Determinants of Energy Consumption in Pakistan

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Abstract: *Energy is an important input of economy and any disruption in its supply may hamper economic growth. Keeping in view of such importance, this study tries to explore determinants of energy consumption in economy of Pakistan. Data on these determinants namely: economic growth, financial development, population and energy prices are utilized from 1972 to 2015 for empirical analysis. Auto Regressive Distributed Lag (ARDL) test is used to check the long run association among variables. The results of the empirical work confirm that economic growth, financial development and population have positive and significant impact on energy consumption. Energy prices have negative effect on energy consumption, but its impact is insignificant in the study. On the basis of the study it is suggested that country should focus on smooth energy supply for quenching the demand of the fast growing population.*

Key Words: *Energy Consumption, Financial Development, Economic growth, Population.*

1. INTRODUCTION:

Energy plays a vital role in the economy on both demand and supply sides. On the demand side, energy is a composite commodity that the consumers want to buy to satisfy their wants and derive utility. On the supply side, energy is an important input besides the traditional factors of production like capital, labor and raw material. Thus the availability of energy in sufficient amount has been among the critical factors essential for the sustained development of an economy.

Energy is a composite commodity[1] and any disruption in its availability can hamper the full or partial functioning of different sectors of the economy. The effects of such uncertainty or disruption in its supply are clearly visible in developing countries. The smooth supply of energy is not only vital for economic growth but it is also significant for the development and welfare of human beings, which ultimately results in alleviation of poverty and unemployment.

The consumption of energy benefits people in improving their life style. It enhances the quality of social services like basic health and modern education through improved technologies and working of modern equipments. Further, provision of modern and best fuel (gas) at door steps helps in improving the lives of rural women and little children who used to spend most of their time in gathering straw, dung and firewood for cooking of meals and heating of their rooms. Thus it may be true to state that energy services have an indirect but significant role in poverty alleviation. A good example for understanding the role of energy in poverty reduction is the small scale and cottage industries, employing up to ten workers. Generally, these industries are informal and mostly located in rural areas. Now if electricity is provided to these areas with managed outage, the working hours of these industries can increase, which will enhance employment and productivity, and lead to income generation and poverty alleviation. Energy sector is also an important source of employment in itself. Many people are engaged in electricity generating and gas distribution establishments as well as coal mining and transportation. etc. Such employment has a positive impact on the standard of living and poverty reduction.

1.1 The Nexus between Energy and Economic Growth

Energy is an important input of production and therefore directly related to economic growth. In fact, the conventional factors, labor and capital, are useless without availability of energy. Thus, energy supply and economic growth are interconnected through the process of production. This mutual dependence of energy and growth is explored by many researchers using different methodologies; however, the results from these studies are mixed. Some researchers have used time series data to examine the energy growth nexus, while others have used panel data of different

[1] Electricity, Petroleum, Natural gas, Coal and Firewood are the traditional sources of energy; with solar energy as the emerging and rapidly expanding source.

countries[2].The reasons behind differences in the results are; dissimilarities among countries in terms of sources of indigenous energy supplies[3], differences in the estimation methodologies and time spans used in various studies, as well as differences in the political situations, institutional systems for energy supplies, energy policies and price mechanisms prevailing. For example, Kraft and Kraft (1978) concluded that there was unidirectional causality from GDP to energy consumption using data from 1947 to 1974 for USA while the same was negated by Akarca and Long (1980) using 1946-1972 data.

With the passage of time, new analytical techniques are developed. Obviously, the researchers use the latest techniques for data analysis. The primary tool used for time series data analysis was the Ordinary Least Squares (OLS). However, the researchers realized that certain assumptions of OLS are not fulfilled in the real/practical situation. To resolve such issues, different techniques are developed over time, like the Johansen Co-integration (1990) and the Auto-Regressive Distributed Lag model- ARDL (1997) etc. As such, the results obtained even for the same countries but through different methodologies were not mutually supportive and no consensus could be found on the causality of energy consumption and economic growth.

