energy use of community facilities, and to identify opportunities to conserve energy.
- Communities and NGOs lack knowledge about renewable energy systems and suppliers, and how they might partner with governments, donors, and the private sector to bring energy services to remote populations in a cost-effective and sustainable fashion (e.g., using livestock wastes to produce biogas, using crop seeds or wastes to produce biofuels).
- Consumers of energy products and services, along with journalists and community leaders, do not understand that the costs of these services must be covered by either the consumer or the customer – there is no ‘free lunch’.
- Consumers and the general public are also not fully aware of the opportunities to make known their points of view on government policies and on energy company performance to regulators and government representatives.

When this list is examined, it becomes apparent that ALL of the stakeholders in the energy sector need to be empowered through capacity building programs so that as many players as possible can be contributing to meeting the energy needs of Pakistan through the wisest possible means.

ANNEXES:

LIST OF DISCUSSIONS

Date:	Representative and Organization:
March 25:	Mr. Jonathan Addleton, USAID/Pakistan Mission Director
March 26:	Mr. Syed Yawar Ali, Chairman, Lahore Electric Supply Company Mr. Tariq Hameed, Chairman, Pakistan Water & Power Development Authority (WAPDA) Mr. Muhammad Saleem Arif, General Manager, National Transmission & Dispatch Co. Mr. Faisal Farooq, Chairman, Pakistan Dairy Development Company Mr. Asif Khan, HRH Heritage Mr. Shahzad Mughal, Director, Office Interior Solutions Mr. Abuzar Bokhari, CEO, RPlus Mr. Nasir Akram Sheikh, Director, United Wire Industries Limited. Mr. Bryan Hunt, Principal Officer, US Consulate Lahore Dr. Amanda Pilz, Political & Economic Counselor, US Consulate Lahore Ms. Kathleen Egan, Public Affairs Officer, US Consulate Lahore MR. Syed Aftab Qamar, Commercial Specialist, US Consulate Lahore Hassan Raza, Commercial Assistant, US Consulate Lahore Mr. Eugene Miller, Deputy COP, PISDAC
March 27:	Mr. Safdar Ibrahim, Chief Operating Officer, Karachi Electric Supply Corporation Mr. Mohammed Ashgar, Chief Financial Officer, Karachi Electric Supply Corporation Ms. Perveen Shaikh, President, Entrepreneurship Career Development Institute Mr. Javed Mahmood, Chief Executive, Hub Power Company Limited (HUBCO) Mr. Irfan Ullah Marwat, Minister of Mines, Sindh Province Mr. Aslam Mohsin Ali, Secretary General, American Business Council of Pakistan Mr. Wasif Islam Raza, Vice President, Corporate Banking Group, CITIBANK Ms. Mary Witt, Consul General, US Consulate Karachi Mr. Matthew Bunt, Vice Consul, US Consulate Karachi

