Reforming the Energy Sector of Pakistan: The Case of Punjab

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Reforming the Energy Sector of Pakistan: The Case of Punjab

Energy Market, Institutional Framework and Governance Issues

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Foreword

The demand and consumption of energy is on the rise in Pakistan and has reached a stage where the gap between demand and supply is widening and becoming unbridgeable. However, it has still not resulted in sufficiently shaking up the political leadership and policymakers to plan and strategize for an integrated energy policy; a policy that recognizes the scale of the deepening crisis; and adopts a holistic, long term view in earnest and urgency.

Energy is critical for political stability, economic growth and sustainable development of Pakistan. For the past two years the Centre for Public Policy and Governance (CPPG), through its seminars & policy dialogues, is sensitizing the policy makers, professionals and the civil society groups about the scale and size of the impending crisis (See CPPG Quarterly News & Research, Special issue on Energy Crises and Policy, October 2013 on the subject). It is in this spirit that this report, 'Reforming the Energy Sector of Pakistan: The Case of Punjab - Energy Market, Institutional Framework and Governance Issues' is being presented.

The research for this study was completed after almost a year's hard work by a team of two researchers. The USAID financial and technical support helped the CPPG in enhancing its Think Tank capability by establishing the Forman Christian College Public Policy Research and Resource Centre. This study on Energy Sector was initiated through this program and is the second study that is completed through USAID's Ambassador's Small Grants Project. We remain deeply appreciative of this support.

This study is different from many other studies on the energy sector as it examines the issues emanating in the energy sector in totality i.e. inclusive of electricity, gas and oil. It is, therefore, multidimensional in identifying the nature of crisis and then recommending specific solutions. Another salient feature of the study is that taking into cognizance the 18th Constitutional Amendment, it focuses on Punjab, draws lessons and suggests the way forward for the province. The report also draws our attention to two sets of critical questions: first, was the unbundling of WAPDA carefully studied? second, was sufficient research done on what implications the creation of independent power projects have on the institutions of governance in the energy sector?

The study is divided into six chapters. The first two chapters identify the key issues and provide an overview of the history of how misgovernance and lack of planning have deepened the energy crisis. In the third and fourth chapters, institutional arrangements, their functioning and inadequacies are analyzed. The analysis and findings incisively convey that the breakup of WAPDA and proposed privatization of the energy sector were neither adequately studied nor their implications critically explored. The fifth chapter focuses on Punjab and, in the light of 18th Amendment, assesses the challenges and opportunities that have become available to the province. As the largest province and the biggest consumer of energy, the study forcefully argues that Punjab has the potential to contribute towards not only redesigning the distribution and transmission of energy but also influencing the energy mix - hydel, coal, gas and oil. It also makes a case for alternate sources; wind, solar and bio-fuels. More importantly the study makes a persuasive case for integrated energy sector governance so that policy, planning and management act in concert rather than divided compartments across various ministries, government departments and bureaucratic agencies. While making immediate, medium and long term recommendations, the study calls for collaborative research, analysis and implementation for an integrated energy plan having a broad national consensus of the provinces and other stakeholders' ownership.

Besides our internal faculty review team, I am indebted to two anonymous reviewers for their invaluable comments, which have enormously helped the authors in improving the quality and content of this study. We do hope that besides scholars, policy analysts and civil society activists, the Government of Punjab would find some of the recommendations of the study helpful in devising its energy needs and policy.

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Acronyms

ADB	Asian Development Bank
AEDB	Alternative Energy Development Board
ARL	Attock Refinery Limited
CCI	Council of Common Interests
CEO	Chief Executive Officer
CHASNUPP	Chashma Nuclear Power Complex
CNG	Compressed Natural Gas
CPP	Captive Power Plant
CPPA	Central Power Purchasing Authority
CPPs	Captive Power Producers
DISCOs	Distribution Companies
DW	Durbin Watson
FDI	Foreign Direct Investment
FESCO	Faisalabad Electric Supply Company
FoDP	Friends of Democratic Pakistan
FYA	First Year Allowance
GDP	Gross Domestic Product
GENCOs	Generation Companies
GEPCO	Gujranwala Electric Supply Company
GoP	Government of Pakistan
GST	General Sales Tax
GWh	Gigawatt hours
HDIP	Hydrocarbon Development Institute of Pakistan
HESCO	Hyderabad Electric Supply Company
HPPs	Hydro Power Plants
HSD	High Speed Diesel
HUBCO	Hub Power Project
ICB	International Competitive Bidding
IESCO	Islamabad Electric Supply Company
IPDF	Infrastructure Project Development Facility
IPP	Independent Power Producer
IPP	Institute of Public Policy
IPPs	Independent Power Producers
KANUPP	Karachi Nuclear Power Plant
KESC	Karachi Electric Supply Company
KOE	Kg of Oil Equivalent
kW	Kilowatts
LDO	Light Diesel Oil
LESCO	Lahore Electric Supply Company
LOI	Letter of Interest
LOS	Letter of Support
LTCF	Long-Term Credit Facility
MEPCO	Multan Electric Supply Company
MNC	Multinational Corporation
MoF	Ministry of Finance

MTOE	Million Tonnes of Oil Equivalent
MW	Megawatt
NEPRA	National Power Electric Regulatory Authority
NFC	National Finance Commission
NRL	National Refinery Ltd.
NTDC	National Transmission Distribution Company
OGDCL	Oil and Gas Development Company Ltd.
OGRA	Oil and Gas Regulatory Authority
PARCO	Pak-Arab Refinery Ltd.
PEPCO	Pakistan Electric Power Company
PESCO	Peshawar Electric Supply Company
PIDE	Pakistan Institute of Development Economics
POL	Pakistan Oilfields Limited
PPDB	Punjab Power Development Board
PPDCL	Punjab Power Development Company Limited
PPIB	Private Power Infrastructure Board
PPL	Pakistan Petroleum Limited
PPMU	Punjab Power Management Unit
PRL	Pakistan Refinery Ltd.
PSEDF	Private Sector Energy Development Fund
PSDP	Public Sector Development Programme
PSO	Pakistan State Oil
QESCO	Quetta Electric Supply Company
SECP	Securities and Exchange Commission of Pakistan
SEPCO	Sukkur Electric Power Company
SNGPL	South Northern Gas Pipelines Ltd.
SPP	Small Power Producer
SSGC	Sui Southern Gas Company Ltd.
T&D	Transmission and Distribution
TOE	Tonnes of Oil Equivalent
USAID	United States Agency for International Development
WAPDA	Water and Power Development Authority
WEO	World Economic Outlook

Executive Summary

- Pakistan has been facing a deep energy crisis since 2008 which has negatively impacted on the growth of the economy. The economic cost of power outages was over 7 percent of GDP in 2012 while the average annual growth rate of GDP per capita has been just 0.2 percent since 2008. The result of the persistent energy crisis has been riots and protests, causing a lot of damage to public property and constituting a threat to the general law and order situation of the country.

- Such a public response was expected given the multidimensional nature of the crisis. Unlike previous instances where there was only a shortage of electricity, this time around the energy crisis worsened as power outages were coupled with the shortage of gas and increased prices of electricity, gas and oil. Therefore, tackling the energy crisis requires an overall review and a deeper understanding of the development of energy sector, mainly in the three key areas – gas, oil and electricity. The purpose of this study is to follow such an approach. First, we analyze the evolution of system and market of Pakistan's energy sector, especially after the unbundling of the Water and Power Development Authority (WAPDA) and how these have impacted regulatory reforms, institutional capacity, planning and governance of the sector. Second, we assess the impact of the 18th Amendment on the power sector and provinces, especially Punjab since the amendment provide more autonomy to the provinces to setup their own initiatives.

- Through historical analysis, this study explores the wrongdoings of the past that have resulted in an energy crisis. The main reasons identified are: (i) The shares of commercial and non-commercial energy have reversed. The share of commercial energy increased to 66 percent in 2012 from only 34 percent in 1972. (ii) The shift from more productive use of energy to less productive due to the shift of energy usage from industry to domestic consumers. (iii) Every energy crisis in Pakistan came after a period of strong economic growth. This happened in the early 70s, late 80s and recently mainly because of low growth in energy supply as compared to energy demand and the absence of long-term planning in the sector. (iv) From 1971 to 2012, the growth rates of energy supply, economy and population were 5.0, 3.7 and 2.8 percent respectively. Even the growth rate of energy consumption (3.9 percent) is greater than the growth rate of energy supply. This is another planning failure of the policymakers.

- After historical analysis, the report analyzes the structure of the energy sector, especially that of the power sector. This exercise is done for the pre and post WAPDA unbundling phase. Before the unbundling of WAPDA, the power sector was performing well. This was because planning was well integrated, coordinated and properly implemented. The system in place was also well equipped with a strong network of power transmission lines across the country. Similarly, the distribution of electricity was efficiently coordinated and managed by the 12 Area Electricity Boards (AEBs). Under this system, there was hardly any load-shedding except in the mid-80s for one to two hours at peak evening times. This structure remained intact till1994.

- In the early 90s, there was a shift in global thinking towards market economy and globalization which led to a structural change in the power sector of Pakistan. The idea behind this change was to bring in more private investment rather than conduct public investment by

increasing the role of the private sector. The first visible step in this direction was the unbundling of WAPDA. The unbundling process started in 1994 and was completed in 1998. Furthermore, the government introduced the Power Policy of 1994 which negated the Integrated Power Plan of 1994. The impetus of this policy was to restructure the entire power sector in line with the Strategic Plan of 1992. The over-riding reform goal was to create new governance arrangements that provide long-term benefits to consumers' through the creation of competitive wholesale and retail markets to improve efficiency and responsiveness to customer preferences; by incentive regulation of privatized transmission and distribution networks to improve their efficiency and facilitating competition across them; and by reducing the role of government and political influence generally.

- However, the implementation of this policy, along with other policies introduced after the restructuring of WAPDA have led to the present day energy crisis because neither the reforms as envisaged were completely implemented nor the long term planning and implementation mechanisms of the earlier structure adhered to. These policies presented lucrative incentives to the private sector leading to an influx of private sector projects and a change in the generation landscape such that the private sector is now responsible for a major chunk of the total power generation capacity in the country. More importantly, the private sector was allowed to use any form of energy input for electricity production with the consequence of more reliance on oil and gas as sources of electricity production. This changed the power generation energy mix gradually increasing the cost of production.

- Thus, introduction of the private sector into the system has forced the sector to utilize domestic resources sub-optimally exposing the country to two main risks: first, dependence on gas at a time when domestic reserves are depleting implies severe constraints in the medium to long-run; second, the growing reliance on thermal power has exposed the economy to 'international oil price shocks'. This is because no long-term investment was made to boost hydel power generation capacity when the economy was growing and demand for electricity was increasing. Instead, only small projects were undertaken signifying that the focus of all policies was limited to short-term development of the sector.

- Performance of the Distribution Companies (DISCOs) is also very poor in terms of transmission and distribution (T&D) losses and recovery of bills. This is because DISCOs do not have the capacity to be run like big corporations since they were drastically made into independent companies from WADPA's Area Electricity Boards (AEBs) during the restructuring process. As a consequence, they do not have proper designing and planning departments in spite of having the infrastructure and technology. Their leadership lacks the necessary management skills to run a large company as the staff was never given any proper training on how to manage their affairs independently. Additionally, the human resources at various organizational levels have weak requisite technical knowledge. This is because no organizational assessment of skills to job role has been performed.

- Another point of concern is that the rate of billing recoveries and T&D losses differs greatly across DISCOs and provinces. This is not because these DISCOs differ in the level of technology, management or use different mechanisms for collection but because consumer behavior, attitude and capacity with regard to payment of bills differs greatly across regions. For example, in Punjab, the consumers are much more responsible in paying their dues and thus the rate of power theft is low because of better law and order situation in the province,

which is not the case in other provinces. *It is thus pertinent to note that it would not make any difference to the rate of recovery even if management of Punjab's DISCOs is swapped with that of DISCOs of other provinces.*

- In terms of overall sectoral governance, *the senior management and Board of Governors of public sector organizations inclusive of distribution companies, generation companies and regulatory authorities change regularly because of political intervention. Thus, these organizations now lack the required institutional memory necessary for long-term development of the sector.* Further, since the unbundling of WAPDA, structure of the energy sector has become quite complex leading to a breakdown in governance as enough concentration has not been paid on evolving a working coordination mechanism among the various independent entities.

- Under the 18th Amendment, provinces have been given considerable autonomy to invest in the sector. However, the major change with regards to electricity is that the defunct Concurrent List has been moved to the Federal Legislative List Part II. What are the implications of these constitutional provisions on the working of provinces? Do provinces have the capacity needed to handle such a complicated sector? Unfortunately, the answer to this question is no because of a number of bottlenecks. These include: an unequal availability of natural resources in the provinces, lack of technical knowledge and field expertise of staff, inability of the provincial government to provide sovereign guarantees to the private sector bringing in Foreign Direct Investment (FDI) and the absence of a national coordination plan.

- To further assess the impact of the 18th Amendment on provinces, Punjab was used as a case since it makes the largest contribution to GDP and consumes the biggest chunk of national energy. In 2012, Punjab consumed more than 68 percent of oil, gas and electricity while its share in production of these was only 21 percent. In terms of indegenous resources, the only potential that Punjab has is in the form of renewable energy mainly from wind and solar but this potential is not enough. Thus, Punjab is heavily dependent on other provinces *and therefore needs to work in harmony with them to fulfill its energy requirements.* The area where the energy sector of Punjab is performing relatively well as compared to other provinces is in the recovery of bills and low level of energy theft. The recovery rate of fuel bill in DISCOs within Punjab is above 97 percent with the lowest rate of T&D losses.

- Based on the analysis, the report provides a set of policy recommendations to improve the energy situation of the country both in the short and long-run. In the short-run, the government needs to correct the structure of the sector by reorganizing it and building the capacity of organizations working within the sector; otherwise, overcoming problems and issues faced by the sector will be difficult. These reforms should begin from the top and it is recommended that

For the short term:

- The Ministry of Water and Power, and the Ministry of Petroleum and Natural Resources be merged into a single Ministry of Energy. This is necessary for integrated planning and coordination of the sector, and would serve to improve implementation mechanism of various

plans and policies.

- An institutional mechanism be devised to coordinate the activities of OGRA and NEPRA to ensure coherent regulation.
- Capacity of DISCOs, GENCOs and regulatory authorities be improved through institutional reforms: recruitment of qualified and competent leadership with security of tenure to professionalize the working of these organizations.

For the long term:

- Emphasis must be laid on the expansion of power generation capacity to reduce the energy deficit of the country by commissioning of the Pak-Iran Gas Pipeline, construction of the Diamer-Bhasha Dam, completion of the Neelum-Jhelum Hydro Power Project and exploitation of Thar coal deposits.
- The share of the power sector in the PSDP should be increased from the existing 19 percent to upto 30 percent to fast track the completion of the on-going projects.
- A special monitoring unit also needs to be set up in the Planning Commission to oversee implementation of these projects.

I. Understanding Energy Crisis: Past Trends and Present Situation

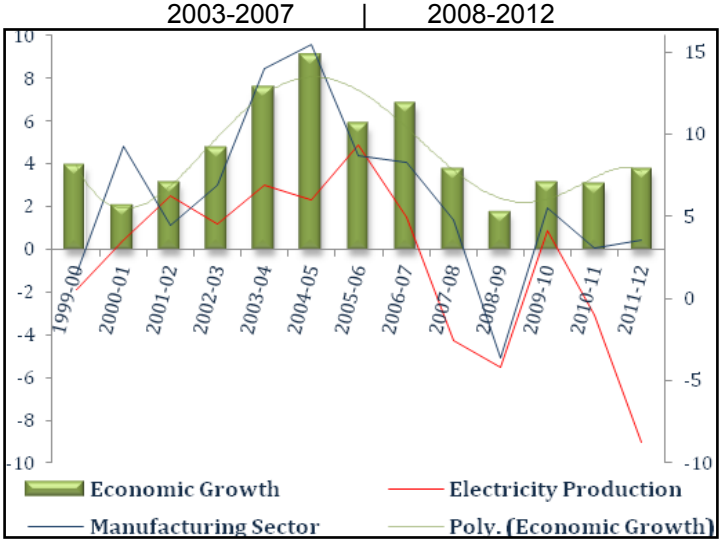
I. Understanding Energy Crisis: Past Trends and Present Situation

The last decade of Pakistan's economic performance can be clearly divided into two episodes: (i) high growth with macroeconomic stability and, (ii) low growth with macroeconomic instability (see Chart 1.1). There are many reasons behind the low growth period of Pakistan. These include: the breakdown of governance, corruption, failure of the rule of law, political turmoil, macroeconomic imbalances, and structural deficits, etc. However, the single most important cause of such a poor economic performance and widespread violent agitation in Pakistan is the ongoing energy crisis. On one side, there is high incidence of power outages which have made life very difficult for the average citizen, especially in the hot summer months. On the other side, there is an excessive shortage of gas for domestic usage in winters especially in Punjab and gas stations remain closed for almost three days a week across the country. As can be seen in Chart 1.1, during high growth period, high production of electricity leads to increased manufacturing production. The reverse happens during the low economic growth period.

Chart 1.1: Pakistan's GDP, Manufacturing Production Index, and Electricity Production (% change, year-on-year)

High Growth Period | Low Growth Period

2003-2007 | 2008-2012



Source: Pakistan Economic Survey, Ministry of Finance.

Note that Economic Growth is on left-axis and manufacturing production index and electricity production is on right-axis.

Unlike previous crises, the energy crisis that we are going through at the moment is not only due to the power outages, as was the case in the past, but this time around it also involves a shortage of gas and higher prices of energy products: electricity, gas and oil. Therefore, the energy crisis this time is much more severe and has broader economic impact than previously. Therefore, tackling the problem of energy crisis requires an overall review and deeper understanding of the development of the energy sector as a whole, mainly in the three key sources – gas, oil and electricity. The purpose of this study is to follow such an approach.

The working definition of energy followed in this study is of primary energy. Primary energy is defined as the energy form found in nature that has not been subjected to any conversion or transformation process. It is the energy contained in raw fuels and other forms of energy received as

input to a system. Primary energy can be non-renewable or renewable. Sources of non-renewable energy include fossil fuels such as crude oil, coal and natural gas; and mineral fuels such as natural uranium. Renewable sources of energy include hydel, solar, wind, biomass and geothermal energy.

The focus of this chapter is on analysing the energy balances of Pakistan in the historical context. This analysis helps us to identify the root causes and intensity of problems of present energy crisis. The chapter also discusses the current issues faced by the sector and the way forward.

1.1 Pakistan's Energy Balances In The Historical Context

This section presents historical trends of the energy balances of Pakistan since 1971. It analyses both the energy supply and energy consumption trends.

