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Major Trends and Policies in Pakistan's Energy Sector Management

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Abstract

Energy sector in Pakistan is facing disastrous decline from almost one decade. There are multiple reasons behind this phenomenon. In order to find out genuine causes of this decline and workable solution it is dire need to hold a comprehensive study of three aspects of energy sector; energy generation, energy management and issues and problems in overall energy sector. The underlying purpose of this article is to bring out not only the causes of energy sector's dilapidation but also suggest some workable solutions as well.

Key Words: Energy Crisis, Water distribution, Thermal power projects, Nuclear power projects, Power management

Introduction:

Energy has become one of most crucial element among all elements of state power. Economic development, social standards and defense of a state completely depends on the energy base of the state. In order to measure the socio-economic prosperity in a society per capita energy consumption is used as a set standard. Energy prosperity is strongly associated with Human Development Index (HDI)**(Asif,2012, p.1)** of a country. As a matter of fact the aggregated global civilization is not only depending on energy but also it is increasing dependency on energy. United Nations anticipated that the population of world will increase up to 9.1 billion by 2050. A great part of this population is estimated to be grown in the developing world- Asia and Africa. **(Asif,2012, p.3)**This growth in population shall inevitably increase dependency on the energy sector. Growing economic growth shall also demand advanced and adequate energy provision as well. Overall energy scenario suggests a sustainable energy base for each nation in order to sustain its economy and maintain impressive stand in the committee of nations.

As Asia and Africa are marked as the region that will have to bear most of the burden of population and economic activity till the mid of this century, it has become vital for the regional actors to take energy sector as their top priority in order to secure their position as the key player in all economic and strategic matters of the region.In Asian region China has merged as key competitor with other regional and global powers. In South Asia India occupies a pivotal position by its potential to influence the regional actors. Although Pakistan is

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included in the nuclear club and possesses viable deterrence in the region, yet it is facing serious energy crisis. As far as ratio of population growth and increase in economic activity is concerned, Pakistan is in dire need of strong and sustainable energy base. At present, Pakistan is going through severe energy crisis and it is in dire need of new energy resources. Development in energy sector is significant not only for the prosperity of the state but also for the strategic strength of the state.

Growth of Energy Sector in Pakistan

Pakistan took off as very fragile state with meek resources and infrastructure. Energy sector was also in a quite dilapidated condition. At the time of inception, Pakistan inherited worth Million 1.2 tonne of oil equitant (MTOE) for the population of roughly 33 million. The installed electricity capacity was around 50 MW approximately. This energy was quite challenging. Pakistan was facing quite serious and immediate issues like Defence and refugee settlement problems at that time. The energy sector got primacy with the growing economic activity and population increase. Pakistan explored different sources of energy by and by with the availability of resources, technology and manpower. This article will explore all energy trends and scenarios taking in view their efficiency, effectiveness and implication.

Part I: Major Trends and Policies towards Energy Generation

First choice available to Pakistan was hydropower resources. At the time of independence Pakistan had only two hydropower projects; Malakand Power Station with the capacity of 9.6 MW and Renala Power Station with the capacity of 1.1 MW. (Sajjad Zafar, personal communication, June 11, 2015)The gross capacity of these two power stations was not more than 10.7 MW. In the entire decade of 50s the development in hydropower sector remained sluggish. There were many factors behind this slow progress. Beside Pakistan's serious defense and rehabilitation issues financial constraint and water disputes with India also served as main factors regarding slow development in the energy sector. Pakistan adopted different measures in order to resolve the water distribution issue with India. Water distribution issue resolution took more than a decade. Pakistan, meanwhile took some steps to enhance its hydropower generation. Water and Power Distribution Authority (WAPDA) was created in 1956(Asif, 2009). WAPDA under took several hydropower projects. In the initial phase the energy sector of Pakistan remained focused on two energy resources; hydropower and thermal power. The progress in each sector can be assessed separately in detail.

1. Hydropower

Pakistan, basically inherited hydropower energy generation projects at the time of inception that is why Pakistan kept its focus on the hydropower in the initial phase. Hydropower is comparatively cheaper source of energy as compare to other energy resources. At the same time installation of this power project is a multi-million dollar project. Water is a natural resource, but this resource requires a smart planning for proper utilization for agriculture and power generation purposes. In order to take advantage from this natural resource Pakistan exerted to resolve water distribution issue with in India. Consequently, Indus Water Treaty was finalized between India and Pakistan in 1967, under the aegis of World Bank. Indus Water Treaty is a landmark in the hydropower sector in Pakistan. Indus Water Treaty made it possible to take up mega projects like Mangla and Terbela dams. Total benefits acquired from the Indus Water Treaty are given in detail in the table given below

Indus Water Treaty Benefits

System of Works approved by the IWT in Pakistan	Location	Capacity
Dams and Related Work	Jhelum River	Live Storage of 4.75 MAF
	Hydro-electric	3,00,000 kw generating facilities
	Indus River	Live Storage of 1.2 MAF
Link Canals (Construction and remodeling)	Rasul –Qadirabad	19,000 cusecs
	Qadirabad Balloki	18,600 cusecs
	Balloki Suleimanki	18,500 cusecs
	Marala Ravi	22,000 cusecs
	Bambanwala-Ravi-Bedian-Dipalpur	5,000 cusecs
	Trimmu Taleri	11,000 cusecs
	Kalabag Jhelum	22,000 cusecs
	Taunsa Panjnad	10,000 cusecs
Barrages	Qadirabad	
	Ravi	
	Sutlej	
Tubewells and Drainage Works	About 2,500 tubewells to contribute to the lowering of the water table, some of which will yield additional water supplies for irrigation use	
	A system of open drains to lower the water table in about 2.5 million acres of land now under cultivation but seriously threatened by water logging and salinity.	
Other Works	Ancillary irrigation works directly related to the foregoing, including remodelling of existing works.	