Date:	Representative and Organization:
	Mr. Syed Hameeduddin, Economic Specialist, US Consulate Karachi
March 28:	Mr. Rizwan Ullah Beg, District Coordination Officer, Sialkot Sh. Adbul Waheed Sandal, President, Sialkot Chamber of Commerce & Industry Ch. Raza Munir, Vice President, Sialkot Chamber of Commerce & Industry Mr. Mian Anwar, Liberman International Mr. Shafiq-ur-Rehman, Export Executive, New Mark Group of Companies Mr. Mansoor Wahid, Managing Director, Medical Devices Ltd.
March 29:	Mr. Mukhtar Ahmad, Advisor to the Prime Minister on Energy Mr. Munir Ahmed, Chairman, Oil & Gas Regulatory Authority (OGRA) Lt. Gen. Saeed uz Zafar, Chairman, National Electric Power Regulatory Authority (NEPRA) Mr. Bikash Pandey, Country Representative - Pakistan, Winrock International Mr. Khalid Rehman, Chairman, Private Power & Infrastructure Board (PPIB) Mr. Sami Rafi Siddiqui, Director, PPIB Mr. Ashfaq Mahmood, Secretary, Ministry of Water & Power Mr. Mohammed Yousuf Mumon, Additional Secretary, Ministry of Water & Power
March 30:	Air Marshall Shahid Hamid, Chairman, Alternative Energy Development Board (AEDB) Brig. Dr. Nasim Khan, Secretary/Member Technical, AEDB Mr. Mujahid Sadiq, DG International Cooperation, AEDB Mr. Rashid Aziz, Senior Energy Specialist, The World Bank Mr. Asad Aleem, Programs Officer, Asian Development Bank
March 31:	Mr. Waqar Ahmad, Secretary, Ministry of Petroleum & Natural Resources Mr. Hilal Raza, Director General, Hydrocarbon Development Institute
April 2:	Dr. Akram Shiekh, Minister of State and Deputy Chairman, Planning Commission of Pakistan Dr. Asad Ali Shah, Member (Infrastructure & Energy), Planning Commission of Pakistan Energy Discussion with USAID/Pakistan Economic Growth Chiefs of Party

LIST OF SOURCES

Asian Development Bank (2002). Country Strategy and Program 2002-2006.

Asian Development Bank (2005). Country Strategy and Program 2006-2008.

Asian Development Bank (2006a). Pakistan: Power Transmission Enhancement Investment Program.

Asian Development Bank (2006b). Pakistan: Renewable Energy Development Sector Investment Program.

Asian Development Bank (2006c). Pakistan: Private Participation in Infrastructure Program.

Barnett, Thomas (2003). 'The Pentagon's New Map'. Esquire magazine article (March 2003).

Barnett, Thomas (2004). The Pentagon's New Map [the book].

ECDI (2007). Bottom of the Pyramid Project – End of Project Report [on Solar Lamps] (March 2006 – February 2007).

Energy Information Administration (2006). Pakistan: Country Analysis Brief and Renewable Energy Profile.

Ernst & Young (2007). Emerging Investment Opportunities in the South Asian Power Sector.

ESMAP (2001). Pakistan: Clean Fuels.

ESMAP (2006). Pakistan: Household Use of Commercial Energy.

Government of Pakistan (2005). Energy Security Plan (power point presentation).

Government of Pakistan (2006). Policy for Development of Renewable Energy for Power Generation.

Hydrocarbon Development Institute (2006). Pakistan Energy Yearbook 2006.

Merrill Lynch (2007). Pakistan Independent Power Producers – Industry Overview (for investors).

National Electric Power Regulatory Authority (2005). State of Industry Report 2005.

National Electric Power Regulatory Authority (2006a). Annual Report 2005-2006.

National Electric Power Regulatory Authority (2006b). State of Industry Report 2006.

Private Power & Infrastructure Board (2002+). PPIB Profile.

Private Power & Infrastructure Board (2004). Pakistan Coal Power Generation Potential.

Private Power & Infrastructure Board (2006). Additional Seven Raw Site Hydel Power Projects' Profile.

SAARC Energy Center (2007). SAARC Energy Newsletter, Vol. 1, Issue 1.

Stoft, Steven (2002). Power System Economics: Designing Markets for Electricity.

UNDESA (2006). Multi-Dimensional Issues in International Electric Power Grid Connections.

UNDP (2004). Pakistan: Sustainable Development of Utility-Scale Wind Power Production.

USAID (2005). Energy and Gender.

USAID (2006a). The Role of Energy in Development.

USAID (2006b). Powering Health Guidebook.

Winrock Intl., UNDP, SNV (2007). Feasibility study of Domestic Biogas in Pakistan (draft report).

World Bank (2005). Lessons from the Independent Private Power Experience in Pakistan – World Bank Working Paper.

World Bank (2006). Pakistan: Electricity Distribution and Transmission Improvement Project. Project Information Document.

World Energy Council (2000). Renewable Energy in South Asia (Pakistan section).