Energy Supply

Table 1.1 gives the trend of energy supply of Pakistan. In 1971, the total energy supply of Pakistan was 17,041 tonnes of oil equivalent (TOE). The main sources of energy supply at that time were oil, 18 percent; gas, 14 percent; electricity, 2 percent; coal, 4 percent; and biofuels and wastes, 62 percent.[1] In 2010, the energy supply of the economy increased to 84,595 TOE with an average annual growth rate of 4.2 percent. This increase in the energy supply has brought a very clear change in the patterns of energy sources. Dramatic changes are seen in shares of oil, gas, biofuels and wastes: the share of the oil increased from 18 percent to 25 percent; the share of gas increased from 14 percent to 32 percent; and the share of biofuels and wastes decreased from 62 percent to 34 percent. However, there is not a considerable change in the trends of electricity and coal. The share of electricity increased from 2 percent in 1971 to slightly above 4 percent in 2010 and the share of coal increased from 4 percent in 1971 to 5 percent in 2010.

Overtime, this pattern of change and increasing reliance on oil and gas as major sources of supply has exposed the country to many risks and brought negative repercussions on the economy. Firstly, oil is mostly an imported source of energy, the price of which has been increasing continuously, especially in the last few years. The price of oil increased to $108/bbl (as of February, 2013), an increase of almost 3 times as compared to its price in 2000.[2] This also led to an increase in oil prices domestically, escalating to Rs. 113 in December, 2013 from Rs. 15 in 2002; an increase of more than 750 percent. Furthermore, Pakistan has exhausted more than half of the original recoverable domestic oil reserves, which were at 1,114 million TOE as of 2012. The cumulative production of oil was 626 million TOE as of June, 2012, or 68 percent. This left us with the balance recoverable reserves of 488 million TOE.

Secondly, our gas reserves are also depleting. By December 2012, Pakistan exhausted 56 percent of the original recoverable reserves; having depleted the biggest field, Sui, by almost 80%.[3] If gas consumption grows annually even at moderate rates, the present recoverable reserves will largely be exhausted by 2025. As this limit approaches, the marginal cost of gas supplies will rise sharply as smaller and more distant fields are tapped. We have already witnessed an increase in gas tariffs. These could further increase because of the deterioration of reserves and shortage of gas. To avoid such a situation we have two choices: efficient use of gas and an increase in the gas exploration rate.

Electricity and coal are the least contributing sources to total available energy of Pakistan. Togeth-

er, these made 15 percent of the total energy supply in 2012. While we have enormous amount of reserves of these two sources, they are not being utilized properly. Biofuels and gas still remain as the main source of energy in Pakistan, fulfilling the energy needs of a major portion of the population. These sources also cater to the energy needs of the industrial sector. High use of biofuels and wastes is the main reason for the degradation of jungles and resultant floods in Pakistan.

Pakistan's import of energy mainly consists of oil and coal. The imported energy was 17 percent in 1971 which increased to 27 percent in 2000. Although, this figure decreased to 21 percent in 2005, it again increased to 23 percent in 2012. The indigenous supply of per capita energy was 230 kg of oil equivalent (KOE) in 1971. This increased to 389 KOE in 2005 at an annual rate of 1.6 percent but later decreased and reached 358 KOE in 2012.

Table 1.1 also highlights the trends of electricity production. The installed capacity in 1971 was 1,862 MW which increased to 22,797 MW in 2012 at an annual growth rate of 6.3 percent. It must be noted that out of this total generation capacity, the share of hydro capacity was 36 percent in 1971 which decreased to 29 percent in 2012. In absolute terms, although the hydro installed capacity has increased from 667 MW in 1971 to 6,556 MW in 2012 but the growth in the installed capacity of other sources outweighed the growth in hydro-capacity. The period-wise developments in the installed capacity of hydro and other plants tell the story of current power shortages and increase in tariffs of electricity. Note that there is a continuous increase in the overall installed generation capacity of power plants although the growth rates were volatile between periods. But in case of hydro installed capacity, this is not the case. The hydro installed capacity increased till 1985 at a rate of 11 percent annually, after which there was no increase in capacity till 1990. Similarly, there was hardly any increase in the installed capacity in the last ten years.

The generation of power was 7,572 gigawatt hour (GWh) in 1971 which increased to 95,091 GWh in 2012 at an annual growth rate of 6.4 percent. The generation of power in 2012 came down from a peak level of 98,213 GWh attained in 2007. Besides the problem of generation of capacity, the power sector is facing other problems including *circular debt, fuel mix for thermal power generation, transmission and distribution losses (T&D), management and governance issues, and complex structure of the sector.* These issues are discussed in detail in Chapters 2, 3 and 4 of the report.

Energy Consumption

Table 1.3 shows Pakistan's long-term energy consumption trends by source and sector. In 1971, the total energy consumption of Pakistan was 17,041 TOE. Overtime, the energy needs of the economy increased, raising this figure to 83,997 TOE in 2012 with an annual growth rate of 4.0 percent. A major portion of total energy consumption of Pakistan is being consumed by power plants, transformation, energy industry itself and energy losses. The total energy consumption was over 8 percent in 1971 and increased to around 20 percent in 2000. Presently, the share of these is almost one-fourth of the total energy consumption while the remaining energy is consumed by the economic sectors. Technically, in the energy literature, such consumption is called the final energy consumption defined as *the total energy consumed by end users, such as households, commerce, industry and agriculture.* It is the energy which reaches the final consumer's door and excludes that which is used by the energy sector itself.[4] Below is a detailed description of final energy usage by source and sector.

Table 1.1: Pakistan's Primary Energy Supply Trends

	1971	1975	1980	1985	1990	1995	2000	2005	2010	2012
PRIMARY ENERGY SUPPLY (TOE)	**17,041**	**20,335**	**24,828**	**32,278**	**42,668**	**53,687**	**63,486**	**75,521**	**84,595**	**83,997**
Percentage Shares of:										
Oil	17.9	17.7	17.5	22.0	24.2	27.4	29.9	21.8	24.8	23.8
Gas	13.9	17.5	20.2	20.0	23.6	24.5	26.3	33.9	31.9	38.1
Electricity	2.0	2.6	3.0	3.5	3.6	4.0	3.1	4.4	4.3	9.6
Coal	3.8	2.8	2.8	4.2	4.6	4.0	2.9	4.9	4.9	5.1
Biofuels & Wastes	62.4	59.3	56.5	50.2	44.0	40.1	37.8	34.9	34.1	22.9
Growth Rates (%)										
Total	-	4.5	4.1	6.8	5.7	5.9	3.4	4.4	2.3	-0.4
Oil	-	4.2	3.8	13.2	7.7	9.3	5.2	-3.4	4.9	0.4
Gas	-	10.8	7.1	6.5	9.3	6.9	4.8	11.4	1.0	2.0
Electricity	-	11.6	7.1	11.1	6.0	8.5	-1.2	13.4	1.9	4.4
Coal	-	-3.5	4.0	18.5	7.5	2.6	-3.0	19.0	2.3	-3.7
Biofuels & Wastes	-	3.2	3.1	3.7	3.0	3.5	2.2	2.4	1.8	-5.3
IMPORT OF ENERGY, NET	**2,920**	**3,855**	**4,746**	**6,834**	**9,246**	**13,056**	**17,258**	**15,663**	**20,298**	**19,319**
Percentage of Total Primary Energy Supply	17.1	19.0	19.1	21.2	21.7	24.3	27.2	20.7	24.0	23.0
INDIGENOUS PER CAPITA PRIMARY ENERGY SUPPLY*	**230**	**235**	**247**	**260**	**303**	**326**	**332**	**389**	**363**	**358**
(Kg of Oil Equivalent)										
ELECTRICITY										
Installed Capacity (MW)	**1,862**	**2,430**	**3,518**	**5,615**	**7,449**	**12,100**	**17,399**	**19,384**	**20,922**	**22,797**
Growth Rate (%)		6.9	7.7	9.8	5.8	10.2	7.5	2.2	1.5	4.4
Hydropower Installed Capacity (MW)	**667**	**867**	**1,567**	**2,898**	**2,898**	**4,826**	**4,826**	**6,499**	**6,481**	**6,556**
Percentage Share in Total Capacity	35.8	35.7	44.5	51.6	38.9	39.9	27.7	33.5	31.0	28.8
Growth Rate of Hydro Capacity (%)	-	6.8	12.6	13.1	0.0	10.7	0.0	6.1	-0.1	0.6
Generation (GWh)	**7,572**	**9,941**	**14,974**	**23,003**	**37,673**	**56,957**	**68,125**	**93,832**	**95,608**	**95,091**
Growth Rate (%)	-	7.0	8.5	9.0	10.4	8.6	3.6	6.6	0.4	-0.3
Transmission & Distribution (T&D) Losses (%)	26.3	25.3	29.1	20.3	20.7	22.8	24.3	25.5	20.3	17.3

Source: Database of Pakistan Economic Survey, Hydrocarbon Development Institute of Pakistan, International Energy Agency and World Development Indicators.

* The Indigenous Per Capita Primary Energy Supply is defined as the ratio of total primary energy supplied minus import of primary energy divided by the population.

Gas:

Gas is the second largest source of final energy consumption in Pakistan with a share of 27 percent; however, this share has significantly changed overtime. In 1971, its share was only 10 percent but now, at 26 percent, it is a major portion of the final energy consumption. The annual average growth rate of its consumption is 6.3 percent; much larger than the final energy whose growth rate was 4.0 percent only. *This is a clear indication of the excessive consumption of gas and its recent supply constraints.*

Also, there is a very clear pattern of change in the consumption of gas by economic sectors. In 1971, three-fourth of the gas was consumed by the industrial sector and reached to 43 percent in 2012. Similarly, there is a very significant change in consumption trends of transport and residential sectors. In 1971, the residential sector consumed 3 percent of the total gas. In 2012, this increased to over 34 percent. Similarly, an increase in the demand of gas in transport vehicles grew at a phenomenal rate, especially in the last decade. After industry, it accounted for a major portion of incremental consumption during the period as we observe fairly high growth rates of gas consumption patterns in industrial, residential and transport sectors. Additionally, as shown in Table 1.1, gas is given the highest priority in electricity generation at the moment.

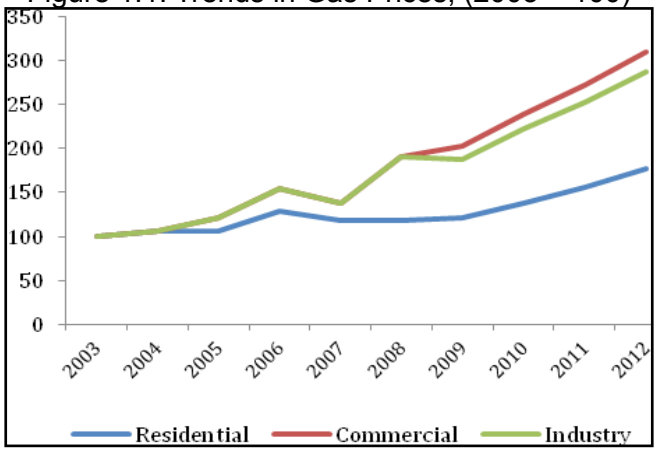
Table 1.2: Status of Current Available Primary Energy Sources

Source of Primary Energy	**Original Recoverable Reserves** (MTOE, as on End June, 2012)	**Used** (as on End June, 2012)		**Remaining**	
		Actual (MTOE)	**Percentage**	**Actual** (MTOE)	**Percentage**
Natural Gas	1,114.4	626.3	56.2	488.1	43.8
Oil	141.2	95.3	67.5	45.9	32.5
Coal	186,007	-	-	-	-

Source: Own calculations using statistics from the Pakistan Energy Year Book, 2012.

The distortions in allocations of gas are a reflection of wrong pricing policies and influence of powerful vested interests[5]. For example, during the tenure of the military government, many were obliged and granted licenses for setting up (Compressed Natural Gas) CNG stations while the powerful MNC lobby of fertilizer companies pre-empted large supplies of natural gas at extremely low prices without necessarily passing on the benefits to farmers and instead enjoying high corporate profits. These developments impacted the prices of gas significantly. The levels and trends in prices of natural gas are given in Figure 1.1.

Figure 1.1: Trends in Gas Prices, (2003 = 100)



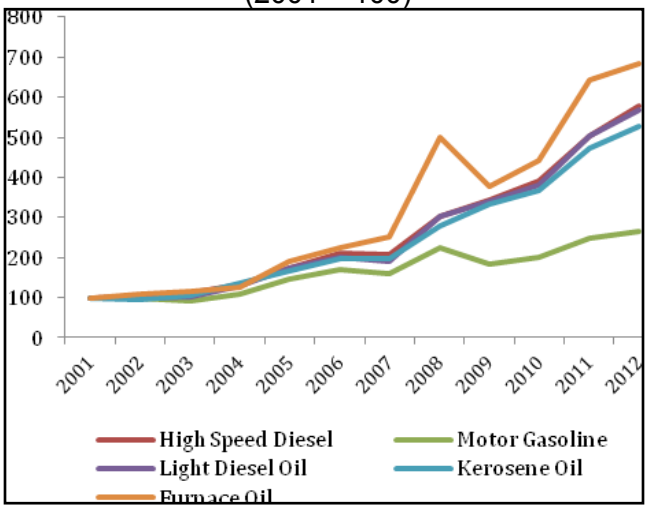
Source: Pakistan Energy Year Book, various issues.

Oil:

The consumption of oil was 11,618 TOE in 2012. The transport sector consumes almost three-

fourths of the final oil consumption. Also, as shown in Table 1.1, oil and gas are the two major sources of electricity production in Pakistan at the moment. Oil consumption by other sectors has mostly declined and we observe a decline in its usage for running tube wells in the agricultural sector along with less usage of kerosene oil by lower income households. Similarly, the use of motor spirit and High Speed Diesel (HSD) in the transport sector has been restricted by the shift to CNG.

Figure 1.2: Trends in the Prices of Petroleum Products, (2001 = 100)



Source: Pakistan Energy Year Book, various issues.

A major reason of such a change in the pattern of oil consumption is the increasing prices of POL products in the last five years. The trends of these prices are shown in Figure 1.2. We observe, for example, that the price of HSD increased by 13 percent annually between 2001 and 2007 but thereafter, the rate of increase escalated to 23 percent, primarily on the pretext of higher international prices. It is interesting to note that in 2001, the price of HSD was only 54 percent of the price of motor spirit. But by 2011, it had reached 118 percent of the price. This imposed a disproportionate burden on low income consumers who use public transport. Similarly, the price of furnace oil rose sharply since 2007 at the annual rate of 17 percent; and later at an annual rate of 22 percent from 2007 to 2012. This contributed to raising the costs of thermal power generation substantially. Kerosene oil is another product which experienced a major change in its relative price. In fact, there was a time when this product was subsidised. However, this is no longer the case and like other POL products, it is subject to 16 percent GST. LDO has also met a similar fate.

Electricity:

The consumption of electricity has increased rapidly, and is the highest among all sources of energy. All sectors exhibit a change in their electricity consumption pattern, especially industry and households. The share of the industry decreased from 54 percent in 1971 to 28 percent in 2012 while the share of residential electricity consumption increased to more than 46 percent in 2012 from just about 12 percent in 1971. However, there is no significant change in the consumption pattern of commerce and public services sector. In case of agricultural sector, energy consumption decreased from 19 percent to 12 percent.

Note that the growth rate of the overall electricity consumption is not very large during 2005 to 2012. It can be argued that the flattening of demand is a reflection of the loss of growth momen-

tum in the economy during the period. But the lower of growth of GDP can be due to other factors along with constraint in energy. This clearly indicates that a supply-side factors constraint has been operative in restricting growth.

Table 1.3: Pakistan Energy Consumption Trends

	1971	1975	1980	1985	1990	1995	2000	2005	2010	2012
TOTAL ENERGY CONSUMPTION (TOE)	**17,041**	**20,335**	**24,828**	**32,278**	**42,668**	**53,687**	**63,486**	**75,521**	**84,595**	**83,997**
Percentage of Total Energy Consumption by Power Plants, Transformation, Energy Industry Own Use and Energy Losses	8.2	9.2	9.4	10.5	15.2	17.2	19.8	18.1	17.4	17.5
FINAL ENERGY CONSUMPTION (TOE)	**15,647**	**18,461**	**22,486**	**28,880**	**36,202**	**44,440**	**50,932**	**61,873**	**69,834**	**69,298**
Percentage of Total Energy Consumption	91.8	90.8	90.6	89.5	84.8	82.8	80.2	81.9	82.6	82.5
ENERGY CONSUMPTION BY SOURCE AND SECTOR GAS (TOE)	**1,497**	**2,266**	**3,017**	**4,477**	**6,009**	**8,197**	**10,177**	**15,540**	**19,124**	**18,099**
Growth Rate (%)	*-*	*10.9*	*5.9*	*8.2*	*6.1*	*6.4*	*4.4*	*8.8*	*4.2*	*-5.4*
Percentage Share in Final Energy Consumption	*9.6*	*12.3*	*13.4*	*15.5*	*16.6*	*18.4*	*20.0*	*25.1*	*27.4*	*26.1*
Percentage Use by:										
Industry	75.2	76.7	56.1	39.0	37.7	45.5	39.7	47.2	39.0	43.0
Transport	0.0	0.0	0.0	0.0	0.0	0.0	1.0	5.6	13.1	15.4
Residential	3.2	5.0	10.0	17.6	24.7	29.9	30.8	24.5	27.0	33.9
Commerce and Public Services	2.7	3.4	4.6	4.6	4.6	4.6	4.5	4.2	4.2	5.1
Others*	18.9	14.8	29.3	38.8	33.0	20.0	24.1	18.5	16.6	2.7
OIL (TOE)	**2,661**	**3,181**	**4,150**	**5,927**	**7,748**	**10,013**	**11,678**	**11,412**	**11,966**	**11,618**
Growth Rate (%)	*-*	*4.6*	*5.5*	*7.4*	*5.5*	*5.3*	*3.1*	*-0.5*	*1.0*	*-2.9*
Percentage Share in Final Energy Consumption	*17.0*	*17.2*	*18.5*	*20.5*	*21.4*	*22.5*	*22.9*	*18.4*	*17.1*	*16.8*
Percentage Use by:										
Industry	5.7	7.0	5.5	13.5	16.4	18.4	16.2	15.0	11.6	12.2
Transport	39.0	39.8	53.3	54.5	58.0	65.8	69.7	70.6	74.2	79.2
Residential	**15.0**	**17.7**	**16.6**	**14.3**	**16.7**	**7.9**	**6.2**	**4.8**	**3.1**	**0.7**
Commerce and Public Services	23.8	20.6	13.4	8.2	2.4	1.7	2.3	3.1	7.6	2.7
Others*	**16.5**	**14.9**	**11.2**	**9.5**	**6.5**	**6.3**	**5.6**	**6.5**	**3.5**	**5.1**
ELECTRICITY (TOE)	**459**	**613**	**890**	**1,512**	**2,475**	**3,605**	**4,178**	**5,814**	**6,631**	**6,251**
Growth Rate (%)	*-*	*7.5*	*7.7*	*11.2*	*10.4*	*7.8*	*3.0*	*6.8*	*2.7*	*-5.3*
Percentage Share in Final Energy Consumption	*2.9*	*3.3*	*4.0*	*5.2*	*6.8*	*8.1*	*8.2*	*9.4*	*9.5*	*9.0*
Percentage Use by:										
Industry	53.6	56.1	39.7	35.5	35.9	29.1	29.5	29.3	27.5	28.4
Residential	11.9	11.9	22.8	28.9	32.5	40.8	46.9	45.4	46.5	46.4
Commerce and Public Services	15.3	15.7	17.2	19.5	14.0	14.1	13.4	13.5	14.3	14.1
Agriculture	18.7	15.8	20.0	15.9	17.5	16.0	10.1	11.8	11.6	11.1
Others*	0.5	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
COAL (TOE)	**581**	**542**	**640**	**1,049**	**1,522**	**1,538**	**1,374**	**3,285**	**3,858**	**4,058**
Growth Rate (%)	*3.7*	*2.9*	*2.8*	*3.6*	*4.2*	*3.5*	*2.7*	*5.3*	*5.5*	*5.9*