1.2 Other Determinants of Energy Demand

The foundation works of Goldsmith (1969), Mckinnon (1973) and Shaw (1973) on the nexus between finance and economic growth draw the attention of researchers towards this vast area and subsequently a large volume of work has so far been done in exploring this nexus. It is therefore logical to assume a significant but complex relationship between energy consumption and financial development. The later facilitates the household to get easy credit from financial institutions, which they can spend on purchasing cars and automobiles, televisions, refrigerators and air conditioners etc.; all energy-using equipments. Likewise, the investors, after getting loans from financial institutions, can establish new factories and install the requisite machinery. Obviously, all this boosts up the demand for energy.

The survey works by Ozturk (2010) and Payne (2010) have opened avenues for research in exploring other determinants of energy consumption besides economic growth conventionally used in past studies. Although, Masih and Masih (1997) and Asafu-Adjaye (2000) had used energy prices in their studies on energy demand, however, no other explanatory variables were included. The observation of Karanfil (2009) and Ozturk (2010) encouraged researchers to explore other important determinants of energy demand. Keeping these aspects in view, the researchers like Shahbaz (2011), Javid M. (2013) and Chang (2015) etc. have included financial development in their analyses on energy demand.

A complex link therefore exists between energy consumption, economic growth and financial development that need to be explored and comprehended properly. Such investigation and the resulting information could help the governments, regulatory authorities and investors in designing efficient and reliable energy policies for achieving efficiency in production and ensuring sustainable economic growth and development. The present study is a meager attempt in this direction.

2. LITERATURE REVIEW:

As indicated above, Kraft and Kraft (1978) was the first who studied energy in relation to growth using Sims (1972) approach for USA using the long-run annual data over the period of 1947–1974 and concluded that increase in economic activity may influence energy consumption but not the vice versa.

After this first initiative, a large volume of research work appeared on the subject. In this context, Akarca and Long (1980) re-examined the work of Kraft and Kraft (1978) for US economy using time period 1974 to1990 and argued that structural changes taking place after World War II were not considered. Hence the earlier results were spurious. They concluded with no causal relation to exist between energy consumption and economic growth. Likewise, Yu and Jin (1992) conducted analysis in bivariate framework and supported the 'no relation' hypothesis.

Masih and Masih (1996) on the other hand analyzed panel data of six Asian countries (India, Pakistan, Indonesia, Malaysia, Singapore and Philippines) for energy-growth nexus and concluded that three out of six countries (Pakistan, India and Indonesia) are co-integrated while the remaining three countries (Malaysia, Singapore and Philippines) were not.

Masih and Masih (1997) again examined energy demand in relation to economic growth and energy prices by selecting data on two highly energy dependent nations, namely, North Korea and Taiwan, and found that all the three variables (energy consumption, national income and energy prices) were moving together (parallel) in the long run as well as in short run. Similarly the role of prices as determinants of energy demand is also studied by Asafu-Adjaye (2000) in case of prominent energy consuming Asian countries (India, Indonesia, Philippines and Thailand). The study comes up with the conclusion that prices play important role in the energy demand in most of these countries.

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[2] Examples of time series data analyses are Aqeel and Butt (2001) for Pakistan and Dhungel (2008) for Nepal etc. Examples for multiple countries using panel data are Masih & Masih (1966) and John Asafu (2000) etc.

[3] For instance, Saudi Arabia and U.A.E have plenty of oil resources while countries like Pakistan and India have hydro electricity and natural gas.

Lee and Chang (2008) used Cobb-Douglas Production function for analysis of energy consumption in sixteen Asian countries over the period 1971 to 2002 indicated that energy is an important factor for economic development of Asia and any energy conservation policies in the countries concerned will be feasible only at the cost of low economic growth. As intimated above, the literature surveys by Ozturk (2010) and Payne (2010) revealed that other important variables could be included in the analysis of energy and economic growth. In response to this, many researchers tried to incorporate other determinants in their analyses of energy consumption. Examples are Ang (2007) who included carbon dioxide (CO2) emissions, Lean and Smyth, (2010) used exports, Chang et al. (2001); Shahbaz et al. (2011) included employment, Tang (2009) used population, Chandran et al. (2010); Ciarreta and Zarraga, (2010); Masih and Masih (1997) considered energy prices, while Tang (2009) also included foreign direct investment (FDI) besides others.