(Michel,1967 pp.169)

Indus Water Treaty made possible for Pakistan to construct viable enegy projects. WAPDA has taken up these projects with great responsibility. Tarbela dam provides total installed capacity of 3478 MW, Mangla 1000 MW

and Chashma 184 MW . beside these mega projct many other projects are also completed. As fara as energy managementt is concerned, it is important to keep the pace of energy with the increasing population and and growing economic activity. Unless energy sector keep abreast with these indicators of social development no prosperity can ever be achieved.Currently the hydro projects completed under the WAPDA patronization are listed below

SALIENT FEATURES OF COMPLETED PROJECTS

Project	Cost Rs. (Million)	Technical Data	Objectives
Chaklal Kas Lift Irrigation Scheme completed in 1961	0.40	Pumping Water from Chaklal Kas near Hassan Abdal involving lift of about 90 ft.	Provision of irrigation facilities for 1,400 acres
Rawal Dam Completedin 1962	21.20	Type: Stone masonry gravity dam. Height: 113.50 ft. Length: 700.00 ft. Live storage capacity: 4,300 acre ft.	Provision of 20 million gallons per day of potable water to Rawalpindi/Islamabad and irrigation of small area
Guddu Barrage Completed in 1962	174.80	Type: Gate Controlled weir with navigation lock. Width 64 spans of 60 ft. each Maximum Discharge capacity: 1.2 million cusecs.	Controlled irrigation supplies (including extension) for 2.9 million acres in Jacobabad, Larkana and Sukkur districts of Sindh and Nasirabad district of Balochistan.
Tarica Dam Completed in 1965	66.80	Type: Earth Fill Dam. Height: 115 ft. Length: 2,340 ft. Outlet capacity: 2,000 cusecs	Irrigation of about 3,200 acres in Kohat Valley.
Karachi Irrigation Project (Hub Dam) Completed in 1963	1,092.00	Type: Earth Fill Dam. Height: 151 ft. Length: 2" 300 ft. Reservoir capacity: 100,300 acre ft. Spillway capacity: 108,000 acres	Irrigation of 2",000 acres in Lasbela and 1,000 acres in Karachi district. Drinking water supply of 69 MGD for Karachi and 15 MGD for industries in Balochistan.
Khanpur Dam Completed in 1964	1,385.00	Type: Earth-cum-rock Fill Dam. Height: 167 ft. Length: 1,547 ft. Reservoir Capacity: 106,000 acre ft. Spillway capacity: 166,000 cusecs	Irrigation of 36,470 acres in Attock, Rawalpindi and Abbottabad districts and supply of 131 MGD of water to Islamabad, Rawalpindi, POF Wah and Industries around Taxila.

(WAPDA Energy Year Book 2012-13, p. 13)

Besides these projects, most crucial and controversial project is the construction of Kalabagh Dam. This project has generated such a prolonged controversy and discord among the stakeholder that the palnned sketch as yet not seen a formal ground breaking. This project was actually conceived in mid 80s in order to fine out some viable solution for the future energy requiremnets. Kalabagh dam is mega project with diverse specifications. This dam would be ground filled with overall height of 79m (259 ft) and length of 3,350 m. This dam is planned for a place called Kalabagh in the district Mianwali, Punjab. Overall, insalled power of the Kalabagh Dam is expected ti

be 3600MW. its estimated annual electricity generation is just about 11,400 GWh. Presently, Pakistan is procuring this same amount of electricity from the IPPs at the price of Rs. 131.5 billion. However, Kalabagh dam would be able to provide the same amount at the expenditure lower than 6.5 Rs billion. Water distribution among the provinces is the main issue behind delaying this project.

(www.pildat.org/Publications/.../ConstructionOfKalabaghDamBackgroundPaper.pdf)Although resolution of such task of national interests are the reponsibility of Council of Common Interests (CCI) but council remained dorment for longer period of time. It was only in March 1991 that an Accord was signed by the four provinces over the problem of water division. The key figures of this Accord are presented below:

Water Distribution Accord 1991

Province	Kharif	Rabi	Total
Punjab	37.07	18.87	55.94
Sindh*	33.94	14.82	48.76
Khyber Pakhtunkhwa (a)	3.48	2.30	5.78
(b) Civil Canals**	1.80	1.02	3.00
Balochistan	2.85	1.02	3.87

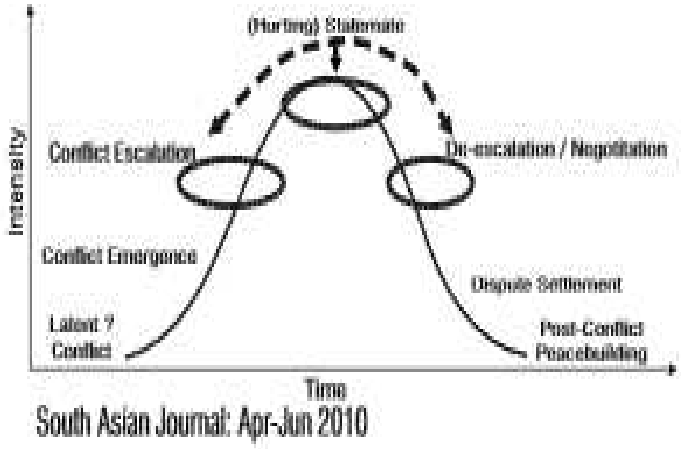
* Including already sanctioned Urban and Industrial uses for Metropolitan Karachi.