Percentage Share in Final Energy Consumption	*3.7*	*2.9*	*2.8*	*3.6*	*4.2*	*3.5*	*2.7*	*5.3*	*5.5*	*5.2*
Percentage Use by:										
Industry	83.2	93.2	97.3	98.6	99.8	99.9	100.0	100.0	100.0	100.0
Others*	16.8	6.8	2.7	1.4	0.2	0.1	0.0	0.0	0.0	0.0
BIOFUELS AND WASTE (TOE)	**10,448**	**11,860**	**13,788**	**15,916**	**18,447**	**21,086**	**23,524**	**25,822**	**28,255**	**29,272**
Growth Rate (%)	*-*	*3.2*	*3.1*	*2.9*	*3.0*	*2.7*	*2.2*	*1.9*	*1.8*	*3.6*
Percentage Share in Final Energy Consumption	*66.8*	*64.2*	*61.3*	*55.1*	*51.0*	*47.4*	*46.2*	*41.7*	*40.5*	*42.2*
Percentage Use by:										
Industry	10.8	10.8	10.8	10.8	10.8	11.1	11.1	11.1	11.1	12.0
Residential	89.2	89.2	89.2	89.2	89.2	88.9	88.9	88.9	88.9	88.0
PER CAPITA PRIMARY ENERGY CONSUMPTION (Kg of oil equivalent)	277	291	305	330	387	431	455	491	478	464
ENERGY INTENSITY (GDP per unit of energy use)	**277**	**291**	**305**	**330**	**387**	**431**	**455**	**491**	**478**	**464**
(constant 2005 PPP $ per kg of oil equivalent)										
Overall Economy	-	-	4.0	4.2	4.2	4.2	4.2	4.5	4.9	5.1
Industrial Sector	-	-	5.6	5.3	5.8	5.2	5.6	5.5	6.0	6.3

Source: Database of Pakistan Economic Survey, Hydrocarbon Development Institute of Pakistan, International Energy Agency, and World Development Indicators.

* The sectors that consumed the energy include: residential, industry, commercial, transport, agriculture, government and public lightings. Others include all those that are not included in the calculations.

Coal:

Coal has a both a limited utilization as a source of energy and limited share in the final energy consumption. There is not a very noticeable change in the consumption patterns overtime with only a marginal increase from 4 percent in 1971 to 6 percent in 2012. Also, most of the coal is consumed by the industrial sector.

Biofuels and Wastes:

Biofuels and wastes make up the biggest source in the final energy consumption of Pakistan. Although, over the years, the share has declined from 67 percent to 42 percent, these are still a major source of energy consumption today. The growth rate of consumption of biofuels and wastes is very smooth over the period of analysis. This source of energy is mostly utilized by households in the rural areas of Pakistan and partly by the industrial sector. In the long-run, the share of households is almost 89 percent and that of the industry is 11 percent.

Description of sources of energy supply and consumption in the historical context highlights the fundamental mistakes that Pakistan has made in its strategy for development of the energy sector in the long-run. Firstly, this includes the lack of development of long-term plans to address the increasing energy requirements of the economy and also utilisation of indigenous resources. Instead, the governments mostly believed in ad hoc solutions to the crises faced. This is a major failure of the policymakers as every energy crisis in Pakistan is followed by a period of rapid economic growth (for details see section 1.2 on energy and economic growth).

Secondly, we see a lack of exploitation of coal and renewables as a source of energy. In fact, most of the coal used by the economy is imported despite the fact that Pakistan has one of the largest reserves of coal in the world in Thar, Sindh. Pakistan has a large potential to produce electricity from renewable sources therefore, the strategy should be to utilize more of the domestic coal and explore the renewable sources.

Thirdly, another factor is the failure of the governments to develop hydel capacity. Pakistan has enormous sources of water flowing from the Himalayas that are ideally suitable for construction of dams as sources of hydroelectricity and as water reservoirs. But no development has been made in this respect over the last three decades. The last big dam, Tarbela, was built almost thirty years ago and, thus, this enormous potential for renewable energy remains largely untapped.

Fourthly, the strategy followed by Pakistan has been one of exploitation of gas reserves, which at one stage in the history of Pakistan appeared to be ample. Consequently, these reserves have been wastefully used with implicit large subsidies and are now beginning to deplete rapidly. In the 90s, as part of the policy of encouraging IPPs, thermal power generation was given preference. Consequently, the demand for oil rose rapidly not only for producing electricity but also in the transport sector. In the light of this, Pakistan faces two major contingent risks in the coming years. First, as gas supplies run out there is a likelihood of energy shortages, which is already happening. Second, the heavy dependence on imported oil makes the economy vulnerable to global oil price shocks. This was also experienced in 2008 when the oil import bill rose sharply and our foreign exchange reserves came under heavy strain, putting the country under financial crisis.

Lastly and most importantly, we have used energy quite inefficiently in the past and as a result the output of GDP per unit of energy has remained very low. This was $4 in 1980, which although increased to $5 in 2012, but is still very low as compared to other countries in the region. Another example of the inefficient use of the energy is the shift from the productive use of the energy to unproductive use i.e. the share of the domestic use of energy has increased while that of the industry has decreased.

Some lessons that we can draw from this analysis are as follows:

- In 1971, the share of non-commercial energy was 62 percent while the rest was commercial energy mainly because at that time the economy was mostly agrarian. Overtime, the Pakistani economy shifted from the agricultural sector to industrial and services sector. There was a rapid increase in the commercial activity as well, especially in the last decade. Similarly, there was a visible increase in conspicuous consumption as the stock of cars, trucks, etc. increased. These developments increased the demand for energy and had two major negative impacts on the use of energy as mentioned below:
    - The shares of commercial and non-commercial energy reversed; the share of commercial energy increased to 66 percent in 2012 from only 34 percent in 1972.
    - There was a shift from more productive use of energy to less productive use because of the shift of energy usage from industry to domestic consumers.
- Every energy crisis in Pakistan came after a period of strong economic growth. This happened in the early 70s, late 80s and recently as well mainly because of low growth in energy supply as compared to energy demand and absence of long-term planning in the energy sector.
- Theory on energy economics says that to meet and sustain the energy requirements and put it on a higher growth trajectory for a long-period, the growth rate of energy supply should

be greater than the growth rates of economy and population. In Pakistan's case we observe that in the long-run (from 1971 to 2012), the growth rates of energy supply, economy and population were 5.0, 3.7 and 2.8 percent respectively. Even the rate of energy consumption, 3.9 percent, is greater than the growth rate of energy supply. This is another planning failure of the policymakers.

1.2 Energy Availability And Economic Growth

Economic growth and prosperity of a country in the long-run depends on the basic factors of production like labor, capital, and land. Economists mostly link the relationship between these factors of production and economic output through the production functions. However, for a considerable amount of time, economists did not consider energy as a factor of production and ignored its importance in the production process. The mainstream economic growth models like Solow's exogenous growth, Arrow's learning by doing and Hicks' induced innovation did not include resources or energy explicitly in their models (Hall et al., 2001).

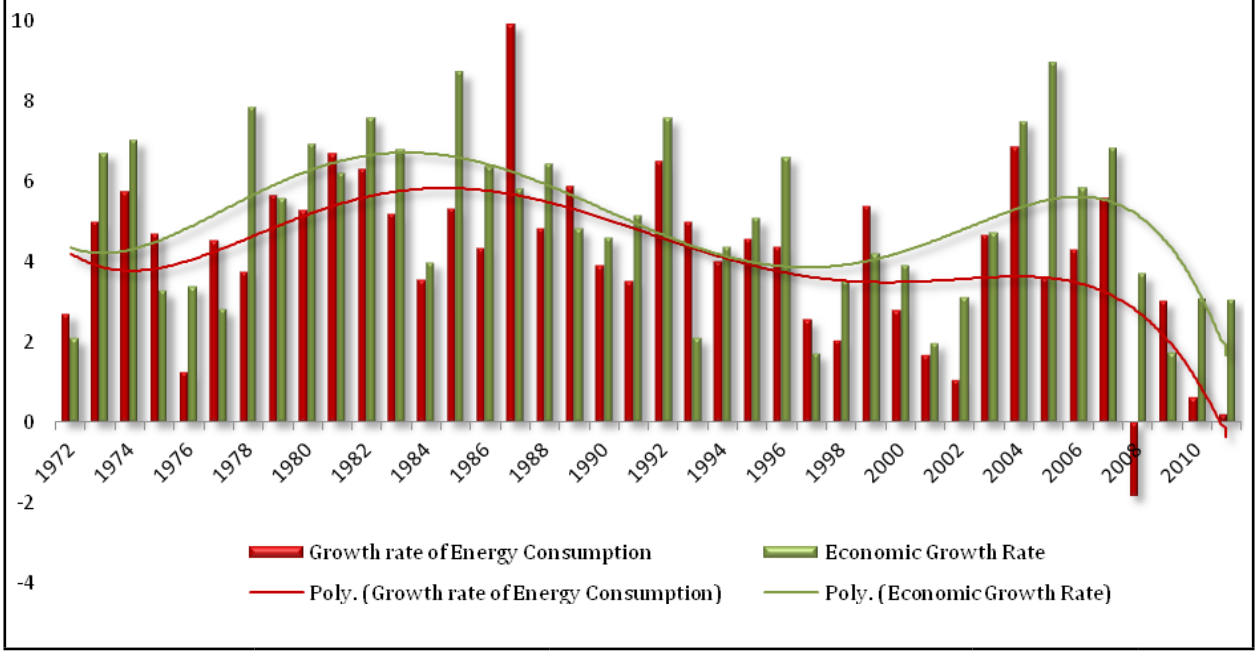
However, lately, the geological economists have given energy a key role in the production process. They have placed huge emphasis on the role of energy and its availability in the production and growth processes (Jorgenson, 1984). These models show how scarcity of energy imposes a strong hindrance in the economic growth of a country. Now, energy is considered as the 'oxygen' of an economy and the lifeline of economic growth, particularly in the industrialization stage of an emerging economy (WEO, 2012). Without heat, light and power we cannot build or run the factories and cities that provide goods, jobs and homes, nor enjoy the amenities that make life more comfortable and enjoyable (Howarth, 1997). The importance of energy in the economic growth can be realized from the fact that the excessive productivity slowdown around the world in the 1970s was primarily due to oil crises.

Similar is the case with Pakistan. The Pakistani policymakers and planners did not consider the importance of energy in development plans and policies while, in the economic history of Pakistan, energy constraint impacted the economic growth severely. As shown in Exhibit 1, the relationship between energy availability and economic growth is measured first by graphical analysis and, second, through regression analysis. The figure shows that there is a strong relationship between energy availability and economic growth in the case of Pakistan. The period where there is high growth of energy availability, the growth rate of economy is also high and vice versa.

The history of the relationship between growth rates of energy availability and economy is divided into five phases (as shown in the exhibit).[6] Of these, three phases reflect low energy availability and economic growth while two signify high energy availability and economic growth - the dilemma of the economic history of Pakistan. During periods of higher economic growth, we failed to construct proper energy plans to address the future energy needs of the country, resulting in a cyclical pattern of their relationship. It is not that only the unavailability of energy impacted the economic growth negatively, however, energy constraint seemed to impact the economic growth the most.

Exhibit 1: Relationship Between Energy Consumption and Economic Growth

1st–In 1974, Pakistan experienced its first power crisis coupled with world oil crisis that reduced the economic growth; although, initially, Mangla dam somehow mitigated the power crisis. In the latter half, energy consumption outweighed the economic growth.	2nd–A number of power projects during the 1980s supported the high economic growth rate. Completion of Tarbela Dam was a major source of energy during this period.	3rd–During this period, Pakistan was again in the midst of power crisis due to a rise in excessive electricity consumption as compared to economic growth because of increasing urbanization, industrialization and rural electrification. Also, Pakistan faced an unstable political environment. A number of projects started during this period which not only met the demand but also created surplus in the system.	4th–The government was aware of the energy shortages to sustain the economic growth rate. But only short-term solutions were taken.	5th–High economic growth once again created energy crisis in Pakistan. This time, the crisis was not only in power but also in gas and oil sectors.



Regression Analysis on Energy Consumption and Economic Growth

The regression results of the primary energy supply, along with other independent variables, on per capita GDP are as below:

$$GPCY = 0.261 + 0.006GPRI + 0.352GMYS + 0.278GPPEC + 0.036GTM + 0.223GPWA + 0.121GPD$$

(0.445) (0.305) (2.502)** (2.920)* (4.499)* (1.888)*** (1.679)***

R-square = 0.521 *DW-statistic = 1.913*

F-statistic = 4.342 (0.002)

Where,

GPCY	=	Growth Rate of Per Capita GDP
PRI	=	Growth Rate of Private Investment (as percentage of GDP)
GMYS	=	Growth Rate of Mean Years of Schooling
GPPEC	=	Growth Rate of Per Capita Primary Energy Consumption
GTM	=	Growth Rate of Telecommunication Services
GPWA	=	Growth Rate of Per Capita Water Availability
GRD	=	Growth Rate of Road Length

Note that all variables are in growth rates. Values in parentheses are the t-ratios. The asterisks *, **, *** indicate that the coefficients are significant at the 1%, 5% and 10% level of significance respectively. The estimated model passed the Wu-Hausman test of endogeneity against the test hypothesis that primary energy is endogenously determined. The period of analysis is from 1976 to 2011 and the model has been estimated using the technique of OLS.

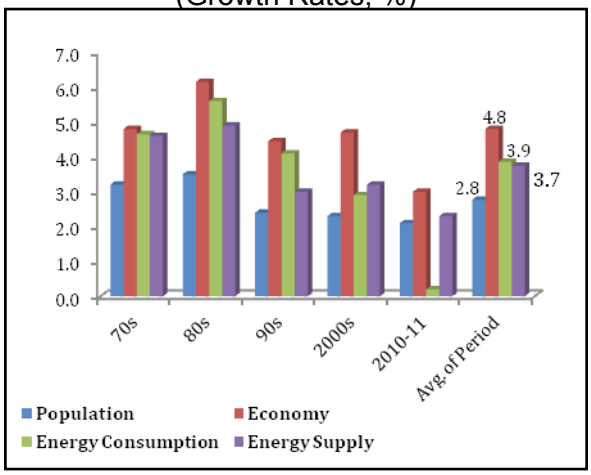
Source: Own estimates from the database of Pakistan Economic Survey, Hydrocarbon Development Institute of Pakistan, International Energy Agency and World Development Indicators.

The figure also shows the trends (polynomials) of energy consumption and economic growth. We observe that there is a significant positive relationship between the two. The correlation coefficient of this relationship is 0.559, which is significant at the 1 percent level of significance. Also, in Exhibit 1, regression analysis on how energy consumption impacts the growth rate has been performed. Besides energy consumption, other infrastructure variables are also included, for example, access to telecommunication, water availability and road lengths. To control the structure of the economy, two variables are included in the regression analysis. These are: the mean years of schooling of adult population (proxy for skilled labor) and private investment as percentage of GDP. All variables are in per capita growth rate terms, except the variable on road length and private investment as percentage of GDP. Detailed methodology of the regression analysis is given in the Technical Appendix of Chapter 1. From the regression analysis we can also see that there exists a strong link between energy availability and economic growth. The elasticity of energy availability is 0.5 percent which means that, on average, 1 percent increase in growth of per capita energy consumption leads to 0.5 percent increase in per capita GDP growth rate. Other infrastructure variables also impact the GDP per capita growth rate positively and significantly. Of the controlled variables, growth rate of private investment as percentage of GDP is insignificant although its direction of impact is positive. Overall, the regression gives a good fit to the data as can be seen from the value of R-square, F-statistic, and DW-statistic. The conclusion from these two analyses is that the story of the current energy crisis is the same as that of previous energy crises. During the period 2003-2007, remarkable economic progress by Pakistan made millions of Pakistanis enjoy a major uplift in their material well-being. There was a noticeable increase in the conspicuous consumption of masses and in the growth of industrial sector and commercial activity across the country. This resultant increase in economic activity coupled with a growing population

placed greater stress on the economic infrastructure, mainly energy. But the energy sector was too incapacitated to facilitate such an increase in demand mainly because no adequate provisions were made to cater for the future growth in energy demand.[7] As a result, the situation of energy in Pakistan suffered a substantial deficit, both in terms of capacity as well as inefficiency in the delivery of services.

In the history of economic development of Pakistan, energy supply has mostly been less than the energy consumption and economic growth rate (see Chart 1.2). Chart 1.2 presents decade-wise growth rates of population, economy, energy use and energy supply since 1971 to 2011, which are 2.8, 4.8, 3.9 and 3.7 respectively. Thus, on average, energy supply is less than energy consumption by 0.2 percentage points and 0.9 percentage points from the economic growth. The result of this is the different epochs of economic growth. Another important determinant of energy demand is the rapid increase in population growth rate which led to a rapid increase in per capita energy use and less availability of per capita energy. *These long-term developments are a major factor behind the present energy crisis like in the past, and highlight the policy failures of many governments that have taken charge since independence.*

Chart 1.2: Long-term Trends in Population
Growth, Economic Growth, Energy Use, and Energy Supply
(Growth Rates, %)



Source: Own calculations using databases of Pakistan Economic Survey, Hydrocarbon Development Institute of Pakistan, International Energy Agency, and World Development Indicators.