2.1 Energy Consumption and Financial Development

Financial development was indicated to be such an important explanatory variable. Consequently, Sadorsky (2010) used it in the analysis of energy-growth nexus for 22 emerging economies for the period 1999 to 2006 using panel data and using five different indicators for financial development. He concluded that financial development and energy demand had a positive relationship

Following Sadorsky, Shahbaz et al. (2010) also included the said variable in their analysis of energy and growth relationship in case of Tunisia for the period 1971 to 2008 and supported the earlier results of positive relationship between energy consumption and financial development.

In this continuation, Faridul Islam et al. (2013) tested the energy-growth nexus with inclusion of financial development for Malaysia over the period 1971 to 2008 and concluded that financial development and energy consumption were positively correlated.

Zeran and Mustafa (2014) studied the relationship between energy consumption and financial development in the newly industrialized countries (India, Malaysia, Mexico, South Africa, Philippines, Thailand and Turkey) over the period 1971 to 2010. Their findings revealed a positive and significant relationship between the two variables. The authors concluded that financial development can cause efficient use of energy that will in turn lead to reduction in energy costs.

Salman & Atyya (2014) explored the role of financial development and energy consumption for economic growth in case of two oil rich countries (Algeria and Egypt) and one oil scarce country (Tunisia) over the period 1980 to 2010 using demand based model for energy feasting. Results indicated that financial development is positively related to energy consumption in Algeria and Tunisia. As such, these countries needed comprehensive policies/reforms regarding energy usage, financial management and energy pricing so that productivity of the system could be improved.

Shu-Chen Chang (2015), while extending Sadorsky's (2010) previous work, focused on non-linear effects of financial developments and income on energy usage by using the data from 1999 to 2008 and panel threshold regression. The results suggest that energy consumption generally increases with income in case of developing countries, while it increases with income only after a threshold level of income is reached in case of advanced countries.

2.2 Studies on Pakistan

The first study on energy-growth nexus in case of Pakistan was conducted by Riaz (1984) using simple regression. The author argued that economic growth and energy consumption were highly correlated. He further stated that such high correlation between the two variables in developing countries is slightly slowed down when industrial sector of the economy is developed with the passage of time.

Aqeel and Butt (2001) conducted a study on the causal relationship between energy consumption and economic growth utilizing data from 1955-56 to 1995-96 and employing cointegration & Hsiao's granger causality. They concluded that energy is the driving force for economic growth. Energy conservation policies should be adopted as it would not adversely affect the economic growth and substitution of other forms of energy by natural gas would be stimulus for economic growth. An enhanced level of energy consumption will resultantly create more employment.
Siddiqui (2004) conducted a study on energy use and economic growth by focusing only on the commercial energy supply for the period 1971 to 2003 using ADL method for estimation and Granger causality. The results revealed that energy consumption did not affect economic growth in aggregate form. However, when energy is disintegrated into its components, then a positive relationship holds.

Qazi and Riaz (2008) re-examined energy consumption and economic growth relationship using Bounding test utilizing data from 1971 to 2007 and concluded that Pakistan used 18% of its energy demand from indigenous sources and 82% through imports which needs to be improved by investing more in the energy sector.

Amjad Ali et al.(2015) have made an effort to investigate the relationship among financial development, energy consumption and economic growth in case of Pakistan utilizing data from 1980 to 2012 using Johanson cointegration and concluded that energy consumption is positively correlated with financial development. The results also accepted the validity of Environmental Kuznets Curve (EKC) hypothesis for Pakistan

3. RATIONALE AND SIGNIFICANCE OF THE STUDY:

Energy plays a key role in development of a country. The nexus between energy consumption and economic growth is an area of high interest for researchers. After going through the existing literature, it is concluded that many researchers established the relationship between energy demand and economic growth along with other conditioning variables, which influence energy demand. However, hardly any researcher could combine the three important conditioning variables, namely, financial development, population and energy prices, in the energy-growth nexus. The present study will fulfill the gap and amalgamate these variables in energy analysis. These explanatory variables influence energy feasting in the following channels.