** Engaged Civil Canals above the rim stations.

(Bisht, 2013, p.53)

Water distribution has remained the major bone of contention behind the idea of the construction of Kalabagh Dam. All provinces except Balochistan have serious concerns over the water disribution issue. However, WAPDA rejects all such concerns over the manufacturing of Kalabagh dam. Many experts favour the construction of the dam. However, some experts have objections on the Kalabagh dam project as well. But the impartial studies propose that Kalabagh dam would have more merits as compared to its demerits. According to the experts, dams serve to be the source of harnessing both surface and underground water that is usually remained under utilized. Most of surface water remain unused in case of Pakistan. This is a bleak reality that most of surface water of Pakistan is under utilized and drains into sea without procuring any benefits. The construction of dam can offer enhanced probability for beneficial consumption of water. It can serve as major factor in eradication of floods that cause multiple losses of life and property. The

problemresolution mechanism described in the South Asian Journal regarding this project is given as under;



(Feyyaz, 2011, p. 16).

Construction of Kalabagh Dam and resolution of issues over this projects can easily be dealt by virtue of good governance. Among all the projects under construction the proposed Kalabagh dam of much worth as far as its benefits are concerned. The biggest drawback of this project is the plitical influence and maladministration. If stakeholders are able to overcome mutual differences and they are able to develop consensus, the proposed Kalabagh dam can bring a considerable change in energy sector of Pakistan.

2. Thermal Power Projects

Basis of thermal power development in Pakistan are found in the decade of 60s. The fundamental rationale behind the development of thermal power sector was to provide back up to the hydopower capability. the seasonal fluctuation in the in the hydropower generation capacity was a solid reason behind the progression of thermal power development. Hydropower resources are require some typical site specifications that are mostly improvised in the Northern areas of the country . In lieu of these circumsatnces, Transmission lines losses become inevitable. Thermal power was integrated in the system to assist and support the areas which are complicated to be served by hydropower. Thermal power sector is chiefly supervised by three major institutions:

a. Water and Power Development Authority (WAPDA)

b. Independent Power Producers (IPPs)
c. Karachi Electric Supply Company (KESC)

The above mentioned three institutes have their own specified projects, managerial system and maintainance methods. A brief discussion of effectiveness and efficiency of these institutes is going to be discussed in the coming paragraphs

Thermal Power of WAPDA

Thermal power, the second supply of energy, had the full amount of installed capability of roughly 67MW at the time of the inception of Pakistan. Since the hydro based sources of Pakistan were not in a formidable position and a clash with India on water division was also in the process, the energy secter was developing at dawdling pace. The climate and season of Pakistan make it inveitable to extend thermal power provision for the support of hydropower base in the season of water deficiency. While considering all these comlicated factors, Pakistan developed thermal power resources at a striking rate. The overall installed capacity of thermal power reached upto 441MW during 1960s. In the 1970s, this capacity increased to 650 MW. Water and Power Development Authority (WAPDA) patronized the growth of the capacity of energy generation in Pakistan. Gas, Furnace oil and High Speed Diesel are the most frequently used fuels. As compared to natural Gas, both fuels are are very expesive commodities in the power generation sector. It is not advantageous in any way to rely on these luxurious resources. Till 1990s, WAPDA supervised and set up all thermal power projects. After 1990s, WAPDA was immobilized. Until 2008, WAPDA produced 4, 899 MW with its thermal power projects. This power generation comprised 24.4 % of country's sum energy production. WAPDA initiated around 13 projects of thermal power in various appropriate locations all over the country. Prior to the orientation of independent power producers, WAPDA accomplished all projects initiated under its supervision. Below is given a tabulated version of power facility in MWs, fuel choice and date of commissioning.

S. No	Project	Current Capacity (MW)	Fuel Used	Date of Commissioning
1	Multan	195	Gas/FO	1960- 1963
2	Faisalabad	132	Gas/FO	1967
3	Shahdara	59	Gas/HSD	1966- 1969
4	Guddu	640	Gas/FO/HSD	1974- 1986
5	Faisalabad	244	Gas turbine	1975
6	Duddu	1015	Gas/FO/HSD	1985- 1993
7	Jamshoro	850	Gas/FO/HSD	1990- 1991
8	Pasni	17	HSD	1991
9	Muzaffargarh	1350	Gas/FO	1993- 1995
10	Kotri	174	Gas/HSD	1994
11	Lakhra	150	Coal	1995- 1996
12	Punjgoor	38	Gas turbine	1999- 2000
13	Quetta	35	Gas/ HSD	2004

Figure 1- Thermal Power Plants under Wapda (www.wapda.gov.pk)

a. The Independent Power Producers (IPPs)

Till the decade of 70s Pakistan successfully managed to balance between growing demand and supply of energy. Till mid-80s, due to negligence towards initiating new energy projects Pakistan faced serious energy shortfall. This shortfall further increased in next decade. So much so in that in 1994 Government of Pakistan established Private Power Infrastructure Board (PPIB). The purpose of the establishment of this board was to facilitate private sector in the field of power generation. Government gave a new power policy in 1994. The policy gave following points for the IPPs;

1. IPPs were free in choosing location, plant range, equipment and fuel. They were given liberty to choose any kind of fuel ranging from diesel oil, LAPG, natural gas, furnace oil and so on.
2. The supply and transmissionn of fuel was gaurenteed by the Government of Pakistan.
3. IPPs were allowed free repatriation of equity and were exapted from most of the taxes
4. Government of Pakistan gaurenteed the provision of oil and payments of power purpaches.

5. Govrnment of Pakistan developed a mechanism for the indexation of certain portions of tariff based upon Rupee/Dollar exchnage rate, international fuel price variations, interest rates and variations.(Aziz, 1994).

Private sector was generously encouraged to invest in the energy sector. Energy policy of 2000 further facilitated private energy sector. IPPs are operating independantly under the directions, term and condition of government of Pakistan.Currently IPPs are dispensible part of Pakistan's energy sector and they are contributing more than 6296 MW of the totall installed capacity of electricity. The following table highlight details of major thermal projects, their capacity, nature of technology and date of their commissioning.