1.3 Multidimensional Cost Of Energy Crisis

Since the energy crisis that we are facing is multidimensional in nature, it also has multidimensional impacts on the lives of the people of Pakistan. Its strongest impact is on the economy of Pakistan and, therefore, on the social well-being of people. GDP growth rate is low due to the forced shut down of a large number of industrial units. This has led to massive unemployment in the labor force, and made us less competitive internationally. This phenomenon also decreased the average productivity of the people. There is hardly any growth in GDP per capita in the last five years while the average annual growth rate was only 0.2 percent[8]. This means there is no improvement in the economic well-being of people in the last five years.

Secondly, Pakistan is experiencing capital flight as a lot of firms have quit business from Pakistan and are moving to other countries. This is because in the present energy crisis, there is not only a shortage of energy but also an increase in the prices of power, oil and gas due to the tariff ad-

justments for cost recovery. This phenomenon has also led to double digit inflation in general and specifically in food because the cost of production and transportation has increased manifolds. In 2007-08, Pakistan had the highest double digit inflation rates for almost all products especially food commodities. Moreover, a major portion of the public revenue goes to this sector as subsidies which have created the problem of fiscal space for the government (MoF, 2012).

Large-scale food insecurity can hit the country due to a decrease in the production of food crops. This can happen because of two major reasons. First, due to higher prices and shortages of energy products, many tube-wells are non-operational. Second, the rise of energy prices has led to an increase in the prices of fertilizers. Farmers who use tube wells for irrigation are unable to operate them and suffer shortages in water supply. At the household level, people are unable to perform their routine tasks properly because of unavailability of energy and experience a severe deterioration in their quality of life. Offices, shops and other establishments are also unable to function effectively and there is a general loss of productivity. Altogether, the energy crisis can be classified as one of the primary sources of insecurity for the masses today in terms of the impact on their economic well-being and quality of life.

As a result of such an acute shortage of energy, there are riots and protests by people storming the streets and roads causing lot of damage to public property and constituting a threat to the general law and order situation of the country. The economic cost of power outages only in terms of output lost is over 7 percent of GDP (IPP, 2013). This has impacted the social life severely thus making our poverty reduction efforts inappropriate and increasing the crime rate (Qureshi, 2007). Lack of access to energy services places a disproportionate burden on women because housewives are not able to perform their work properly and timely, thus affecting welfare of children (USAID, 2007). Also, there is an increasing social insecurity as basic services like education and health have been disrupted.

1.4 Summary And The Way Forward

The purpose of this chapter was to study the energy sector of Pakistan in the historical context using past trends of supply and consumption of different sources of energy. These analyses helped identify the wrongdoings of the past that led to the present energy crisis that is much severe than the previous instances. The problems and issues faced currently by the energy sector require an extensive analysis of the structure of the energy sector in Pakistan. Although these issues and problems have been highlighted in the previous sections but will also be analyzed extensively in the subsequent chapters.

An attempt will be made to diagnose the extent to which the energy shortage is due respectively to natural causes and to what extent manmade causes are involved, especially with regard to the problems of governance. A number of questions will primarily be focused in the course of the study, which range from the structural constraints to the governance and management of the sector. For example, why governments' followed a roller-coaster course and different administrations at different points in the country's history failed to develop strategies that would ensure a sustained supply of energy against the rising demand? Why the sector was mostly handled by ad hoc and infeasible solutions? Why decisions of privatization did not fulfill the desired results of competitiveness and efficiencies, and in fact brought inefficiencies in the sector? Given this, the purpose of this study is to look into the nature of these issues to identify the root causes of the current energy crisis that has emerged overtime and to give short-, medium- and long-term solutions for policy initiatives to an energy surplus Pakistan.

Objectives of the Study

Following are the main objectives of the study:

- To analyze the evolution of system and market of Pakistan's energy sector especially after the unbundling of WAPDA and its impact on the regulatory reforms, institutional capacity, planning and governance of the sector. Studying these factors as the prime reasons for the present energy crisis in Pakistan is the main objective.
- After the implementation of the 18th Amendment, the provinces were given more autonomy; how will this impact on the sector and provinces, especially the Punjab province? Does Punjab have enough capacity to handle the sector and resources to fulfill the energy needs of the Punjab's economy?

II. Energy System of Pakistan: Structure of the Sector and Market

II. Energy System of Pakistan: Structure of the Sector and Market

For a deep understanding of energy crises in Pakistan, it is crucial to thoroughly understand and analyze the energy system of Pakistan and its dynamics with regard to the energy markets and the overall economy. A fundamental understanding of it is very important to comprehend the root causes of all energy crises in Pakistan. In Chapter 1, we discussed the historical reasons for energy crises in Pakistan. The focus of this chapter is to analyze the evolution of energy system, its structure and market especially after the unbundling of WAPDA and their impact on the institutional capacity, regulatory reforms, planning and governance of the sector. Chapter 3 will focus on the institutional capacity, regulatory reforms, planning and governance of the sector.

The energy system of Pakistan revolves around the generation, suppliers and distribution system and the government acts both as a producer and regulator. The public and private entities both play an important role with regard to the generation and supply of energy and the process of energy transformation from generation to distribution follows a proper supply-chain mechanism. At each step of this supply-chain, there exist some rules and regulations which are governed by a system. Therefore, it is important to analyze whether this structure of supply-chain is providing energy in a way that is fulfilling the needs of the consumers efficiently? Is it providing energy at a desired price and according to the needs of Pakistan? Does the system have enough capacity for this?

Additionally, we need to have a better understanding of the energy market to understand the market deficiencies in the recent energy crisis. What is the behavior of the domestic energy market: is it competitive, aggregated or disaggregated, integrated or disintegrated? Is it working in accordance with the behavior of the local people? How does the supply-chain work? Does anyone have an unbalanced power within this supply chain, if so, who does? What are the problems associated with the current structure of the energy sector? What is the role of the private entities in the sector? Did they bring in competitiveness or inefficiencies in the sector? These are the type of questions that will be answered in this chapter. Following the analysis of Chapters 2 and 3, we will be able to see how the system is the main reason of all the problems that this sector is facing at the moment.

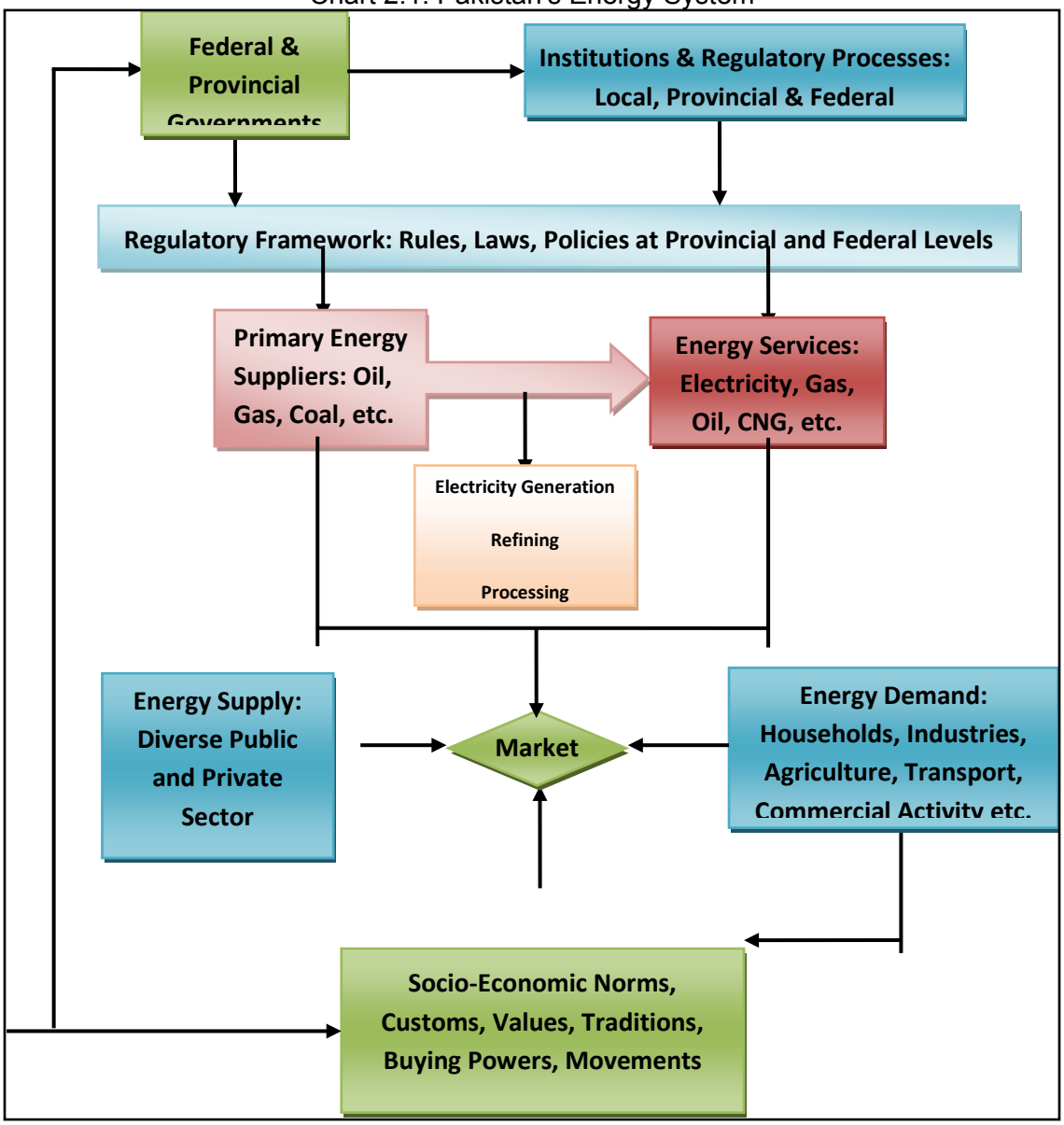
2.1 Energy System Of Pakistan

Studies on the energy sector of Pakistan have mostly touched only one aspect of the energy system rather the system as a whole. Also, these studies have focused on the current system rather on the evolution of the system. However, to understand the energy system of Pakistan and the issues associated with it and to answer the questions posed above, we need to explore and understand the system as a whole and also need to study it from a historical evolution point of view. This will give us a better understanding of the present energy crisis.

Prior to 1985, the energy system of Pakistan mainly consisted of the public sector. However, it was becoming difficult for the Government of Pakistan (GoP) to handle and finance the sector and, therefore, it decided to bring the private sector in. Thus, as a first step, the GoP announced and offered lucrative incentives to potential investors. As a result, in 1985, a 1292MW Hub Power Project (HUBCO) was initiated as a major power project which was unique in Pakistan and the world as well. However, its installation process was very slow due to several reasons and it took the project 12 years to fully establish itself in 1997. Following this, the government introduced a

number of policies in the early 90s and later to bring the private sector in as a major player in power production.

Chart 2.1: Pakistan's Energy System



The present energy system of Pakistan consists of the following components: primary energy suppliers, generation to energy services, transmission, distribution and final consumers. Like any other commodity, the demand and supply of energy is determined through a market which is highly intervened and regulated by the government. Chart 2.1 broadly shows how the energy system works in the Pakistani context and how different components within this system interact. As can be seen from the Chart, every component plays an important role in the energy system of Pakistan. In this section, we first explain how the different components of the system interact and then in the subsequent subsections we present detailed descriptions of each of the components. Broadly speaking, we discuss how the system flows, how different components impact each other,

what are their roles and what are the issues associated with them.

Government is the most important component of the energy sector of Pakistan. It plays a very important role in the generation and distribution of the energy. The GoP impacts the energy market through rules, regulations and laws formed by the public sector institutions and organizations. These mainly include the Ministry of Water and Power, and the Ministry of Petroleum and Natural Resources. All other entities come under these two institutions that mainly formulate the energy policy and the development plans of the sector. They also control the energy market through regulatory processes. The first intervention of the government comes directly as a supplier of the primary energy both from domestic resources and through import to the generation companies. *This intervention comes in the form of giving subsidies to the energy suppliers.*

In the second stage, primary energy is converted to energy services primarily in three forms: electricity generation, refining and processing. During the conversion process, primary energy is supplied to various plants (heat, power, gas, petrochemical, liquefaction, etc.), oil refineries and some of it used by the energy industry itself. However, a major part of energy is lost during the conversion process. In 2012, this was estimated at over 3 percent. The oil companies are mainly controlled by the Ministry of Petroleum and Natural Resources and regulated by the Oil and Gas Regulatory Authority (OGRA). The generation of electricity is done by various power generation companies, both public and private. The public sector mainly produces electricity through hydel sources like Tarbela and Mangla dams etc. and partly through thermal resources via generation companies (GENCOs). The private sector, however, produces electricity through various GENCOs. The main GENCOs operative in Pakistan include Independent Power Producers (IPPs) like HUBCO and Kot Addu Power Company; Karachi Electric Supply Company (KESC), a vertically integrated company; and Captive Power Producers (CPPs). The generation activities of all these organizations is overseen and managed by the Pakistan Electric Power Company (PEPCO). PEPCO is an umbrella institution and almost 90 percent of the energy generation falls under it. This implies that PEPCO has a very strong influence within this system and on the energy market as a whole. The rest of the power generation falls under the control of other institutions. All of the generated energy, both by public and private companies, is purchased by a single buyer, the Central Power Purchasing Authority (CPPA).

In the third stage, the generated energy is transmitted to energy services. This is mainly done through distribution companies which include National Transmission Distribution Company (NTDC) and KESC. The NTDC is further divided into a number of subsidiaries. These are power distribution companies (DISCOs) which include LESCO, QESCO, PESCO, IESCO, GEPCO, FESCO, MEPCO, HESCO, KESCO and SEPCO. The main consumers of energy services are domestic, commercial, industrial, transport, agricultural, public lightening, etc. Details of their shares in the energy consumption are given in Table 1.2.

The interaction of suppliers and consumers happens through the energy market as shown in Chart 2.1. *Another important point to be noted here is that although market forces (supply and demand) work in this market, the determination of prices of energy products does not happen freely. This is because the government heavily influences this market and bears part of the final price by paying subsidy on the final tariff.* The main reason for this is that a bulk of the energy consumers in Pakistan cannot afford it at the prices if determined by free market forces since a vast majority of our population is poor. Therefore, the government bears a major portion of the final price. This impact of socio-economic factors is shown in Chart 2.1. We observe that it not only impacts the

market forces and working of the energy market but also has a heavy influence on the formulation of the energy policy. The government has to bear part of the final price to prevent possible unrest in the country due to high prices as such a situation will have huge socio-economic costs (as given in Section 1.3 of the report).

After describing the energy system of Pakistan briefly, the subsequent sections analyze the sub-components of the system in detail.

Primary Energy Suppliers

The primary energy suppliers in Pakistan include oil refineries such as Attock Refinery Limited (ARL), Pak-Arab Refinery Ltd. (PARCO), Byco Petroleum Pakistan (Byco), Dhodak Refinery, ENAR Petrotech Refinery, National Refinery Ltd. (NRL) and Pakistan Refinery Ltd. (PRL). The oil and gas exploration companies mainly include the Oil and Gas Development Company Ltd. (OGDCL) and Pakistan Petroleum Limited (PPL). The distribution companies in the gas sector include South Northern Gas Pipelines Ltd. (SNGPL) and Sui Southern Gas Company Ltd. (SSGC); while those in the oil sector are Pakistan State Oil (PSO) and Shell Pakistan. The main function of these companies is to provide primary energy to generation companies which through the conversion processes convert the primary energy to energy services as described above.

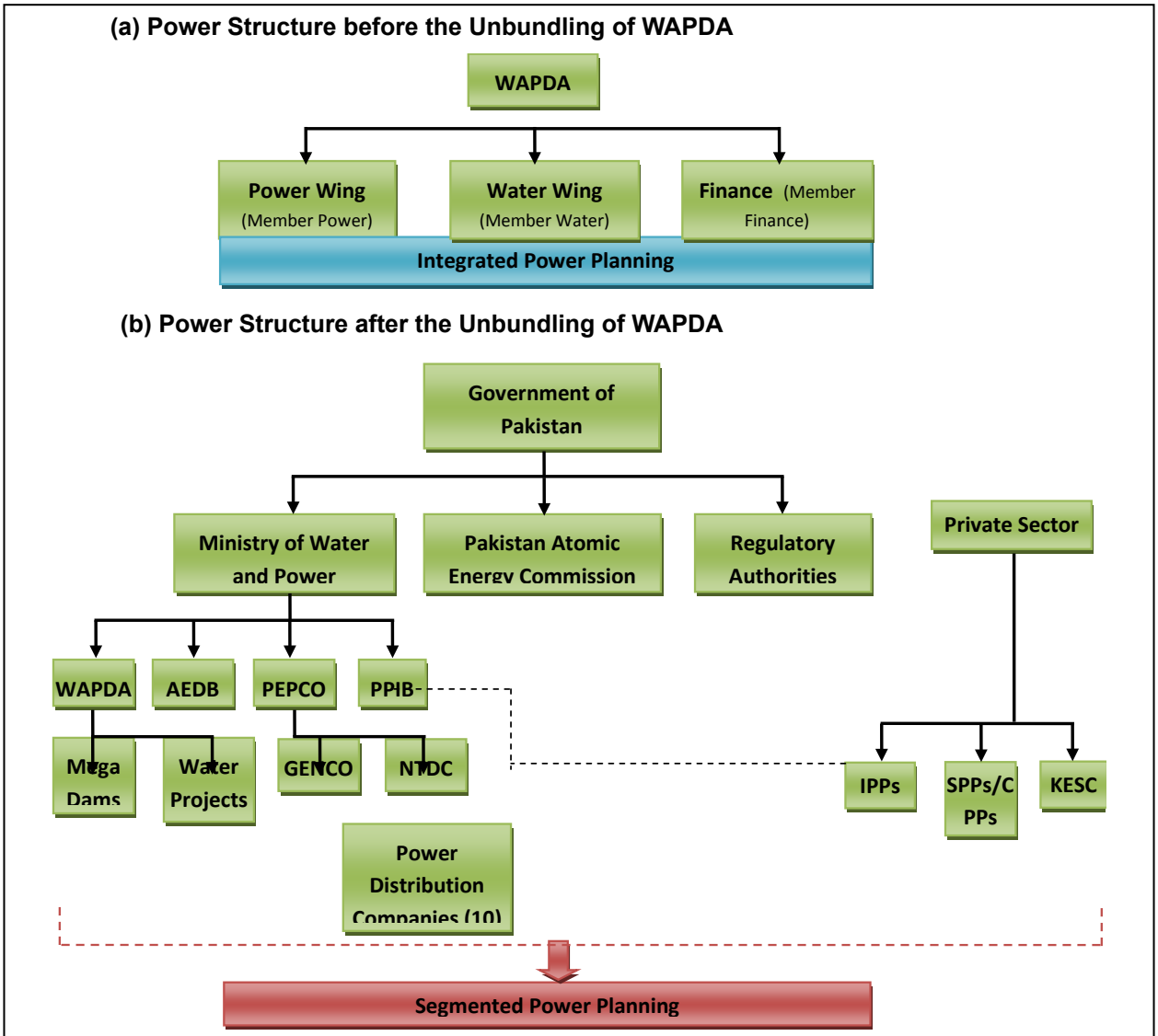
Generation of Energy: Structure and Capacity

Energy in Pakistan is generated by both public and private companies but most of the energy comes from public limited companies. The long term trends of different sources of energy supply are given in Table 1.1. The main focus of this section is to analyze the structure and capacity of the energy sector especially of the power sector since, in Pakistan, the power sector makes most of the energy sector and this is where most of problems lie. Our analysis will cover the situation before and after the unbundling of the Water and Power Development Authority (WAPDA). These structures are shown in Chart 2.2. As described above, before unbundling, WAPDA was the main organization responsible for the generation and distribution of power. It was established in 1958 as a semi-autonomous body for the purpose of coordinating and giving a unified direction to the development of schemes in water and power sectors, which were previously being dealt by the respective provincial Electricity and Irrigation departments. Initially, WAPDA had a very simple structure and consisted of one chairman and three members: power, water and finance. Member Power was responsible for the whole power sector, Member Water oversaw all water projects and Member Finance prepared the financial plans. Further, the water wing was responsible for the generation of power from hydel sources while the power wing was responsible for the generation of power from thermal plants and the transmission of electricity. Member Power also oversaw the department of designing and planning which forecasted the future requirements based on the power load collected from different area boards across the country. Well developed software and proper econometric techniques were used for these plans which were regularly updated based on new information.