The credit offered by the banking sector to household increases their purchasing power, which boosts their demand for consumer goods (durable) and results a surge in the demand for energy. Similarly, the credit available to industrial sector increases investment demand, which subsequently results in the establishment of new factories with installation of plants and machinery that results into energy demand. Therefore easy availability of credit via financial development is a potential variable that affects energy consumption.

Different researchers have used different proxies for measuring the financial development. Sadorsky (2010) used five different proxies for estimating financial development. In contrast, Shahbaz et al. (2010) used only one variable, the credit availability to GDP ratio, for measuring the financial development. Some researchers; for instance Khan et al.(2005) and Kakar et al.(2011), used money supply (M2 concept) to GDP ratio for computing the extent of financial easiness, while others used liquid liabilities to GDP ratio for measuring financial development. Instead of using one proxy, the present study constructs an index of ten relevant variables for evaluating the financial development in Pakistan, using the Principal Component Analysis approach. This index will utilize maximum indicators and hence depict the actual position of the country regarding financial development which is previously highlighted while using one indicator for the sector.

Population growth is also a potential variable, which affects energy consumption. Shahbaz et al. (2015) argued that as population grows, the limited resources of rural areas are pressurized that force people to move to urban areas. Such situation creates increase in energy demand. More people need more houses, more goods and more appliances. New houses need electricity, natural gas and kerosene oil for cooking meals and heating rooms in winter. Naturally, this increases the demand for energy. Again, an increase in urban population leads to higher demand for transportation facilities and which in turn increases the demand for energy (petroleum and CNG).

Energy price (composite) is the natural argument in the demand for energy analysis. Economic theory suggests a two-way causality between energy prices and consumption demand. However, energy is a necessity and the demand or consumption is not likely to be affected much with increase in the prices. As such, the prices are likely to be affected positively with increase in energy consumption. Further, energy prices are not determined freely by market forces of demand and supply in Pakistan; rather, these are controlled by the government authorities specially in case of petroleum, natural gas and electricity. Anyhow, we include this variable in our analysis and see the results.

4. OBJECTIVE OF THE STUDY:

The study is intended to examine the long run relationship between energy consumption and economic growth in Pakistan by incorporating other conditioning variables like financial development, energy prices and population as determinants.

5. RESEARCH MODEL AND METHOD:

5.1 Model Specification

Keeping in view the models suggested by Islam et al. (2013), Malick and Mahalik (2014) , M. K (2014, Shahbaz et al. (2015) and also the objectives of this study, the following functional form is suggested to show the relationship between energy consumption, economic growth, financial development, energy prices and population:

EC= f (GDP, FD, Pop, EnP) ….(1)

For the purpose of empirical analysis and to capture non linearity, the above equation is transformed to the log linear format as under:

$$lnEC_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 lnFD_t + \beta_4 lnPop_t + \beta_5 lnEnP + \varepsilon_t \quad \ldots.(2)$$

In the above relationship, β's are the relevant coefficients of parameters showing partial elasticities, where the subscript 't' represents the time series nature of the variables concerned and 'ε' is the error term with usual properties. This model will be used for empirical investigation over the data period 1972 to 2015. The symbols used for different variables in the model are explained below.

5.2 Variable Description and Sources of Data

EC stands for energy consumption, which is the dependent variable. The data is collected from several editions of Pakistan Energy Book, published by Hydrocarbon Development Institute of Pakistan (HDIP) and unit of measurement is tons of oil equivalents (toe).