S. No	Name of Project	Gross Capacity (MW)	Technology	Date of Commissioning
1	KAPCO	1638	Combine cycle, steam turbine on LSFO/Gas/ Diesal	27. 06. 1996
2	HUBCO	1292	Stean turbine on fuel oil	31. 03. 1997
3	Kohinoor Energy Ltd	131	Deisel Engine on fuel oil	20. 06. 1997
4	AES Lalpir	362	Stean turbine on fuel oil	06. 11. 1997
5	AES Pakgen	365	Stean turbine on fuel oil	01 02. 1998
6	Southern Electric Power	117	Deisel turbine on fuel oil	10. 03. 1999
7	Habibullah Coastal Power	140	Combine cycle on natural gas	11. 09. 1999
8	Fauji Kabirwala Power	157	Combine cycle on natural gas	21. 10. 1999
9	Rousch (Pakistan) Power	450	Combine cycle on fuel oil	11. 12. 1999
10	Saba Power	134	Steam turbine on fuel oil	31. 12. 1999
11	Japan Power Generation	135	Deisel Engine on fuel oil	14. 03. 2000
12	Uch Power	586	Combine cycle on natural gas	18. 10.2000
13	Altern Energy	10.5	Flared Gas/ Gas engine	06. 06. 2001
14	Liberty Power	235	Combine cycle on natural gas	10. 09. 2001
15	Tanvir, IRAN	39	Import from Iran	-. 09. 2003
16	Rental Power Station	150	Gas turbine	22. 02. 2007

Figure 2- Independent Power Plants(WAPDA Yearbook, 2012-13-*www.finance.gov.pk/publications/YearBook2013_14.pdf*)

a. Karachi Electric Supply Company

KESC is another independent thermal power company. KESC was developed in 1913. It is an older power company of Pakistan. In 1952, Pakistan's Government acquired greater part of the shares of KESC. As a result, KESC

came under the control of the Government. KESC is engaged in all aspects of power generation; generation, transmission and distribution. Total area comes under its jurisdiction is almost 6000 sq km. its consumership is around 2 million. In 2005 Governmnet of Pakistan tranfered 73% shares of the company and it was made privatized. From then on the management of KESC is under the control of new owners. KESC generates all its electricity from thermal power plants. Total installed capacity of the company is around 1756 MW. The detail of this energy installation is given below:
KESC Thermal Power Stations

Power Station	Installed Capacity (MW)	Fuel
Korangi	316	Gas/Furnace Oil
Korangi Town	80	Gas
Site	100	Gas
Bin Qasim	1260	Gas/Furnace Oil

Figure 3 - KESC Thermal Power Stations (www.kesc.com.pk/en)

3. Nuclear Power Projects

Nuclear Power Projects

In the overall Pakistan's energy mix nuclear power is a trace element with the meger contribution of 2.3% of total installed energy capacity. Pakistan's nuclear program remained limited and slow till 1954. A deal with Canadian firm General Electric was signed for the installantion of 137 MW capacity nuclear reactor in 1965, almost a decade later of the initiation of research in the Atomic Energy sector. This reactor was named as KANUPP (Karachi Nuclear Power Plant). This plant was finally commissioned in 1972. For the next thirty years this plant provided almost 10.2 billion kWh. As each nuclear power plant has its own commissioned life, the KANUPP also retired in 2002. In 2004 KANUPP was reconditioned for further working. This plant was enabled to work for the next 15 years but with less output capacity. The second nuclear power plant is CHASNUPP (Chashma Nuclear Power Plant), it is located in chashma. Total energy generation capacity of CHASNUPP is around 325 MW. It was commissioned in 2000. KANUPP and CHASNUPP are the only operating nuclear power plants with combined insatlled capacity of 462 MW. Proposal for the construction of thid nuclear power plant is also

under operation. Totall installed capacity of proposed CHASNUPP is estimated is around 325MW. (http://www.paec.gov.pk)

4. Renewable Energy Sector

Pakistan is bestowed with ideal climatic conditions that are, beside other benefits, are quite conducive for energy generation. All renewable energy resources like wind, solar and tidal are in abundance in Pakistan. The history of renewable energy resources not quite new in Pakistan but some serious work has been done in this regard quite recently. Although some small-scale wind turbines were installed on pilot project basis but it was in the decades of 70s and 80s that some 4000 biogas units were set up in total. It was lack of proper patronization from the pertinent authorities that these projects could not proliferate into mega projects. (Sajjad Zafar, personal communication, June 11, 2015)

Part II: Management of Energy Sector

'Ministry of Water and Power' is managing the Energy sector and it is dealiing mainly with water and electricity. strategic and fiscal planning for long-term plans also comes under the jurisdiction of this ministry both in the public and private sectors. WAPDA, along with its corporations is handling long-term projects in the energy sector. WAPDA was established as semi-autonomous body in 1958. Its major obligation was the construction of mega projects. Operation and maintenance, power transmission and distribution of the mega projects was also the responsibility of this institution. WAPDA has performed effectively in the energy sector of the country till its disintegration during Musharraf Era. There are many project at the credit of WAPDA. Several energy policies are responsible for the working and managemant of energy sector. Some notable policies are discussed below that have shaped the current situation of the energy sector in Pakistan.