The main characteristic of this energy system was that the planning was integrated, coordinated and properly implemented. The system was also well-equipped with a strong network of power transmission lines across the country. Similarly, the distribution of electricity was efficiently coordinated and managed by the 12 Area Electricity Boards (AEB), headed by one Chief Engineer (also Chairman Area Electricity Board). The AEBs were established under the AEB scheme in

1982 in order to provide more autonomy and representation to provincial governments, elected representatives, industrialists, agriculturalists and other interest groups in the functions of the AEBs. Under this system there was hardly any load-shedding except in mid-80s for one to two hours during peak hours in the evenings. In 1994, the Planning Department of WAPDA prepared a National Power Plan in collaboration with Acres International Limited, a Canadian power sector Company. This was the most cost effective power plan prepared on the basis of indigenous resources, mainly, hydro-electricity, gas, renewable sources and nuclear energy. However, this plan was not used because of a change in the structure of the power sector at that time. This structure remained intact till 1994 (Zaidi, 2013).

Chart 2.2: Structure of the Power Sector before and after the Unbundling of WAPDA



Note that WAPDA is Water and Power Development Authority, AEDB is Alternative Energy Development Board, PEPCO is Pakistan Electric Power Company, PPIB is Private Power Infrastructure Board, CHASNUPP is Chashma Nuclear Power Complex, KANUPP is Karachi Nuclear Power Plant, NEPRA is National Power Electric Regulatory Authority, GENCO is Generation Company, NTDC is National Transmission and Distribution Company, IPP is Independent Power Plant, SPP is Small Power Producer, CPP is Captive Power Plant and KESC is the Karachi Electricity Supply Company.

Source: Extracted from the presentation on Institutional Bottlenecks and Management Issues in the Current Energy Crisis delivered by Mr. Hassan Jafar Zaidi at the Centre for Public Policy and Governance (CPPG). The above diagram is a modified version of the original diagram.

In the early 90s, there was shift in global thinking towards economic development with hype of discussions on global village, globalization and the market economy. This was the time when we saw a structural change in the power sector of Pakistan. The idea behind this change was to bring in more private investment, increase the role of private investors in the sector, and curtail public investment at the same time. The first visible step in this direction by the GoP was to unbundle WAPDA. The process of unbundling started in 1994 and completed in 1998. After unbundling, WAPDA came under the direct control of the Ministry of Water and Power which was established in 1977. Furthermore, the government introduced the Power Policy of 1994 (the policy will be examined in detail in the Chapter 3) which was in negation to the Integrated Power Plan of 1994. The impetus of this policy was to restructure the entire power sector in the country in line with the Strategic Plan of 1992, approved by the cabinet committee. Its main points were[9]:

- De-regulation of the power sector
- Promotion of IPPs
- Restructuring of WAPDA
- Privatization of select corporate entities

The result of the implementation of the Strategic Plan was that WAPDA was devolved into 14 companies: 3 GENCOs, 10 DISCOs (initially there were 8 DISCOs, 2 were added overtime), and the National Transmission and Distribution Company (NTDC). WAPDA was left only with the responsibility of hydel power generation (mainly mega dams) and water management issues. On the other hand, to control the generation and management of thermal power, another institution, Pakistan Electric Power Company (PEPCO), was created in 1992. PEPCO is principally responsible to oversee the operations of the 3 GENCOs and the NTDC. The NTDC was incorporated in 1998 with the objective to take over all properties, rights and assets obligations, and liabilities of 220 kV and 500kV Grid Stations and Transmission Lines/Network owned by WAPDA. Currently, it operates and maintains twelve 500 kV and twenty-nine 220 kV Grid Stations, 5077 km of 500 kV transmission line and 7359 km of 220 kV transmission line in Pakistan.[10] Its main functions are:

- Central Power Purchasing Agency (CPPA)
- System Operator
- Transmission Network Operator
- Contract Registrar and Power Exchange Administrator

Using its first authority under the CPPA, the NTDC procures power from GENCOs, Hydel and IPPs on behalf of DISCOs for delivery through 500 kV, 220 kV and 132kV network. The DISCOs, which were initially the Area Electricity Boards, were responsible to supply power to the end consumers. These AEBs from which DISCOs were created were each initially headed by a chief engineer. Now, one DISCO is headed by a chief executive, 7-8 general managers and under each general manager there are chief engineers. Also, the Board of Directors of each DISCO consists of several members. The employment of all these top level management positions was highly politically motivated. Therefore, the unbundling of WAPDA resulted in overstaffing on key positions, thus making the top tier of the organization very heavy. This had a negative impact on the capacity of the power sector. Similarly, the unbundling also negatively affected the planning system of the power sector. Under the new system, planning became disaggregated and as a result, no proper plan was prepared for the increasing electricity requirements of the country (this issue is discussed in detail in Chapter 3).

However, this change in the structure of the power sector was welcomed and supported by donor

institutions, especially the World Bank (WB) and the Asian Development Bank (ADB). The aim of this transition was to install corporate and business culture through adopting good business practices, enhancing productivity and efficiency including customer orientation and service culture, improving quality of services by setting performance targets, and reducing costs, theft and wastage. This would be based on extensive use of information technology, management information systems, monitoring and prudent decision making[11] under the vision *'to make Pakistan Power Sector customer friendly, efficient, able and responsive in meeting the electric energy requirements of industry, business and domestic customers, and move to an energy sufficient model from the current energy deficient scenario, on commercially viable and sustainable basis, in order to support the high growth economy and to meet the government's objective of* ***Power for All.'***

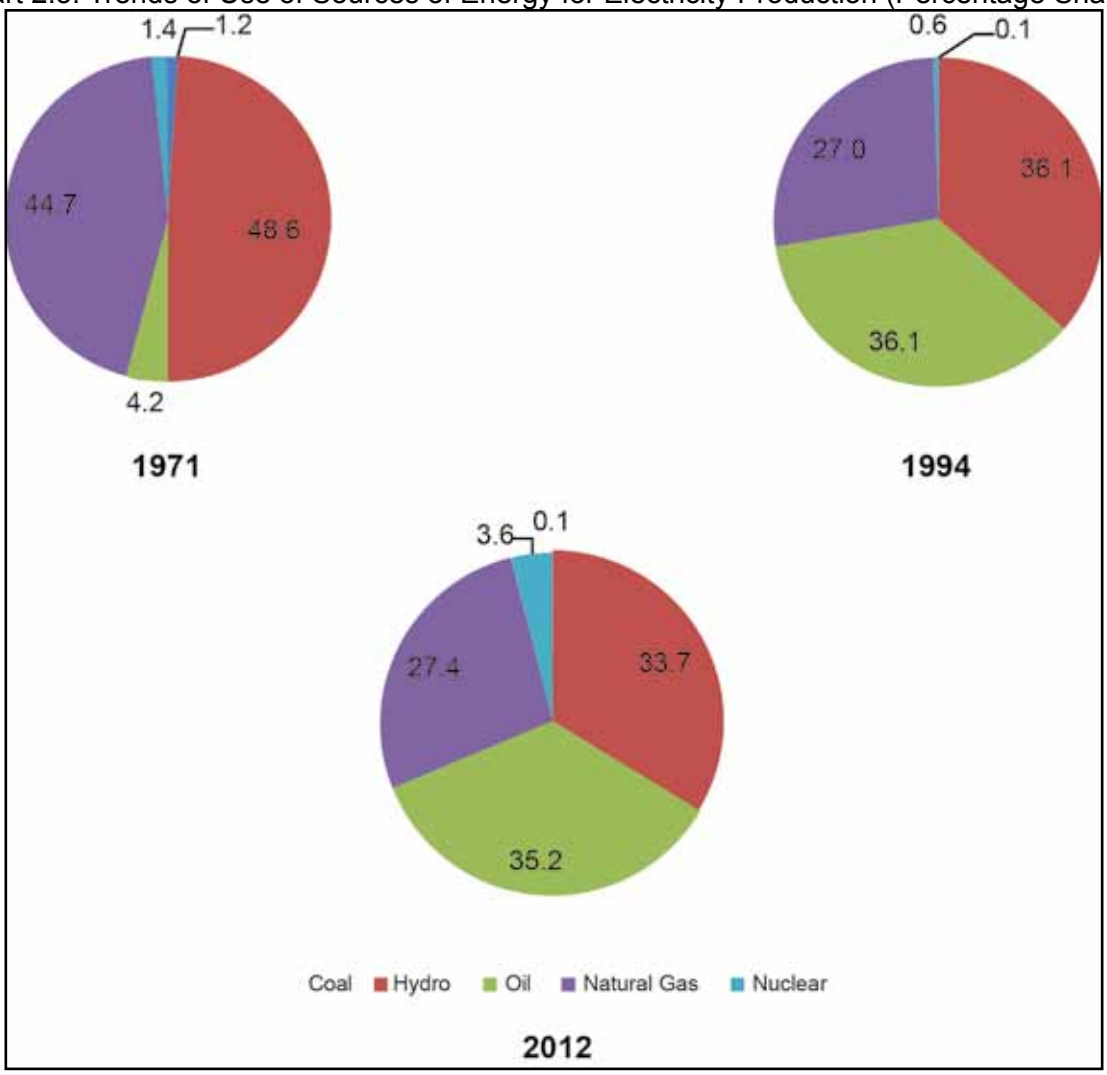
Now, after such a restructuring, we face a number of questions like why the power sector has not been able to fulfill the needs of the country. Why the supply-demand gap has increased instead of decreasing? Why the system has become more inefficient and T&D losses have increased? Why the cost of production has increased instead of decreasing? This study uncovers the following reasons:

Firstly, the plan was not implemented in its true spirit. The main purpose was to privatize the power sector with minimum interference and regulation of the government, particularly the DISCOs but until now not a single DISCO has been privatized. In 1992, the government announced plans to privatize WAPDA's thermal plants and Area Electricity Boards, however, in 1994 legal and political obstacles prevented the implementation of this policy. Secondly, no major project was undertaken after the restructuring of the power sector. Only two major projects were installed in the private sector as IPPs. These are Hub Power Project with a capacity of 1292MW and Uch Power Limited with a capacity of 586MW. All other projects in the private sector were of a smaller capacity and there was no increase in hydel capacity as no dam was built after restructuring.

This was the starting point of the many crises within the power sector that Pakistan is facing at the moment. Under the Energy Policy of 1994, the IPPs are allowed to use any form of energy as input to produce electricity. The consequence of this policy was that the IPPs used more of oil and gas as sources of electricity production. As a result, use of these sources of energy in electricity production increased drastically. This changed the whole pattern of shares of different energy sources (see Chapter 1 for details) and increased the cost of production gradually. Thus, introduction of IPPs into the system forced the sector to utilize domestic resources sub-optimally, exposing the country to two main risks: first, dependence on gas at a time when reserves are depleting implies severe constraints in the medium- to long-run and with an urgent need to switch to other sources; second, the growing reliance on thermal power has exposed the economy to 'international oil price shocks'.

This pattern is visible in Chart 2.3. In 1971, oil was only 3.6 percent of total electricity production while gas was 44.7 percent. At that time electricity mostly came from hydro sources and its share was almost half of the total electricity generation. This pattern changed in 1994 and the contribution of oil increased to 30.8 percent while that of natural gas decreased to 26.8 percent. Similarly, the share of hydroelectricity also decreased to 40.7 percent. These shares have seen drastic changes in 2012. For example, the share of oil increased to 35.2 percent, the share of gas is 27.4 percent and the share of hydroelectricity is 33.7 percent. These changes clearly show how Pakistan inefficiently utilized resources to produce electricity. This pattern of change in sources also has many repercussions on the Pakistani economy.

Chart 2.3: Trends of Use of Sources of Energy for Electricity Production (Percentage Shares)



Source: Database of International Energy Agency.

The first is the increase in the cost of production of electricity and ultimately the prices for the final consumers. Since the price of oil increased overtime in the international markets, we also observe a price increase in the domestic market. This increase in price is not in the control of domestic authorities because oil is mostly imported. The price upsurge was also the starting point of another problem; circular debt. As the prices of energy products increased overtime, the successive governments initially did not pass on the full cost of electricity generation to the final consumers. However, now, the price increase has reached a level that is unsustainable and is causing fiscal problems to the government. Another aspect of the present energy crisis is that the demand for energy products increased geometrically while the supply was added bit by bit. This led to a gradual increase in the gap between the demand and supply of power. It is important to note that the only significant project during this period was the Ghazi Barotha Hydropower Project.

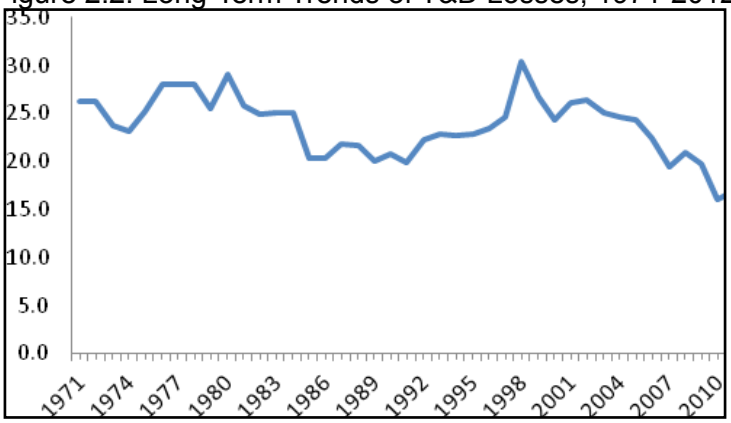
2.2 Performance Of The Distribution Companies (Discos)

The Distribution Companies (DISCOs) were primarily responsible for supplying electricity to final

consumers and collecting bills from them. As discussed earlier, these DISCOs do not have the capacity to run a big company because they were drastically converted from the AEBs. Originally, these only handled 12kV transmission lines while a transmission line of 132kV and 500kV can only be handled by the core department in the NTDC because it has the kind of capacity required to handle such transmission lines. Additionally, the DISCOs do not have proper departments for designing and planning the power load. Although the DISCOs have proper infrastructure and technology available to them, they lack the requisite training and technical knowledge to run these. To make matters worse, their staff lacks the motivation to learn and operate these technologies. We observed that to date, these companies do not have the capacity to work as a proper company because of the aforementioned reasons.

Figure 2.2 and Table 2.1 show the performance of the distribution companies. Figure 2.2 shows the T&D losses over a long period of time. It is important to note that the T&D losses went up sharply after the unbundling of WAPDA. Similarly, the recovery of fuel bills too decreased substantially. In 2012, the total recovery of bills was 86 percent. At the individual DISCO level, the recovery rate in all DISCOs in Punjab was much better than other provinces with a recovery rate of 97 percent. This was followed by Khyber Pakhtunkhwa (KPK) where the recovery rate was 68 percent. This is mainly because of low level of collection

Figure 2.2: Long-Term Trends of T&D Losses, 1971-2012



Source: WDI and NEPRA, State of the Industry Report 2012.

in TESCO. The total amount due for collection was Rs. 15,240 million of which only Rs. 963 million were collected; 6 percent recovery rate. Sindh fell at the third position with only 60 percent recovery rate of the total bill in 2012 (See Table 2.2). Balochistan had the lowest bill recovery rate; 36 percent of the total recoverable of Rs. 34,027 million in 2012.

Table 2.1: Total Units Lost by DISCOs, 2012

(Rs. Million)

Company	Billing Collection (% of Actual Collection)	Units Lost in T&D (GWh)	Units Lost in Billing Collection (GWh)	Total Units Lost	
				GWh	% of Total Purchased Units
LESCO	96.1	2,260	560	2,820	16.9
GEPCO	98.5	782	95	877	12.6
FESCO	98.5	1,051	133	1,184	12.3
IESCO	95.8	793	313	1,106	13.3
MEPCO	97.2	2,235	281	2,516	20.2
Punjab	**97.0**	***7,121***	***1,394***	***8,515***	***15.7***
PESCO+ TESCO	67.9	3,968	2,267	6,235	56.5
Khyber Pakhtunkhwa	**67.9**	***3,968***	***2,267***	***6,235***	***56.5***
HESCO	69.1	1,298	1,044	2,342	50.1
SEPCO	50.9	1,742	1,310	3,052	69.2
Sindh	**60.4**	***3,040***	***2,396***	***5,436***	***59.8***
QESCO	36.2	1,078	2,609	3,687	71.4
Balochistan	**36.2**	***1,078***	***2,609***	***3,687***	***71.4***
KESC	76.6	-	-	-	-
TOTAL	**86.0**	**15,205**	**8,983**	**24,188**	**30.5**

Source: NEPRA (2012).

Also given in the Table are the units lost due to the T&D losses and those lost due to under recovery of the bills by DISCOs. This indicator shows the poor performance of the DISCOs. Although DISCOs in Punjab have relatively lower level of losses, these are still very high as compared to what these should have been. On average, Punjab lost 16 percent of the purchased units. The highest level of units lost is in Balochistan; 71 percent of actual units purchased. After this, Sindh and KPK have the highest levels of units lost. In 2012, Sindh lost 60 percent and KPK lost 57 percent of the purchased units. Overall, on average, all DISCOs except KESC lost 31 percent of the total units purchased.