The following explanatory variables are straight forward:

GDP stands for gross domestic product used as indicator of economic growth. The data are collected from Pakistan Economic Survey (various editions) expressed in Rs. Million

PoP is used for expressing population in million. The data is taken from World Development Indicators (WDI)

EnP denotes energy prices. The data on energy prices are not available separately since 1972, Thus the consumer price index (CPI) is used in lieu and the data is collected from Economic Survey (various editions) .

The variable 'financial development', for which the symbol FD is used, is little bit complicated and needs some explanation.

Ten different indicators are used for measuring financial development of the country these are; (i) Credit availability to Private sector, (ii) Liquid liabilities, (iii) Money Supply (using M2 concept), (iv) Stock Market Capitalization, (v) Central Bank Assets, (vi) Deposits with Commercial Banks (vii) Reserves (reserves held with the State Bank plus commercial banks) (viii) Foreign Remittances, (ix) Gross savings, .(x) Net inflows of Foreign Direct Investment. All these are expressed as ratios to GDP and used in construction of the Financial Development Index. Weight scheme is adopted using PCA method and is given in annexure 3. The method of driving weights from PCA output are given in detail in Handbook on Constructing Composite Indicators published by OECD and is adopted while computing the weights. As all indicators are in ratio form so Geometric Mean is used for aggregation purpose.

5.3 Econometric Methodology

This study utilizes the long-run time series data from 1972 to 2015 of Pakistan. For the examination of stationarity, ADF test is carried out and for long run relationship, the Auto Regressive Distributed Lag (ARDL) Approach for Co-integration is used. In the ARDL method of long run estimates, F bounding test is first carried out which indicate that either long run relationship exist in the model or not. If calculated value of F statistics exceeds tableted value then model is cointegrated and long run relationship exist in the model.

6. RESULTS AND DISCUSSION:

Before handling the time series data, certain tests are considered necessary. The results are discussed briefly as under:

(i) Results of Principal Component Analysis

The correlation matrix (annexed) of ten indicators show high correlations among different indicators and KMO and Bartlett's Test (annexed) suggested that PCA is best fit to use. The table (annexure 3), shows the rotated component Matrix along with weights. With the help of these weights, the index for financial development is constructed and utilized in the analysis.

(ii) Results of Unit Root Test

Results of Augmented Dickey Fuller's (ADF) are given in Table-1, which suggests that most of the variables are stationary at 1st difference. However, one variable i-e energy prices, is stationary at level. The results provide strong foundation for using ARDL approach for long run estimation.

Table 1 ADF unit root test

Variables	At level		1st difference		Result
	ADF Values	P values	ADF values	P values	
LnEn	-1.6036	0.4721	-6.5488**	0.0000	I(1)
lnGDP	-2.4678	0.1302	-4.5361**	0.0007	I(1)
lnFD	-3.024123	0.1377	-6.935347**	0.0000	I(1)
lnEnP	-3.8494**	0.0242	---	---	I(0)
lnPop	-2.7423	0.2263	-3.7409**	0.0311	I(1)

** Significant at 5%

(iii) Results of ARDL Bounds Test

The first step in using ARDL approach is selection of the optimal lag, which is 4 in this study using Akiake Information Criterion (AIC). The ARDL Bound test is used for existence of co-integration or long run relationship and the results are shown in Table-2. The results suggest that long run relationship exists among the variables of the model, as the calculated value of F is greater than all the tabulated value.

Table 2 Results of ARDL Bounds test

Test Statistic	value	k
F-Statistic	8.1	4
Critical Value Bounds		
Significance	I0	I1
10%	1.9	3
5%	2.3	3.5
2.5%	2.6	3.9
1%	3.1	4.4

(iv) Stability Tests

Cumulative sum (CUSUM) and Cumulative sum (CUSUM) of square both are used as stability tests and both tests have shown that the model is stable. The results in respect of CUSUM and CUSUM square at 5% for this study are given in the figures below.