Part- II: Power Management Policies From 1994 till 2013

From inception till the end of 80s WAPDA served as a institution taking under its supervision all departments pertaining to energy from generation, transmission and distribution. It was in mid-80s that after serious energy shortfall, GoP palnned to developed a viable energy policy in order to atttract the multinational investment in energy sector. The underlying idea was to generate an atmosphere suitable and conducive to bulk of electricity generation facilities without affecting the government resources. GoP initiated BOO policy which offered facilities to the private sector for the concessional period of 20 years to Build, Own and Operate (BOO). In 1987 Government

announced financial policy for the private sectorin the field of energy generation. Some vital features of this policy are sumed up below;

1. Creation of PSEDF (Private Sector Energy Fund) to finance the private sector power projects.
2. Finances for the PSEDF were proposed to be arranged by GOP through USAID (US Agency for International Development) and loans from WB (World Bank), JEXIM (Japan Export Import Bank), Governments of Italy, France and Nordic Investment Bank.
3. NDFC (National Development Finance Corporation) was created to manage these funds on the behalf of the GOP.
4. GOP guarantteed to offer required security and confort to the commercial lenders in order to make them for financing these energy projects.
5. PPC was created under the Ministry of Water and Power to facilitate the entire process.

Responding to the offer of the Government presented in 1985, two companies XENEL (Xenel Industrial Limited) of Saudi Arabia and HSPE (Hawker Siddeley Power Engineering Limiited) of UK submitted their proposals. Both comapies proposed two 600MW stations. Xenel proposed 2 × 300 MW units and HSPE proposed 4 × 150 MW units. Both companies submitted a readjusted joint proposal to GOP for a 1200 MW (4 × 300) steam oil fired power. GOP issued latter of intent to both companies separately on 27 April 1988. At that time GOP has not completed fisiablity study of both projects. In the absance of tariff mechanism and standardised agreements these projects saw difficult stages which affected a smooth working by both parties. After almost a decade these projects were ultimately ready for the commissioning by HUBCO. HABCO was established to replace HRPG (Hub River Power Company) in 1991. This project was the landmark project in private energy sector in Pakistan. Afterward, new developments in this regards came forward in 1993-1994. (Policy Framework and Package of Incentives for Private Sector Power Generation Project in Pakistan, GOP, 1994)

Power Policy of 1994

In 1993 Government constituted a twelve member Task Force on Energy. This task force was given the following tasks to meet; reduction of load-shedding, mobilization of energy resources, promotion of the investment from domestic and foreign private sector and recommendations for the development of indigenous oil and gas production. This task force recommended that some special steps are required to attract the foreigne investers in field of energy due to extensive global competition in this regard. Task force suggested few

significant measures that consituted the main point of 1994 energy policy. A constitution for the Private Power Board (PPB) was also suggested, so that one window operation could be further facilitated.

The power policy of 1994 is the outcome of the reccommendations made by the Task Force. This power policy facilitated both domestic and foreign invester aand their donners without putting proposed plans into tedious rounds of discussions and conferences. Investors were offered substential concessions and protections against their investment, systematized agreements, power purchase agreement (PPA), fuel supply agreement (FSA) and bulk power tariff.

These incentives were other than quite attractive fiscal and financial incentives. 'Balancing of Risks' involved in private power generation were the basis of these incentives. The projects with 'Risk' factor were appointed to those parties who were in better position to mitigate these risk factors. The private power investors were expected to deal with the risks in volved in power project concieving, designing, arrangement of funds, construction of fuel obtaining and operations and maintenance for the term of the project were provided protection from the GOP from market risks like they were not bound to sell their product to one buyer.

Private sector was also protected against currency fluctuation risk, foreign exchange availablity risk, natural calamities, fuel price fluctuation, unstable political situation and administration change and most crucial, payment avoidence of power purchaser. All these agreements were given the protection of enforceable laws.

1994 power policy met huge success and many investors approached government. 127 applications were received of total capacity of 26,000MW, 82 letters of interest were issued of gross capacity of 19,662 MW, 34 letter of support were issued wwith the gross capacity of 9,062 MW and 14 projects were commisssioned of gross capacity of 3,021 MW. These 14 projects were based oil and gas consuption. Most importantly, under the power policy of 1994 PPIB (Private Power and Infrastructure Board) was created.

The proposal for PPIB also came from the recommendations of the Task Force established in 1993. PPIB, which was established under an administrative order, was given the task of the development of private participation in the energy sector, provision of one window facility on the behalf of Government, execution of "Infrastructure Agreement" in the name of Government and monotering and helping IPPs in completion "WUL (Water Use Licence)" with relevent Government agencies. The functions and

development of PPIB shall be discussed in detailed afterwards.(Policy Framework and Package of Incentives for Private Sector Power Generation Project in Pakistan, GOP, 1994)

1995 Hydel Policy

Hydle power is most reliable source of energy production. It is not only cheap in cost but also it is most atmosphere-friendly. In 1995, for the promotion of private sector, governmentalso announced Hydel Policy. PPIB was assigned this task. “Total 41 letter of interest were received with gross capacity of 1385 MW, 44 letter of support were issued of gross capacity of 444MW and there is 1 project under development of 132MW gross capacity. There is only one commissioned Hydel power project of 84MW gross capacity by the name ‘New Bong Escape Hydro Power Project”. (http://www.ppib.com)

Power Policy of 2002

On the “Human Development Index (HDI)” Pakistan remained quite deficient in energy prosperity level. Keeping in view these facts, government of Pakistan annpunced Power Policy of 2002. Several amendments have been made in this policy as per emerging requirements.Tremendous reponses were received for this policy. PPIB facilitated this policy in the following way. Against this policy PPIB received 33 letters of interests of the 9998 MW capacity, 4 ICBs were processed of 4000MW, 19 Letters of support were issued of 3788 MW capacity, 13 proposals were received of 2677 MW. Under this policy 12 projects of 2530MW capacity are under construction. 20 projects of 8969 MW are under development. (http://www.ppib.com)

National Policy for Power Co-Generation by Sugar Industry

Government appoved a policyby the name “Policy for Power Co-Generation by Suger Industry” in November 2007. The under lying purpose of the policy was to utilize the ‘waste of suger cane’ for the power generation. It was suggested that this project should be completed by PPIB. PPIB remained succesful in attracting seven suger mills. The registerd sugar mill under PPIB having gross capacity generation of around 550 MW.