Table 2.2: Performance of the DISCOs in Billing Collection, 2012

(Rs. Million)

Company	Billing	Collection	Percentage
LESCO	157,111	151,033	96.1
GEPCO	61,591	60,643	98.5
FESCO	85,562	84,240	98.5
IESCO	74,988	71,875	95.8
MEPCO	98,264	95,559	97.2
Punjab	**477,516**	**463,350**	**97.0**

PESCO	64,354	53,080	82.5
TESCO	15,240	963	6.3
Khyber Pakhtunkhwa	**79,594**	**54,042**	**67.9**
HESCO	32,054	22,155	69.1
SEPCO	29,497	15,007	50.9
Sindh	**61,551**	**37,162**	**60.4**
QESCO	34,027	12,301	36.2
Balochistan	**34,027**	**12,301**	**36.2**
KESC	58,778	45,000	76.6
IPPs	486	441	90.8
TOTAL	**711,952**	**612,298**	**86.0**

Source: NEPRA (2012).

The low billing recovery and high level of units lost by DISCOs are the main contributors to the circular debt at the moment. The question therefore arises as to why the performance of DISCOs deteriorated to such a low level? Our research indicates that there are many reasons to it. To begin with, there was an increase in the cost of electricity production due to an increase in energy prices internationally. Secondly, we witnessed a change in the structure of the power sector. Before the unbundling of WAPDA, electricity was sold at the cost of production and the recovery rate was high enough to cover the costs. But after the unbundling, the recovery rate deteriorated quite substantially mainly because of institutional capacity. As reflected in Table 2.1 & 2.2, the performance of DISCOs varies in billing collection and loss of purchased units. This raises another issue which is related to the consumer market of electricity, i.e., the main reason for different percentages of billing recovery across DISCOs and provinces is not because these DISCOs differ in the level of technology or that they use different mechanisms for bill collection. It is because consumers' behavior and attitude towards payment of bills differ greatly across various regions in Pakistan. In the Punjab province, the consumers are much more responsible in paying off their dues and the rate of power theft is very low mainly because of better law and order situation, but this is not the case with other provinces. *Hence, it would not make any difference to the rate of recovery even if we swap the management of Punjab's DISCOs with DISCOs of other provinces.*

III. Institutional Capacity, Regulatory Reforms, Governance Structure and Planning in the Energy Sector

III. Institutional Capacity, Regulatory Reforms, Governance Structure and Planning In the Energy Sector

This chapter focuses on the issues that are born out of the energy sector itself due to its long-term neglect and negative developments within the sector especially after the unbundling of the power structure. The main focus will be on the institutional capacity; regulatory reforms; issues of governance, management and coordination; and the fate of the short- to long-term planning horizons of the sector.

The specific questions that we will address during the course of this Chapter are: What happened to the institutional capacity of the organizations within the energy sector? Does the staff running these organizations have technical & management knowledge and experience? Does any planning exist in the sector? Who is responsible for the long-term planning of the sector and what is role of each organization in the development plan? What are the main coordination issues between organizations like GENCOs, DISCOs etc. and how can these be resolved to improve the efficiency of the sector? What are the management and governance challenges in these organizations? Do they pertain to human resources, organization structure or incentive structures? Is the poor performance of regulatory bodies NEPRA and OGRA due to policy complications or are there other reasons to it?

3.1 Institutional Capacity Of The Sector

The institutional capacity of the energy sector has negatively impacted overtime, especially, after the structural change in the sector in the 90s. Not only has this change introduced unanticipated issues but has also deteriorated the human and physical resources, level of staffing, skills and analytical abilities quite significantly. The main reason for this is the heavy top tier of the sector's hierarchy, hiring for which was mostly politically motivated. Most of the top management did not belong to the field nor had the technical knowledge or expertise to run the sector. Part of this issue was discussed in Chapter 2 in the case of DISCOs. Other organizations within the sector also met a similar fate.

Presently, the human resources employed in the sector do not have the necessary technical knowledge mainly because they lack the necessary background education or qualifications and are inexperienced in the field. Moreover, the top management of these organizations keeps on changing mainly due to political uncertainties and hence the staff does not have the institutional memory. An example of the lack of skills of the staff would be that a very common issue in the oil and power sector is the determination of tariff rates i.e. the price the government should be charging for oil and power from different consumers. We observed that there is an absence of a concrete mechanism for doing this mainly because NEPRA lacks technical staff and personnel. Therefore, tariffs are determined without any proper mechanism, process or model and these are mostly politically motivated given the socio-economic conditions of the country. As explained in Chapter 2, the tariff rates were mostly kept far below the market price and this trend was followed for a long period of time. One of the main reasons for this is the low income of households but another main reason is the slow adjustment of international market prices to the domestic prices mainly because of the democratically elected governments.

3.2 Regulatory Reforms

Over the decades, several policies have been introduced in the energy sector of Pakistan. The main reasons for these are the uncertain economic conditions, highly unstable political eras and structural changes in the sector's structure. This section provides the salient features of all these policies and critically analyzes them. The main purpose of doing this exercise is to see up to what extent these policies were rightly introduced, implemented, what are their impacts on the energy sector and to what extent these have been responsible for the current energy crisis. Chart 5.1 presents these analyses. Note that the focus of the policymakers is only on the power sector. No proper policies have been introduced for the Oil & Gas, Coal and Nuclear sources of energy; a big drawback in the development of the sector.

Chart 3.1: Salient Features of Energy Policies in Pakistan

Electricity	**Oil and Gas**	**Coal and Nuclear**
1994 Power Policy	1991 Petroleum Policy	
The main impetus of the 1994 policy was to bring in more private investment. The private sector was given very attractive incentives which included: • Private investors were free to choose: o site, technology and fuel o the kind of project: renewable and nonconventional sources of energy etc. o hydro projects on the main Indus river were not open for the private sector • An upfront Bulk Power Tariff • Thermal projects to be implemented on BOO model* • Availability of draft security agreements • Assurance of rupee-dollar convertability and availability of foreign exchange when necessary to cover projects' expenses • PSEDF could provide upto 40% of project capital cost • To attract private investors they were given exemptions from: o corporate income tax o sales tax, iqra, flood reliefs and other surcharges o custom duties on import of machinery o tax to companies that were lending to foreign investors • The power produced by the private sector was either to be purchased by WAPDA or KESC under the long-term contratcs covering the concession period.	The Petroleum Policy of 1991 was the first policy in the oil and gas sector. The salient features of this policy were: • To produce and procure enough oil to sustain the planned economic growth rate • Step up the exploration and development of indigenous oil and gas resources • Mobilize domestic and external financial and external resources • Replace oil import by gas • Stregnthen the research, technical and administrative capabilities of the government agencies within the sector • Progressively free the petroleum industry and trade from government control • Create a competitive environment to give best minium price and quality to consumers • Promote measures of environment protection.	No proper policies have been introduced for these two sources of energy. Only a couple of private and public institutes were established for these.

1995 Hydel Power Policy		
The pupose of this policy was to bring in private investors in the hydel power along the Indus River of upto a limit of 2000MW. Preference was given to 300MW projects irrespective of location provided they did not disturb downstream water users. The salient features of this policy are: • BOOT model** of investment • Guarantee of execution of all terms included in the agreement • Availability of PSEDF upto 30% of total project capital cost • Up-front tariff that was negotiateable later on • Exemptions from the corporate income and sales tax, iqra, flood relief and other surcharges • Only 2% custom duty on import of plant and equipment • The investors were permitted to: o issue corporate bonds o issue shares at discounted rate o foreign banks to underwrite the issue of shares and bonds by the private power companies o 80:20 debt-to-equity ratio • The ownership of the complex to be transferred to GoP • The power would be purchased by WAPDA under a long term contract covering the concession period and Bulk Power Tariff would apply.		
1995 Transm-ission Line		
This policy was introduced in the wake of increased generation capacity due to an increase in private investment. The public provision of transmission lines was limited, hence the GoP decided to bring in private investors to invest in power transmission lines and build power stations. The salient features of this policy include: • Investment under BOM model*** • Transmission Lines and Grid of 220KV and above • Intially 30 years of terms of agreement • Transmission company to be paid service charge in $/month/km • Availability of PSEDF of upto 40% of total project capital cost • Exemptions from corporate income tax and import duties • Selection of sponsors through intermediate competitive bidding.		

1998 Power Policy		
GoP moved towards the creation of a competitive power market in Pakistan by restructuring and privatizing the existing thermal power generation, power transmission and distribution functions, and assets of existing public sector utilities (WAPDA/KESC) by the creation of a fully autonomous regulatory authority, NEPRA, and through its future IPP policy. Highlights of the 1998 Power Policy are: • Hydel projects on BOOT model (transfer of assets to provinces) and thermal projects on BOO model basis • Permission to issue corporate bonds and shares at discounted rates • Almost blanket exemptions from all duties and taxes and relief from Iqra, flood charges etc. • LTCF was given to cover a significant portion of capital costs • FYA of 90% for hydel and indigenous coal based projects • Could raise local and foreign finances • Hydel projects to be transferred to the province it is situated in at the end of concession period • GoP was to bear the hydrological risks		

2002 Power Policy		
The 2002 Power Policy realized the poor performance of public sector entities, the ever-squeezing budgets in the public sector, the need to make tariff free from subsidies and cross-subsidies and reflect market prices etc. There was motivation for resource mobilization and improving efficiency but mainly through the involvement of the private sector. Therefore, power sector reforms by restructuring and deregulation was high on the agenda of GoP. The key features of this policy are: • Invitation of bids on tariff though ICB • Focus on utilization of domestic resources and using local capacity on engineering, design and manufacutirng • 5% custom duty on import of plant and equipment • To enhance the share of renewable sources of energy, hydel and thermal projects were levied full income tax • For major projects above 50MW, Federal One-Window support was provided and for small projects, support was provided at provincial/ AJK level • Ministry of Water and Power remained at the Federal level through PPPIB • Hydrological risks were borne by the power purchasers like WAPDA, NTDC, KESC • The tariff structure divided into two parts: fixed capacity and variable component. The 60% to 66% of this would be fixed capcpity.		

2008 Co-Generation Policy		
The purpose of this policy was generate power by utilizing the sugarcane husk potential because Pakistan is the fifth largest producer of sugarcane. This was expected to provide an additional 3000MW. • Tariff was levelized for 30 years on projects of 60MW or above based on 28% net thermal efficiency • The incentives available to IPPs under 2002 Power Policy were also available to these industries • Power produced was purchased by NTDC or DISCOs at the pre-determined rate by NEPRA		
• No financial incentives were guaranteed by GoP and were the responsibility of PSMA • Could issue corporate bonds and issue shares to raise funds. Foreign banks could also underwrite • 5% custom duty was levied on import of plant, machinery, and equipment • Exemptions from income and sales tax were provided		

2013 Power Policy	Petroleum Exploration & Production (E&P) Policy, 2012	
The main purpose of this policy is to get the country out of the ongoing power crisis and make it a power suplus economy by 2017 by addressing major challenges that the sector is facing. • Build a power generation capacity that can meet Pakistan's energy needs in a sustainable manner • Minimize T&D losses, inefficiencies and financial losses • Minimize pilferage and adulteration in fuel supply • Align the ministries involved in the energy sector and improve the governance of all related federal and provincial departments as well as regulators • The cost of power generation will be reduced from the current 12c/unit to ~10c/unit by 2017 • Doing the above will shift Pakistan from a power deficit country to a power surplus country by 2017	This policy was introduced in continuation of the previous Oil and Gas sector policies. The objectives of the policy are: • To accelerate E&P activities in Pakistan • To promote direct foreign investment in Pakistan • To promote the involvement of Pakistani oil and gas companies • To train the Pakistani professionals in E&P sector as per the international standards • To promote an increase in E&P activity in the onshore frontier areas by providing globally competitive incentives • To make the energy sector of the country secure by enhancing domestic exploration • To decrease reliance on imported energy • To undertake exploitation of oil and gas resources in a socially, economically and environmentally sustainable and responsible manner	
Notes: * Built-Own-Operate model. ** Built-Own-Operate-Transfer model. *** * Built-Own-Maintain model. PSEDF is Private Sector Energy Development Fund, LTCF is Long-Term Credit Facility, FYA is First Year Allowance, ICB is the International Competitive Bidding.		

Sources: NEPRA, Ministry of Water and Power, Ministry of Petroleum and Natural Resources, OGRA, PEPCO, AEDB, PPIB, WAPDA, NTDC and Tahir & Khaliq (2008).

The policies introduced for the power sector too had very limited focus in terms of scope and coverage of the sector. Most of these policies revolved around bringing private investment into the power sector, and focused on how to facilitate them and what incentives should be given to them. The main purpose of this was to enable the sector to meet the demands of the country, to bring in efficiency and to minimize the T&D losses. Furthermore, the policies envisaged that bringing in the private sector will fulfill the gap of the demand and supply of power and bring competitiveness within the sector. The ultimate goal was to privatize the sector and to let the government regulate it through NEPRA and OGRA.

Unfortunately, the desired goal has not been achieved to date because these policies were not implemented in their true spirit. The private sector has brought uncompetitiveness in the sector and is the main reason of the wrong choices of energy use, increase in cost of power generation and high prices of energy products. The problem of circular debt is the ultimate reward of all these policies. This is explained in detail in Chapter 4 of the study.

3.3 Governance And Management Issues

One of the primary reasons for restructuring was to improve efficiency and quality of production and distribution, and to improve the service delivery of the sector. Furthermore, it was envisaged that this process would be achieved rapidly if the private sector was involved in it. Hence the private sector was privatized with the hope of making the sector more competitive. However, unfortunately this did not happen and the objectives were not achieved but the government supported the role of the private sector by bringing in IPPs.

These changes made the structure of the energy sector so complex that it itself lead to breakdown of governance and failure of management within the sector. As seen in Chapter 2 of the study, currently there are more than 20 organizations involved in the sector in different capacities. These include WAPDA, PEPCO, GENCOs and DISCOs, PPIB, AEDB, the Thar Coal and Energy Board, the Infrastructure Project Development Facility (IPDF), the provincial power and irrigation departments and other off-grid renewable energy projects. These organizations, unfortunately, suffer from institutional and structural disconnections, fragmentation in the management and in the priority of issues (FoDP, 2010). Furthermore, the creation of DISCOs was expected to bring efficiency and better quality of services to the system, but they failed to do so and, in fact, are seeking support from the government. In addition, high commercial and technical losses of DISCOs also add-up to the cost of service. NEPRA and OGRA which were built to regulate and bring efficiency in the sector have totally failed to do so. The first reason for this is the high influence of politics in their operations and authority. Secondly, the weak administrative staff in NEPRA lacks professional expertise to supervise and control the power sector and establish a rational and equitable pricing regime. Similar is the situation with OGRA as it faces the same challenges and issues. Additionally, there is a lack of co-ordination between NEPRA and OGRA, which creates distortions between the gas and electricity sectors (Asif, 2011).

3.4 Planning In The Sector

One of the main failures of this sector is its neglect by almost all governments since independence. When Pakistan gained independence, we only had 60MW of electricity; therefore, it should have been realized immediately that in the long-run we would need multiple sources of energy production at the same time. However, unfortunately, this did not happen and very little emphasis was given to energy planning by successive planners. No serious plan was made to prepare for the country's increasing energy requirements. In fact, it had mostly been saddled with 'weak institutions, inappropriate pricing policies and insufficient public sector investment' (Burki, 2007; and USAID, 2007). At that time, most of the energy needs of the country were met by using biomass and biofuels that amounted to almost 67 percent of the total (see Table 1.3 for details).

Although there were some long-term plans in the past but these were not implemented seriously. The main reason for this is the high level of political instability. For example, each time a new government took over, the plans and policies of the previous government were refuted and new policies were formulated. Therefore, there was no continuity in the planning of the sector. Every government sought short-term and quick solutions. Such attitudes by successive governments lead the sector into many problems in the long-run instead of solving them. Thus, policymakers repeatedly failed to make productive efforts to address the failures in this sector, making it a popular playground for political interventions. It seems that the policymakers have separated the importance of energy from the broader public policy objectives of economic growth. If we see the

history of the energy crises in Pakistan, we see that every energy crisis in Pakistan came after a period of strong economic growth, for example the energy crisis faced in the 1980s, 1990s and the present one. This is mainly because of a failure with regard to long-term planning in this sector.

It is due to this negligence that the energy sector is facing a number of very serious issues at the moment. These include circular debt, energy pricing policy, fuel mix in the power sector, limited capacity addition, energy conservation, transmission and distribution (T&D) losses and inefficiency of power plants coupled poor governance of the sector. The governance of this sector is marred by political considerations, short term planning by successive governments, too many incentives for the private sector, and the absence of an effective regulatory body. Moreover, a major portion of the public revenue goes to this sector in the form of subsidies which has created the problem of fiscal space for the government (MoF, 2012).

3.5 Conclusions

The general objective of all plans and policies was to increase efficiency, reduce costs, and improve quality of service. The reforms varied in extent, scope and detail but in general they sought to achieve the objectives by relying less on public enterprise and regulated monopoly, and more on market mechanisms such as private ownership and competition. The proponents of electricity reforms had many and diverse aims; not always mutually consistent. The salient features suggest that ‘the over-riding reform goal was to create new governance arrangements that provide long-term benefits to consumers’. These benefits will be realized by creating competitive wholesale and retail markets to improve efficiency and responsiveness to customer preferences, by incentive regulation of privatized transmission and distribution networks to improve their efficiency and facilitating competition across them, and by reducing the role of government and political influence generally. But unfortunately, these steps have not given fruitful results and the crisis is deepening instead of getting resolved.

IV. Reasons for Current Problems in the Energy Sector

IV. Reasons For Current Problems In The Energy Sector

An analysis of the current problems of the energy sector of Pakistan requires an overall review of the developments in this sector, especially of the three key sources – gas, oil and electricity. We have attempted to do this in the last three chapters, where we tried to diagnose the extent to which the present energy crisis was due to the unavailability of energy and the extent to which it was due to manmade causes; especially with regard to the problems of structure and governance of the sector. We also know that the energy sector is facing a number of issues and problems at the moment which include: the wrong mix of energy use, circular debt, pricing policy, T&D losses, wrong use of fuel mix in the power sector, limited capacity addition and inefficient use of energy.

The literature on the energy crisis in Pakistan has discussed these problems at length. Most prominent of these studies are by USAID (2013); Asif (2012); PIDE (2012); Malik (2012); Khalid and Munir (2012); Ali and Badar (2010); and, Ali and Khaliq (2008). Amongst all the issues highlighted above, circular debt is most frequently studied by researchers and discussed in the media. Our purpose in this chapter is to analyze the extent to which the structure is responsible for these problems and highlight issues that the energy sector is facing at the moment. Doing so will give us a real understanding of these issues and problems and help us diagnose possible remedies. Chart 4.1 gives a cycle of the present energy crisis in Pakistan which not only presents these problems and issues but also gives reasons for these. It also brings to light their ramifications on the economy.