Both 1994 and 2002 Power Policies have their specific remifications. The power projects undertaken by virtue of these policies mainly used costly fuels like Gas, HSD, RFO ect. As a result the cost of energy increased and actual relief never come by as it should be after this much energy generation. In 2006 a few amendment were made in 2002 Power policy. GOP banned RFO, HSD, and Gas fired projects. Secondly WAPDA was allowed to Thermal

Power Generation on case to case basis due to slow response of IPPs. When private sector is involved in a mega projects with concessional and mtivating perspective, there is a need of an astute legal framework in order to keep the risk balancing alongwith the provision of incentive mechanism. An all encompassing home work on the policy making, imlementational hazard and availble alternates beside a firm grip over fiscal and financial issue. (http://www.ppib.com)This much homework was missing on the policy and implementational side. The 1994 Power Policy was recived overwhelmingly but mismanagement and lack of confidence in HUBCO project undermined the confidence of the investors. 2002 Power Policy could attract less foregn investors, dometic inverstor remained at the top. Political instability also affected the opportunities of foreign investment in Pakistan. Detailed comparison of both landmark Power Policies is given below;

Place policies comparison table

Sr.#	1994 Policy	2002 Policy
1	GoP guarantee to PSO for fuel supply to IPPs	No GOP Guarantee to FSA
2	PPIB and WPPO one window	PPIB and WPPO and NEPRA
3	Upfront Bulk Power Tariff & decreasing balance of loan payments (6.5 cents/KWH). No Role of NEPRA	No upfront Tariff. Amortization of loan. NEPRA to decide Tariff – red tape ridden lengthy procedure
4	18% IRR	IRR 15% to RFO, 17% to Hydel and 19% to Coal
5	No restriction on site selection, no feasibility study required	Feasibility Study, EPC and COD level required
6	All fuels allowed	Choice of Fuel restricted – No gas fired, No RFO
7	Standard PPA, IA & FSA	Generation license
8	Indexation of US Consumer Price Index	No indexation of US CPI to Equity
9	EOIs for 55,000 MWs	

(Workshop on *"Challenges in Energy Sector"* conducted by WAPDA, 4-11-12)

Pivate Power sector grew impressively but the incentive package given by the governmnet of Pakistan was not well evaluated and it lacked foresightedness

as far as tarrif and fuel management was concerned. At the end of the day the electricity acquire through furnis oil and gas fell heavey on the energy budget.

Private Power Infrastructure Board (PPIB)

PPIB was proposed by the task force set up for energy in 1993. When energy policy of 1994 was announced PPIB was also created through administrative orders for the following purposes;

1. "Promotion of private investment in power sector
2. Provision of one window facility to the investors in the energy sector on the behalf of GOP, its Ministaries and Departments.
3. Execution of IA and provision of gaurentee on the behalf of GOP.
4. Assistance and monitoring of IPPs in executing PPA, FSA, GSA (Gas Supply Agreement), WUL (Water Use Licence) with relevant agencies of the GOP.
5. Technical, financial and legal support to the Ministry of Water and Power, Provinces/ AJ&K."

PPIB has established itself as an expert body over all sectors of energy from invertments proposal till their execution packages to the investors both from local and foreign countries. It was only due to the expertise of PPIB well trained professionals that Power Policy of 1994 proved to be a mega success. "Gross investment PPIB attracted towards the Pakistan's energy sector is around $9.7 billion both from local and foreign donners. PPIB has on its credit 29 Independent Power Plants (IPPs) with the technology based on the RFO (Residual Fuel Oil), HSD (High Speed Diesel) resources. IPPs are currently providing 42% of total installed capacity of the coutry." (Workshop on *"Challenges in Energy Sector"* conducted by WAPDA, attended by the scholar on 4-11-12)

Private Power and Infrastructure Board Act 2012

Till 2002 PPIB was operating under "Administrative Order", rendering its operation on the behalf of the Government its Ministries and Departments. The board was re-established considering its ever expanding functions. PPIB was re-established under a new statute. This statute reinterating its on-going functions and establishing its new aims and objectives. The process of giving PPIB a status of legal entity was initaited through proper channel. The process was initiated through the Cabinet, CCI, National Assembly and Senate. The "Private Power Infrastructure Board Act, 2012" was passed by the Parliiament and it received retification of the President on March, 2012. It was published in the Gazette of Pakistan on 6tth March 2012. Hence, the legal standing of board established in discharge its broad-spectrum functions.

Functions of PPIB

Under the act of 2012, following are the powers and functions of PPIB;

1. Recommnedation for the development of viable energy policy.
2. Prior to the construction of a hydro-electric power station, consultation with the concerned Provincial governments It will also consult the Provincial authorities on the matters pertaining to the power projects set up by private sector or through public- private partnership and other mascellinious issues pertaining thereto.
3. Building up acoordination network with Provincial Government, Local Governments, Government of Azad Jammu and Kashmir and regulatory bodies for the implementation of power policies, if so required.
4. To coordinate and facilitate the sponsors in obtaining licences ans consents from various agencies of the Federal Government, Local governments and Governmnet of AJ&K.
5. To play effective role in policy implementation in private sector or in public private partnership as per power system requirements.
6. To perform the functions as one-stop organization in facilitatating the private power companies, their sponsors and lenders on the behalf of Federal Government, Ministries and Departments by all necessary and appropriate ways and means.
7. To draft and negotiate the security package documents. And to documentation of agreements and to dfart gautentee the contractual obligations of entities under the power policies.
8. Excute, administer and monitor contract like prescription and receiving of fee and charges for processing applications and deposit and disburse or utilize the same, if required.
9. To obtain security instruments and encash or return charges from sponser or private power companies as deemed appropriate.
10. To act and perform as an agent for development, facilitation and implementation of power policies and related infrastructure in AJ&K and Gilgit Baltistan.
11. To open and operate bank accounts in local and foreign currencies as permissible under the laws and regulation of Pakistan.
12. To provide complete mechanism to commence, conduct, continue, and terminate litigation, arbitration. To provide alternate dispute resolution mechanisms at all levels may be necessary or appropriate. To hire and pay legal services and expertise of the lawyers therefore.
13. Appointment of technical, professional or ther advisers, agents and consultants. This includes accountatts, bankers, engineers, lawyers, valuers and other persons.