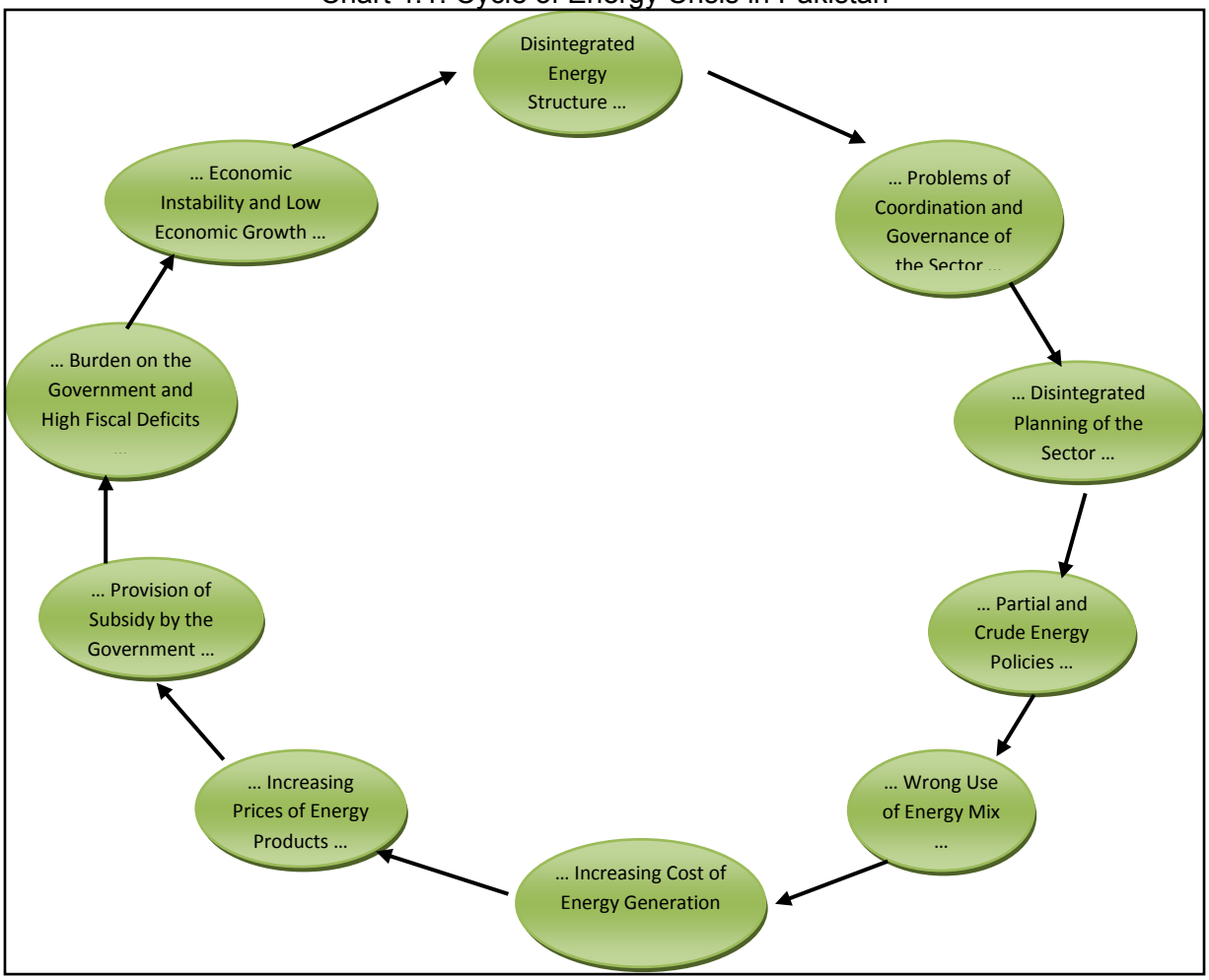
As reflected in Chart 4.1, the real problem of energy crisis in Pakistan starts from the energy structure and ends at it. This cycle keeps on moving and follows a periodic trend. The present energy sector of Pakistan is disintegrated with many plants of small capacity located all across the country. This makes coordination, management and governance of the sector very difficult for the regulatory authorities. Furthermore, the disaggregation into small entities makes integrated planning for the sector very difficult. After the unbundling of WAPDA, no proper development plan was prepared for the sector. The government revised the 1994 Integrated Plan of the sector in 2009 and 2011 but it was not properly planned or implemented.

The government introduced a number of policies after the restructuring of the sector, as explained in Chapter 3, but these policies were never thought out properly. To date, we see an absence of an integrated policy for the entire sector and only a few policies focused on the power sector are available. Moreover, these policies were crude; focused short-term period; were politically motivated; and introduced abruptly, with no proper consultation from field experts. A prominent example of this is the Power Policy of 1994. This policy gave many incentives to the private sector and is the main reason behind the wrong mix of energy use in the sector which not only increased the cost of power production but also put the economy at many risks.

The continuous increase in the shares of oil and gas takes us to the sixth step of the energy crisis i.e. increased cost of generation. In Pakistan, oil is an imported source of energy, the price of which has been increasing overtime because of two reasons. First, it's actual price increase in the international market, and second, depreciation of the Pakistani rupee over the last few years since oil price is dollar denominated. Gas, although a domestic source, is depleting very rapidly and is not sustainable for a very long-period of time (see Chapter 1 for details). The signs of it shortages are already visible in the country as in the winters households cope with gas load-shedding while the CNG stations are provided gas for half of the week only.

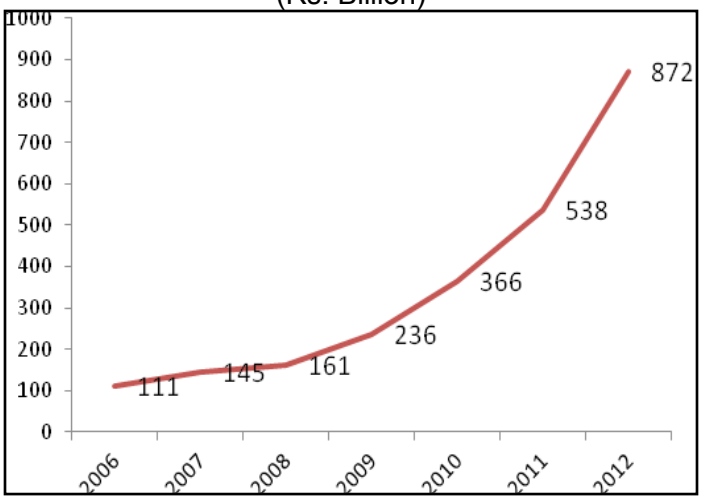
The aftermath of the rising cost of generation is the increase in energy prices to the final consumers. The prices of POL products have increased substantially over the last couple of years; imposing a disproportionate burden on low income consumers who use public transport. Similarly, the price of furnace oil has risen sharply which has contributed to substantially raising the costs of thermal power generation. Since most of the people in the country live below the poverty line, the government has to intervene and give subsidy to the sector to bear part of the cost and burden of high prices for the consumers. This results in the problem of circular debt which has increased to unsustainable levels. The Federal Government has recently taken a big step to resolve the problem and paid a lump sum of Rs. 520 billion to the power sector. This has somewhat resolved the load-shedding in the country. The reasons for this are presented in Chapter 2 of the report. Figure 4.1 gives recent numbers on circular debt. As shown in the graph, the circular debt increased from Rs. 111 billion in 2006 to Rs. 872 billion in 2012; an eight-fold increase.

Chart 4.1: Cycle of Energy Crisis in Pakistan



The payment of subsidy and circular debt is a big problem to the already limited fiscal space. The government, in the last couple of years, has already run large fiscal deficits which amounted to 9.6 percent as a percentage of GDP in 2012-13 and 7.6 percent of GDP in the last five years. These trends seem to continue until we equal the price of energy products to the cost of generation which is not possible given the socio-economic conditions of the general public in the country.

Figure 4.1: The Trend of Circular Debt in Recent Years
(Rs. Billion)



Source: USAID.

The rise of energy prices is a significant factor contributing to the cost-push inflation in the last couple of years, both directly due to an increase in the price of POL products and indirectly via rise in the costs of power generation. This has made the overall economy unstable and remains an area of vulnerability with respect to economic security. *This completes the circle of energy crisis in Pakistan and may be the starting point of another such cycle if things remain the same.*

Now, the question arises as to what can be done to eliminate all the problems and issues faced by the energy sector at the moment. We observe that these problems cannot be removed until we reform the energy structure. The problem of circular debt will persist and the energy sector will remain inefficient until we do this since the problems are inherent - given the political corruption and incompetence in the sector. The roots of 'circular debt' lie in the low cost recovery by the system. This type of circular debt is created when distribution companies fail to clear their dues with power generation companies, which in turn fail to fully pay the fuel suppliers, who in turn default on their payments towards refineries and international fuel suppliers.

V. 18th Amendment and Energy Sector: The Case of Punjab

V. 18th Amendment And The Energy Sector: The Case Of Punjab

In recent years two key developments have fundamentally changed the way government worked and restructured the way Pakistan will be governed. These are the 7th NFC Award and the 18th Amendment. The 7th NFC Award increased the share of the provinces in the divisible pool, thereby giving them more resources to spend; while the 18th Amendment increased the responsibility of the provinces by devolving many sectors to them which were previously the responsibility of the Federal Government. These developments significantly enhanced the range of functional responsibilities of provincial governments and constituted an important step in bringing the government closer to the people. Electricity is one of the sectors that have been partially devolved to the provinces. The focus of this chapter is to study the implications of the 18th Amendment on the working of provinces with particular reference to Punjab.

5.1 Constitutional Provisions For The Energy Sector Under The 18th Amendment And Its Implications On The Provinces

Under the 18th Amendment, a major change with regard to electricity is that the defunct Concurrent List moved to the Federal Legislative List Part II. The constitution addresses the subject as follows:

Article 157-Clause (1): The Federal Government may in any Province construct or cause to be constructed hydro-electric or thermal power installations or grid stations for the generation of electricity and lay or cause to be laid inter-Provincial transmission lines ***[Provided that the Federal Government shall, prior to taking a decision to construct or cause to be constructed, hydro-electric power stations in any Province, shall consult the Provincial Government concerned.]***

Article 157-Clause (2): The Government of a Province may:

- *(a) to the extent electricity is supplied to that Province from the national grid, require supply to be made in bulk for transmission and distribution within the Province;*
- *(b) levy tax on consumption of electricity within the Province;*
- *(c) construct power houses and grid stations and lay transmission lines for use within the Province; and,*
- *(d) determine the tariff for distribution of electricity within the Province.*

Article 157-Clause (3): In case of any dispute between the Federal Government and a Provincial Government in respect of any matter under this Article, any of the said Governments may move the Council of Common Interests for resolution of the dispute.

Clause (1) was changed by adding the new proviso given in the braces. While clause (3) was recently added in the constitution, however, there is no change in the Clause (2) of Article 157. In case of gas, there is no change in the constitution. The constitution says following on this matter:

Article 158: ***Priority of requirements of natural gas.*** *The Province in which a well-head of natural gas is situated shall have precedence over other parts of Pakistan in meeting the requirements from the well-head, subject to the commitments and obligations as on the commencing day.*

Another amendment regarding the minerals, oil and natural gas was done which says:

Article 172-Clause (3): Ownerless property. Subject to the existing commitments and obligations, mineral oil and natural gas within the Province or the territorial waters adjacent thereto shall vest jointly and equally in that Province and the Federal Government.

Under these constitutional amendments, the provinces are now given a considerable amount of autonomy in the energy sector. Also, the provinces are now given more resources than they used to have before the 7th NFC Award. Here, the question arises as to what are the implications of these constitutional provisions on the working of provinces? Clearly the 18th Amendment has significantly increased provincial authority in the energy sector, mainly now that the Federal Government will have to consult the provincial government prior to taking any major project in the power sector. Secondly, the province with most abundance of natural gas will have precedence in meeting its own demand first and, thirdly, the provinces and Federal government will have the same right towards the utilization of the mineral resources. The provincial rights to construct power houses, grid stations and lay transmission lines for use of the province were already given to them before the 18th Amendment.

At this point, an important question is that do the provinces work independently of the Federal Government and do they have the kind of capacity needed to handle such an important and complicated sector? The answer to this is unfortunately no, mainly because a number of bottlenecks still exist for such a change to happen. These include: unequal availability of natural resources in the provinces, lack of technical knowledge and field expertise of staff, inability of the provincial government to provide sovereign guarantees in case of the private sector involvement - especially if it is in the form of FDI, and absence of a national coordination plan.

The main hurdle in the way is the fact that the distribution companies are connected to the national grid and are under the control of the Federal Government, therefore, the generation of electricity by any province is likely to be integrated with the national grid. This gives a disincentive to the provinces to produce electricity on their own because the province generating the electricity may or may not get any benefit despite accruing the generation costs. Therefore, unless some incentives are given against this risk, the provinces are unlikely to invest in power generation.

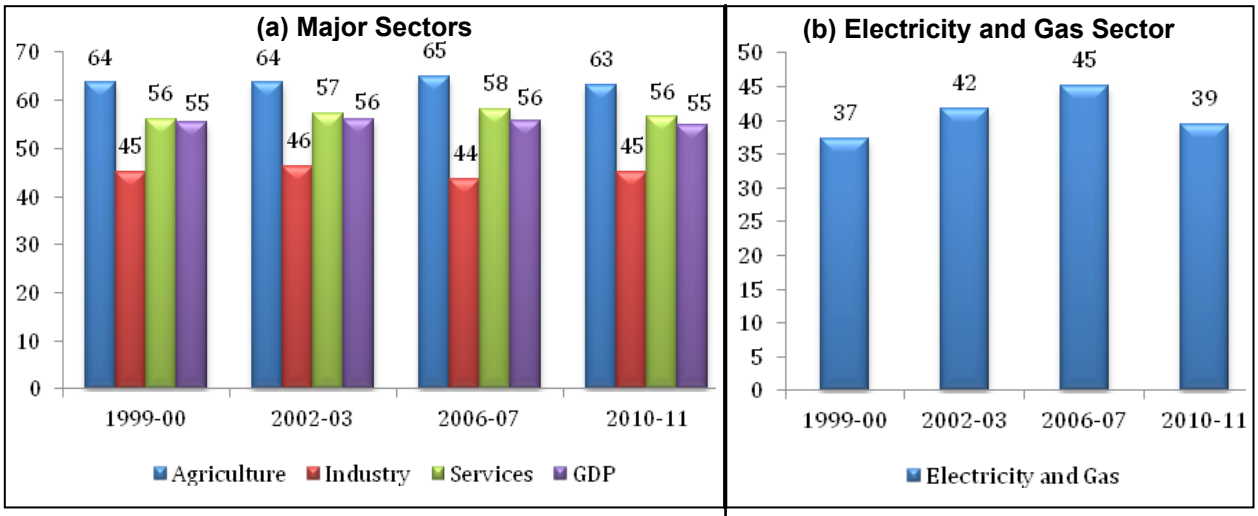
This chapter will analyze all these issues with the focus on Punjab since it is the largest province of Pakistan and consumes the biggest chunk of the national energy resources. We will address a number of important questions like: Since Punjab is the biggest province of Pakistan, how will the 18th Amendment impact Punjab's economy? What plans does Punjab have to meets its energy demands after the implementation of the 18th Amendment? Does Punjab have enough capacity to handle the sector and resources to fulfill the energy needs of the Punjab's economy on its own? If not, what will be future plan of action plan for the province?

The next section briefly presents the contribution of Punjab in the national economy (section 5.2). Following this, the trends of Punjab in consumption and production of energy are given (section 5.3). The structure of Punjab's Energy Department is discussed in Section 5.4 while Section 5.5 gives the policy and institutional framework of Punjab's energy sector. The last section concludes the chapter.

5.2 Punjab's Contribution In The National Economy

Punjab is the biggest province of Pakistan with a population of 103.2 million in 2013, constituting almost 56 percent of Pakistan's population. The Gross Provincial Product of Punjab in 2010-11 was Rs. 3,196 billion at constant factor cost of 1999-2000. At the sectoral level, the value added by the agriculture sector was Rs. 767 billion, by the industrial sector was Rs. 677 billion and by the services sector was Rs. 1,751 billion. Trends of Punjab's shares in the national economy by major sectors are given in Chart 5.1(a). On average, Punjab contributes towards almost 64 percent of the agricultural sector, 45 percent of the industrial sector, 56 percent of the services sector and 56 percent of the GDP. These numbers show that Punjab not only caters to the biggest chunk of the population but also makes a major contribution to the national GDP.

Chart 5.1: Punjab's Share in the National Economy



Source: Chart developed using the data source of IPP (2012).

Chart 5.1(b) also gives contribution of the electricity and gas sectors in the national economy. This sector constituted 37 percent of the national economy in 1999-2000 which increased to 45 percent in 2006-07 but fell to 39 percent in 2010-11.

5.3 Punjab's Energy Balances

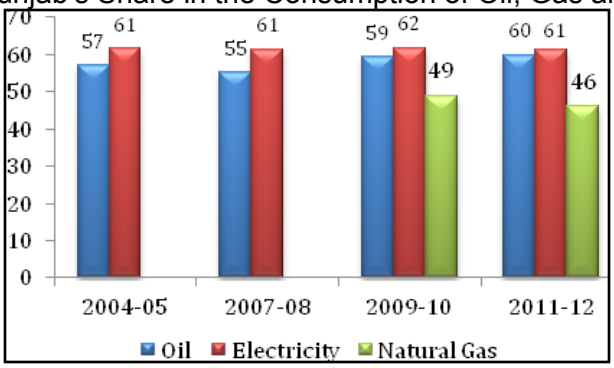
This section is important because it analyzes Punjab's performance in the energy sector. The value Punjab adds to the energy sector is presented in the last section. The section gives trends of consumption and production of oil, gas and electricity in Punjab and also briefly discusses the performance of Punjab in the energy market.

Energy Consumption

Punjab is not only the biggest province of Pakistan; it also consumes most of the energy produced by the country. In 2012, Punjab's consumption of oil, natural gas and electricity was 40,760 MTOE; almost 68 percent of the national consumption. In the total consumption of oil, gas and electricity of 40,760 MTOE by Punjab, the share of oil is 28 percent, the share of gas is 63 percent and the share of electricity is 9 percent. This means Punjab uses gas most intensively as compared to oil and electricity. Punjab's shares in oil, natural gas and electricity as compared to

the national consumption are given in Chart 5.2. As can been seen from the figure, not only does Punjab consume a major part of the total national energy, it also takes a major portion of the individual energy products. In case of oil, Punjab's share was 57 percent in 2005 which increased to 60 percent in 2012. Punjab's share in natural gas remained almost constant at 61 percent since 2005. The province also consumes natural gas more intensively than other sources of energy but

Chart 5.2: Punjab's Share in the Consumption of Oil, Gas and Electricity

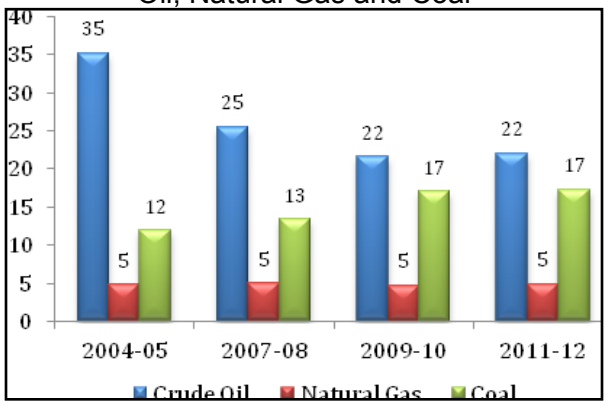


Source: Pakistan Energy Year Book, HDIP.

its overall share as compared to national total is less than half. This share was 49 percent in 2010 which decreased to 46 percent in 2012. The main reason of decrease in the share of gas and electricity in 2012 was the artificial control of these because of unfavorable politics against Punjab.

Energy Production

Chart 5.3: Punjab's Share in the Production of Crude Oil, Natural Gas and Coal



Source: Pakistan Energy Year Book, HDIP.

Punjab's share in the production of crude oil, natural gas and coal are given in Chart 5.3. Compared to their consumption, Punjab contributes very less in their production. Punjab's share in the production of crude oil was 35 percent in 2005 which decreased to 22 percent in 2012. In case of natural gas, Punjab's share in its production was only 5 percent which is constant during the period. The share in coal production was also not much. It was 12 percent in 2005 which increased to 17 percent in 2012. Shares in production of these reveal that Punjab is very energy deficient and heavily dependent on other provinces and imported energy.

The only area where the energy sector of Punjab is performing relatively well as compared to other provinces is the recovery of bills and low level of energy theft. As seen in Chapter 2 of the study, the recovery rate of fuel bill in the DISCOs located in Punjab is above 97 percent. Furthermore, Punjab has the lowest total of receivables ending June 2012. As shown in Table 5.1, the total receivables of provinces were Rs 84.5 billion out of which, Punjab's receivables were only Rs. 5.8 billion i.e. 6.9 percent in total. The highest receivables were of Sindh at Rs. 52.7 billion; a share of 62.4 percent. The second highest receivables were of Khyber Pakhtunkhwa at Rs. 19.8 billion; 23.4 percent of total receivables. Even Balochistan had receivables greater than Punjab (See Table 5.1).

Table 5.1: Receivables of DISCOs by Provinces

(Rs. Billion)

Province	Receivables (Ending June 2011)	07/2011 to 06/2012		Receivables 2012	
		Billing	Collection	Level	Share (%)
Punjab	5.4	15.1	14.6	5.8	6.9
Sindh	39.2	21.9	8.5	52.7	62.4
Khyber Pakhtunkhwa	19.4	3.9	3.5	19.8	23.4
Balochistan	4.7	4.2	2.7	6.2	7.3
Provincial Total	**68.7**	**45.1**	**29.3**	**84.5**	**100.0**

Source: NEPRA (2012).

5.4 Punjab's Position In The Energy Resources As Compared To Other Provinces

The position of Punjab and other provinces with regard to the availability of primary energy sources is given in Table 5.2. The Table gives total original recoverable resources of crude oil, natural gas and coal. Total original recoverable reserves of crude oil available to Punjab at end June 2012 were 57.3 MTOE, a share of 41 percent of the total national reserve. Punjab has accumulatively consumed 78 percent of its reserves and therefore it is left with very little reserves of crude oil. Sindh has the highest recoverable reserves with 45 percent shares in the national reserves. Similar is the condition of Punjab in the other two energy resources i.e. natural gas and coal. In natural gas, Punjab has a share of 35 percent of 1114 MTOE of the total national reserves. Cumulatively, it has consumed 64 percent of its total original recoverable reserves. Also, Punjab has almost no reserves of coal while Sindh has all the reserves.

5.5 Energy Department Of Punjab

Before the 18th Amendment, Punjab mainly dealt with the regulatory aspects of electricity distribution, consumer and supplier disputes, and safety aspects of electrical installations at public and private buildings under the Power Wing of Irrigation and Power Department of the Government of Punjab. After the 18th Amendment, the Government of Punjab established the Energy Department in 2010 out of the already established Irrigation and Power Department. The Energy Department was originally the power wing of the Irrigation and Power Department. The purpose of establishing the Energy Department was to vigorously pursue power generation and work upon

oil and gas projects in lieu of the autonomy given under the constitutional Amendment[12]. Later on the department established a number of boards. At the moment there are four different boards working under the Energy Department. The names and functions of each of these departments are given below. The organogram of the Punjab Energy Department is also shown in Figure 5.1.

Table 5.2: Provinces' Position in Availability of Primary Energy Sources

Source of Primary Energy from	**Original Recoverable Reserves** (MTOE, as on End June, 2012)	**Percentage Share in Total**	**Balance** (Percentage, as on End June, 2012)	
			Used	**Remaining**
Crude Oil	***141.2***			
Punjab	57.3	40.6	78.3	21.7
Sindh	63.8	45.2	71.2	28.8
Khyber-Pakhtunkhwa	19.8	14.0	25.3	74.7
Balochistan	0.3	0.2	6.2	93.8
Natural Gas	***1114.4***			
Punjab	391.3	35.1	63.7	36.3
Source of Primary Energy from	**Original Recoverable Reserves** (MTOE, as on End June, 2012)	**Percentage Share in Total**	**Balance** (Percentage, as on End June, 2012)	
			Used	**Remaining**
Sindh	52.5	4.7	15.6	84.4
Khyber-Pakhtunkhwa	48.4	4.3	41.5	58.5
Balochistan	622.3	55.8	49.3	50.7
Coal	***186,007***			
Punjab	235	0.1		
Sindh	185,457	99.7		
Khyber-Pakhtunkhwa	90	0.05		
Balochistan	217	0.1		

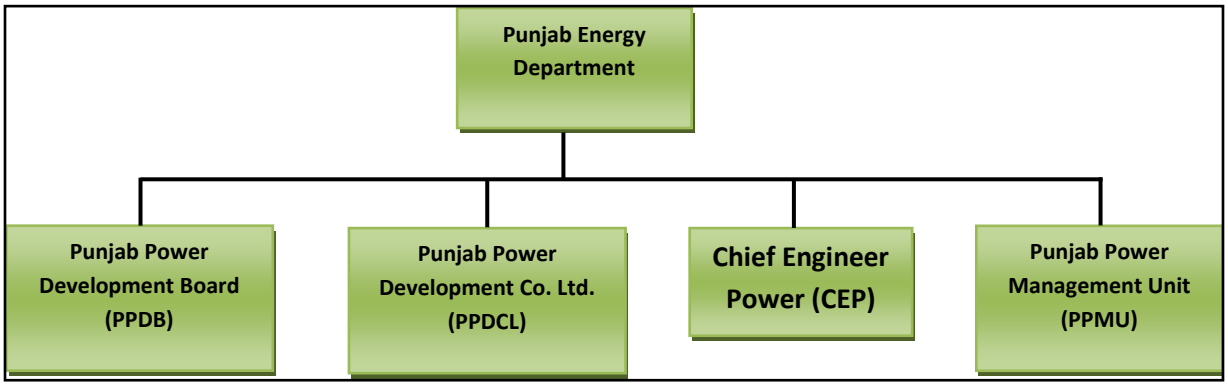
Sources: Own calculations using numbers from Pakistan Energy Year Book, 2012.

Punjab Power Development Board

Punjab Power Development Board (PPDB) is a 'One-Window Facilitator' to promote and encourage private sector participation. The main functions of the PPDB are: to provide a One-Window facility to promote private sector participation in power generation in Punjab based on any technology; to process solicitation of projects and entertain un-solicited proposals for establishing private power projects; to issues Letter of Interest (LOI) and Letter of Support (LOS) to the private sponsor on behalf of Government of Punjab; to play a key role in the implementation of private power projects; to assist private investors in obtaining consents and licenses from various agencies; to assist the regulatory authority, NEPRA, in determining and approval of tariff for new power

projects; to administer IA, PPA and FSA executed by IPPs with GoP and its agencies; and to co-ordinate with WAPDA and all others stakeholders.[13]

Chart 5.4: Structure of the Energy Department of Punjab



Punjab Power Development Company Limited

For development of projects on fast track basis in the public sector, the Government of Punjab has established the Punjab Power Development Company Limited (PPDCL) which is registered with the Securities and Exchange Commission of Pakistan (SECP). Its main functions include: to develop power projects in Public-Private Partnership mode; to arrange funding through loan negotiation or joint venture; to interact with all stake-holders like WAPDA and the Federal Government; to negotiate tariff with NTDC (WAPDA) or others buyers of energy; and to attract private sector to form joint ventures for development and/or operation and management of power projects.[14]

Chief Engineer Power

The power wing has the same functions as the Irrigation and Power Department. These are: implementation of the Administration of Electricity Act, 1910 and Electricity Rules, 1937; establishment of the Provincial Offices of Inspection under Section 38 of the NEPRA Act, 1997 for monitoring the enforcement and violation of instructions by DISCOs with respect to metering, billing, collection of tariff and other connected matters; implementation of the Punjab Cinematograph Rules in accordance with the Motion Picture Ordinance with regard to the use of electricity and cinematograph apparatus in cinemas; dealing with matters connected with the distribution of Power and Distribution companies; overseeing administrative matters related to electricity duty under the West Pakistan Finance Act, 1964 and Rule there-under; regulating, controlling and granting Electrical Contractors Licenses and Supervisors Competency Certificates and other matters connected with Regional Licensing Boards of Lahore, Multan, Faisalabad, Gujranwala, Islamabad and Provincial Licensing Board, Lahore; and conducting investigations into electrical accidents in factories, power houses and other electrical installations.[15]

Punjab Power Management Unit

The Punjab Power Management Unit (PPMU) plans, procures and implements the ADB funded Renewable Energy Projects of Punjab in the public sector. Currently, the PPMU is constructing five small hydro power plants (HPPs) of less than 10MW and has prepared the feasibility of addi-

tional five small HPPs. In addition to this, the PPMU is also working on the capacity development of the Energy Department.[16]

Although the Government of Punjab has taken a number of initiatives and has set up a department for the energy sector, it is still in the initial stages of development. Currently, it does not have capacity in terms of planning, management and availability of trained and experienced staff. Additionally, it faces many institutional and infrastructural bottlenecks in the development of the energy sector.

5.6 Policy And Institutional Framework

After the 18th Amendment, the provinces got significant authority to establish their own policy framework, set tariff rates and make plans for the development of the energy sector. Over four years have passed since the implementation of the 18th Amendment prior to which the provinces were already given some authorities based on which they could develop their own policy frameworks and development plans. But unfortunately, this has not happened in Punjab or in the other provinces. There is only one Generation Policy by the Government of Punjab that was introduced in 2006 and revised in 2009 but it lacked any significant material in it. Although the Government of Punjab announced to revise the policy in the light of mandates given by Council of Common Interests (CCI) following the 18th Amendment, but to date, no such step has been undertaken.

It is also worth mentioning that the Government has identified a number of projects for implementation in Punjab, but no proper plan has been prepared for executing or financing these projects. The list of these projects is available on the Punjab Energy Board website.[17] It is imperative that the government takes pro-active role in this matter and prepares the policy and development frameworks for the province's energy requirements. This is especially important after the 18th Amendment which has increased the responsibilities of provinces significantly.

5.7 Conclusions

Punjab is the biggest province of Pakistan that caters to the largest population of the country and makes the biggest contribution towards the national economy. It also constitutes the biggest chunk of the total energy consumption of the country; however, its contribution to the total energy production is very small. The main reason for this is the poor availability of natural resources in Punjab. The only potential that Punjab has is in the form of renewable energy mainly from wind and solar energy. But this potential is not big enough to fulfill the needs of the province's economy. Similar is the situation with the availability of natural gas. Punjab can produce electricity by installing thermal power plants but by doing so it will face two main risks: first, it will be heavily dependent on oil and gas for electricity production which will be imported because gas reserves have depleted to a large extent; second, as already observed, the production of electricity from these two sources will be very costly. Therefore, in case of energy, Punjab will be heavily dependent on the other provinces because its main sources are available with them. The 18th Amendment does bring autonomy and increased authority to the provinces but they are not ready for such a big structural change yet. Therefore, Punjab has to work in harmony with the other provinces to fulfill its energy requirements since the country is already bearing a high cost for the structural changes implemented in the sector during the 90s, and at the moment is not in the position to bear any more of such changes.

VI. Policy Recommendations for Pakistan's Energy Future

VI. Policy Recommendations For Pakistan's Energy Future

The previous chapters have highlighted multiple reasons for the energy crisis faced by Pakistan today. These range from generation capacity to the structure, management and governance of the sector. The objective of our last chapter is to present a policy prescription for overcoming major challenges that the sector is facing at the moment to put an end the energy crisis in Pakistan. This will enable focused targeting of policy actions and special programs. We then proceed to highlight the key elements of a short term action agenda focused on priority areas that are the root cause of energy crisis. This is followed by the medium- to long-term agenda for improving the energy situation, which requires implementation of steps of a more structural nature coupled with a sustained political and institutional commitment and capacity. Finally, the potential roles of different stakeholders, vis-à-vis, different levels of government, civil society and international community, are identified.

6.1 Short-Term Action Plan

- In the short-run, the government immediately needs to correct the structure of the sector by reorganizing it and build the capacity of organizations working within the sector. Otherwise, removing the problems and issues that the sector is facing will be difficult. These reforms should start from the top, i.e. the Ministry of Water and Power, and the Ministry of Petroleum and Natural Resources should be merged into one and named as the Ministry of Energy. This will make the planning of the sector integrated, coordinated and there will much better scope for implementation of the plans and policies.
- Similarly, regularity authorities like OGRA and NEPRA should coordinate their activities.
- The personnel within these organizations should be properly trained because the energy sector is relatively more technical as compared to the other sectors. Also, the hiring of staff should be merit-based and not be politically motivated. This will also enhance the capacity of these organizations.
- The problem of large circular debt needs immediate resolution. Thereafter, a strong program must be put in place to arrest further increases in circular debt by taking action against bill defaulters without exception, raising tariffs in an equitable fashion, diverting gas from other uses to thermal power plants by implementation of proper pricing policy and rationing if necessary, and ensuring that the DISCOs implement plans for cutting distribution losses, etc. In some ways, management of the power sector has become the ultimate litmus test of governance in the country.
- Inequities involved in the distribution of power outages have been described in Chapter 3. It will be extremely important to make the load-shedding schedule public and agreed to after consultation with consumer groups. Otherwise, there is a danger of widespread public protests that will add to the law and order issues in the country.
- Rs 51 billion have been allocated to the power sector from the federal Public Sector Development Programme (PSDP) 2013-14 which primarily includes construction of a number of small dams and the cost of land acquisition for the Diamer-Bhasha Dam. In addition, there is an allocation of Rs 52 billion to PAEC, largely for nuclear projects. Combined, the share in the PSDP is 19 percent which needs to be raised during the year to 30 percent or so to fast track the completion of the on-going projects. A special monitoring unit also needs to be set up in the Planning Commission to oversee implementation in this vital sector.

6.2 Long-Term Action Plan

i. Emphasis must be laid on the expansion of power generation capacity and reduction in energy deficit of the country by commissioning the Pak-Iran Gas Pipeline, construction of the Diamer-Bhasha Dam, completion of the Neelum-Jhelum Hydro Power Project and exploitation of Thar coal deposits.
ii. Attractive policies, including higher wellhead prices (equivalent to the international price in TOEs) and fiscal incentives will need to be put in place to encourage exploration of oil and gas in the country.

6.3 Punjab's Case

As mentioned in Chapter 5, Punjab does not have an abundance of natural resources (oil, gas and electricity) and most of these original recoverable resources have already been consumed. Also, Punjab has limited potential for big hydel projects as most of this potential lies in the northern region of Pakistan while the eastern region has rich resources of coal. Nevertheless, we present the following policy recommendations for Punjab:

- Punjab has some potential in hydel energy through implantation of river projects which do not have huge set up requirements. The government of Punjab needs to tap this potential to meet its energy requirements in the short to medium run.
- Punjab has great potential in renewable energy; mainly solar and wind. The immediate focus of the government, therefore, should be on harnessing this potential.
- Wastes from industrial units and agriculture in Punjab have a great potential to generate energy however, unfortunately, this source of power has not been utilized yet. A proper proactive policy is needed to tap this potential. Similarly, utilization of biomass as a source of energy should also be considered.
- There is a need to transform coal and gas based thermal plants to coal based plants. This is because these two sources of energy are either rapidly becoming expensive or are depleting.

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End Notes

[1] Note that the major source of primary energy at that time was biofuels and waste. This source of energy supply has not been properly recorded by the official documents while focusing mainly on the commercial energy i.e. oil, gas, electricity and coal.

[2] According to the World Bank databases on World Commodity Price Data, the average price of oil was US$ 28.23/bbl in 2000 which increased to US$ 107.64/bbl in February, 2013.

[3] As of 2011, the original recoverable reserves were 53,963 billion cubic feet according to PEYB HCDIP, 2011.

[4] For detail see the glossary of energy terms of IEA. Web link: http://www.iea.org/glossary.

[5] See United Nation Development Programme to Pakistan, Pakistan National Human Development Report: Human Security in Pakistan, (Unpublished Manuscript: 2011).

[6] Note that the analysis period starts from 1971 because data for the previous years is not available.

[7] The installed capacity generation of electricity has more than doubled every decade up to 2000-01, with an annual growth rate of over 7 percent. However, it is during the last decade that the rate of expansion in capacity has substantially slowed down to 3 percent per annum. In the initial years of the last decade there was a significant excess capacity due to an increase in investment by the IPPs in the mid- to late-90s [SBP (2010), MoF (2012)]. This was the reason behind inadequate provisioning in the latter half of the last decade.

[8] According to the Economic Survey of Pakistan (2012), the GDP of Pakistan at constant factor cost was Rs. 5,383,012 and 6,028,571 million in 2006-07 and 2011-12 respectively, while the population was 161.2 and 178.9 million in 2006-07 and 2011-12 respectively. The annual average growth rate of GDP per capita according to these figures is 0.2 percent.

[9] See PEPCO website.

[10] Taken from the website of NTDC. Weblink: http://www.ntdc.com.pk/

[11] Ibid.

[12] See website of the Punjab Energy Department. Web link: http://energy.punjab.gov.pk/

[13] Ibid.

[14] Ibid.

[15] Ibid.

[16] Ibid.

[17] For details see: http://energy.punjab.gov.pk/power_projects.html

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