14. Hiring of technical and supportive staff and to determine their emoluments, terms and conditions of their employment. To make sure that at no stage of their service these terms and condition regarding their emoluments shall not be reduced as determined in the contract of their job.
15. To perform any other function or exercise any other power as may be accidental or consequal, or some task may be entrusted by the Federal Govt to meet the objectives of this act.

The power and function of PPIB speaks of its singnificance for the promotion and generation of IPPs in Pakistan. Right from its establishment PPIB has rendered impressive services and facilitate several projects of"Independent Power Producers" in Pakistan. Few significan proposals that are facilitated by the PPIB are given below;

a) "Power Generation Policy 1994 (this is beside HUBCO with 1292 MW capacity, which was processed prior to 1994).
b) Hydle Policy of 1995
c) Power Generation Policy 2002
d) National Policy for Power Co-Generation by Sugar Industry January-2008
e) Guidelines for Setting Up Private Power Project under Short Term Capacity Addition Incentive- August 2010" (Workshop on *"Challenges in Energy Sector"* conducted by WAPDA, attended by the scholar on 4-11-12)

PPIB has played a vital role in the power generation, especially in the absence of major hydle power projects. Although energy generation by oil and gas is quite high in cost but still it is the only availbale alternative. Beside sevaral administrative and financial issues, IPPs have filled the energy gaps that could have cause a great damage to the economy of the country otherwise. In the major patterns of energy sector in Pakistan PPIB has a vital role to play. This obvious role of PPIB can be assed by evaluating future targets of PPIB for private power generation. (Malik, 2012). Future Targets of PPIB adds into the major energy patterns in Pakistan. Alongwith public sector, it is facilitating and attracting the private sector in the energy circle of Pakistan in order to fulfill the growing energy needs in the social, economic, domestic and cmmercial sectors.

Future Vision of PPIB and Growth of Energy Sector in Pakistan

PPIB has focused on the energy generation through relatively cheap energy resources. It has planned to develop hydro and coal resources rather than

furnis oil and gas. There are few key plans under the keen focus of the Board. The datails of them is as following;

1. Creation of Development Fund

PPIB has a plan to initiate Development Fund in order to attract Foreign Direct Investment (FDI) in the sectors with high perceived risks. This fund is proposed to be used in two important fields; i) in puttin equity in Engineering, Procurement and Construction (EPC) and in arranging loans in shape of supplies (F7). ii)- Subordinated loans for the projects. Previously development Fund have played a significant role in the development of energy sector. The prime example is the Private Sector Energy Development Fund (PSEDF) that was created with the help of World Bank (WB) and administer through Private Energy Division (PED) under the National Development Finance Commission (NDFC). IPPs actually found their basis through these arrangements. As compare to 90s finding and attracting financing opportunities have become difficult. PPIB is determiined to find conerned and to create Energy Funds.

2. Simplification of the Implementation Methods of Hydro Power Projects

Again with purpose of facilitation and convenience to the investors, PPIB has aimed at to make the implementational methods of Hydro Power Projects more simple and easy to comprehend. The proposed hydro power projects were prepared earlier with the consultation of all stakeholders. PPIB in its 90th meeting has decided that ""the proposed framework for Fast Track Development of Hydro power projects be further studied and modified in consultation with the stakeholders to bring clarity". Such acts are a positive act towards the completion of hydro power projects and towards the further facilitation of the sponsors and lenders for the aforesaid projects.

3. Public Private Partnership in Hydropower Projects

This is further a smart move in puttingg efficiency in building the power project on a fast pace. WAPDA has completed the feasibility studies of two projects proposedly located in Kohistan Valley (KPK); Lower Palas Valley Hydropower Project (665MW) and Lower Spat Gah Hydropower project (496MW)in 2010. Basically these two projects were in public sector but in 2010 WAPDA has decided to complete these projects in Public Private partnership (PPP). An Expression of Interest (EOI) is invited by WAPDA I July, 2011 for this purpose under the provisions of "Policy for Power Generation Project 2002" . in response to EOI WAPDA received proposal from private sector firms. After a careful evaluation two proposals of two separate Korean Consortium were

selected. A Memorendum of Understanding (MOU) has been signed between WAPDA, Govt of KPK and the Korean Consortium on 24th December 2012 and a joint agreement has also been signed. Under the provisions of power policy of 2002 PPIB will cntinue the processing of these projects.

Conversion of Existing IPPs to Cheaper Fuel

In the era of 90s, when IPPs got established, furnis oil gas were taken as the best affordable options. With the passage of time these two resources bacame quite costly. In the last decade an exorbitant increase is witnessed in the prices of oil and gas in the world open market. With that high increase in the fuel price, pakistani rupee has also seen a record devluation. It is witnessed that furnis oil price has increased 527%, Gas price 40% and devaluation of pakistani rupee is recorded in this time period aroung 53%. Alongwith other reasons this national and global economic scenario has added in the turmoil of energy sector in Pakistan. Keeping in view these facts and figures, PPIB also planed to bring IPPs to the cheaper fuel. PPIBhas drafted guidelines for the IPPs to assist them convert their power plant to the cheaper fuels. Although no such suggestion is materialized yet but PPIB is keen to persue these guidelines.(Source: General Manager Planning Power National Transmission & Dispatch Company (NTDC)

Energy management sector of Pakistan has its own history. Intially WAPDA handled all energy sector under the Ministery of Water and Power. All hydle and thermal power generation took place under the patronization and vigilance of WAPDA authrorities. It was in mid 80s that the Private Power Generation sector was introduced for the first time. Form that time onwards, is it working and handling IPPs impressivly. Another significant move is verticle disintegration of WAPDA in the Musharraf era, that has a far reaching impact on the power generation and management sector of Pakistan. After exploring the energy generation history and energy management sector, it is equally important to under stand the issue and problem in the energy sector of Pakistan. Part III of this article is dedicated to the issues of energy sector in Pakistan.

Part: III Major Issues in Energy Sector

Enrgy sector in Pakistan is suffering form several problems and issues. These issues and problems are pertaining to policy, governanace, technical and cost issues. Each of these issues is quite serious in nature and has multiple implications on the energy sector. At the same place if these issues are not resolved on meritt and in time, it will cause a serious desastor not only to the

econmic sector but also it will affect the social fabric of the country. The detail of these issues is given as under;

1. Policy Issues:

- Energy infrastructue od Pakistan was depending heavily on Hydle resources since inception and there were serious water issues bewteen India and Pakistan. Due to serious economic delapidation Pakistan coiuld not form an effective and all encompassing energy policy in the early years of independence. In the coming decades, even after the signing down of Indus Water Treaty with India, Pakistan could not manage to create and implement a comorehensive energy policy that coud match the pace of economic development and growing domestic needs due improved life standards in both rural and urban areas. Only a few policies, that are discussed earlier, could be made with the purpose to meet some urgent needs in the short-termed span. Absence of a comprehensive energy policy that could cover all aspects of enrgy requirements, geneeration, transmission, distribution, and energy resouce selection areas.
- Energy sector of Pakistan lacks synergy between various institution pertaining to energy generation, transmission and distribution. This situation has adversly affected both policy formulation and implementation procedure. It is highly desireable that the energy sector, for the purpose of coherence should work under one single department with one patronizing entity.
- As far as deisions and policies regarding preferences of major resources, till 1970s hydle source was making up almost 70% of Pakistan's energy sector and nearly 30% was being generated through thermal resources and to some extend nuclear resources. The estimated hydle power of the country is upto 45000MW. No effective policy is found in the entire energy generation history of pakisan that show the will of utilization this potential. Some make shift policies are their and others are highly controversial like Kalabagh Dam. In this connection there is serious lack of effective policy and planning. The consequent reliance on thermal resources has made electricity a very costly comodity. Beside this creation of IPPs and heavy reliance on them has worked as a double edged sword that at one hand provides relief of problem and on another hand adversly affect the cost effectivness of the energy sector. (Asif,2012, pp. 135-38)

2. Managerial and Governance Issues

- Electricity provision is considered as basic public service on the behalf of government. In this connection generation and provision of electricity

comes in the realm of governance. In the presence of private power suppliers effective regulatory mechnism becomes all the more important. Poor delivery of electricity has direcy bearing on the quality of governance and ratio of corruption in the system. It is seriously required in the energy sector of Pakistan not only to improve governance standards but also curb prevailing corruption in the system. **(Malik, 2012)**.

- Power theft is another serious issue which is refered in general term as line losses. Weak control over the electricity theft and line losses is the clear manifestation of poor governance. These line losses ultimately become burden either on the budget of consumer or these losses are made up through subsidy by the government. These issues pertaining to the governance are big set back in the energy sector of Pakistan.

3. Technical Issues

- In technical field energy sector is suffering from inadequate maintenance and repair of public sector power generation plants. Financial restraints coupled with sheer neglect is drastically reducing the operating efficienc of these plants.
- Most of the line losses are only because of delapdated maintenance conditions. Timely replacement of transmision line would have reduce the line losses and could have reduce the energy cost.

4. Cost and Affordability Issue

- Poor governance and weak managerial structure coupled with much reliablity on furnis oil and gas, has made the electricity quite an expensive comodity in Pakistan. Public sector power plants are in delapidated conditions due poor maintenance issue. All this scenario has made the cost of electricity high and level of efficient provision of electricity quite low.

- Circural debet is huge reality in the cost and affordibility issue of energy sector. Energy production on highly expensive fuels and management of energy sector under a weak structure ruined by orruption has generated this vicious circle of circular debit. Only in last few years government has injected 1.4 trillion in shapre of different subsidies in the energy sector. Although IPPs have provided a short-term and rather easy alternative but in current scenario both publis and private energy projets are running short of fuel and finances and they functioning and surviving on day to day provision of relief by the government. All these factors have generated a severe chaos in the finance structure of these projects in particular and in the entire system in general.

An Assessment

Enrgy sector has become a lifeline of the developmeny of nation. Power of a state is mainly relying on the strength of energy sector as no economic and defense prowess is possible without a sustainable and reliable energy availablity. Keeping in view the significance of this sector each state is striving to preserve its energy resources and tryingg to yeild them in best of its interest. In this regard Pakistan is facing quitte an alrmingg situation. Energy crisis of pakiatan has multiple reasons behind it. Hydro resources are not utilized to the best of their potential. Thermal and nuclear power projects have not proved that cost effective as the hydro resources are generally. Beside this, management sector is also sufferringg from huge administrative gaps that have generated further isue in the preservation and utilization of energy sector. There are several issues and problems that are highlighted and analyzed in this work. There is serious need to attend all these factors on all levels from policy formulation till policy execution. Unless the competiblity between the supple and demand side is created through long-termed and well articulated policies, it is futile to hope for some batterment in the energy sector of Pakistan.

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