Figure 1Cumulative sum (CUSUM) at 5% significance

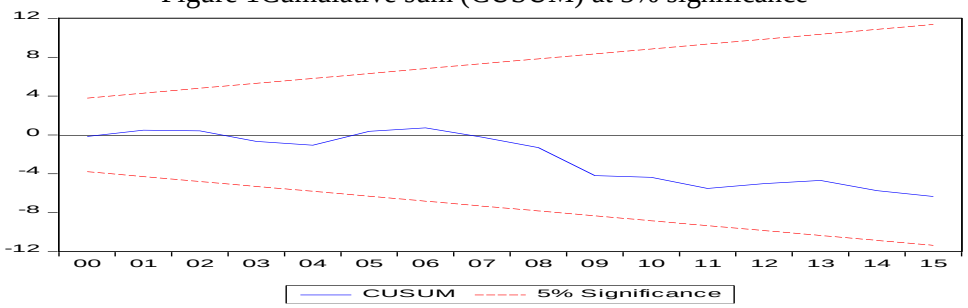
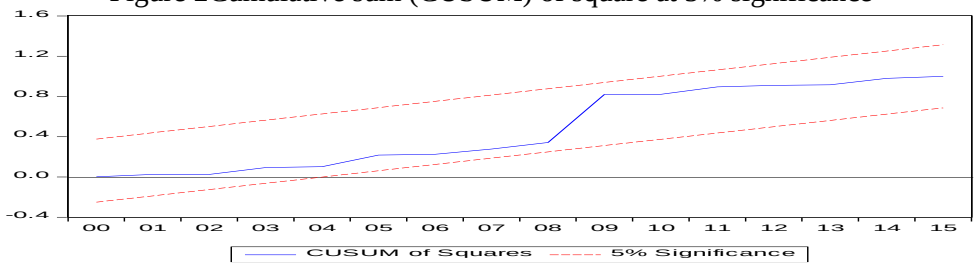


Figure 2Cumulative sum (CUSUM) of square at 5% significance



6.1 Long run Co-integration Results

After going through the usual test, we proceed to formal estimation via the ARDL approach. The long run coefficients are given in the following table.

Table-3 Dependent Variable: Energy Consumption

Variable	Coefficient	Std. Error	t-statistic	Prob.
LNGDP	0.622231	0.23787	2.615877	0.014
LNFD	0.301899	0.12756	2.366722	0.025
LNENP	-0.03952	0.07974	-0.49561	0.624
LNPOP	0.431715	0.14507	2.976018	0.006

Before interpretation of the long run coefficients, it is important to explain the signs of the coefficients of explanatory variables. Signs of all the variables are positive except energy prices. Energy prices are although negatively correlated to energy demand (which is according to economic theory) however, the coefficient is insignificant[4]. All other variables are positively correlated to energy consumption and also significant. It means that these variables positively affect the energy consumption in long run.

[4] This is because of the fact that energy prices are controlled by the government and not determined by the market forces. As already explained, complete data on energy prices are not available and CPI has been used as proxy.

Next looking at the magnitudes of the coefficient, it is revealed that 1% increase in GDP causes 0.62% increase in energy consumption. The next significant determinant of energy demand is the population; and 1% growth in population enhances energy consumption by 0.43%. Similarly 1% improvement in financial development boosts energy consumption by 0.30%. In contrast, 1% growth in energy prices results a minor decrease by only 0.03% in energy consumption, which indicates that energy is among the necessities of life.

Some important insights from these results are at hand. Energy consumption increases with economic growth. This is very natural. Likewise, financial development is positively correlated with energy consumption. It implies that when the private sector enjoys easy access to financial credit, the agents concerned are deemed to invest in equipment and machinery as well as consumer durables, which boosts energy demand/consumption.

Likewise, the population growth also stimulates energy feasting. Increase in population causes new houses to be built and new industries to be installed. All the three factors, namely, economic growth, financial development and increase in population, reinforce one another in boosting the demand for energy. ..

Finally, the increase in energy prices has negative but insignificant impact on energy consumption as can be understood by the fact that energy is a necessary commodity.

7. CONCLUSIONS AND POLICY IMPLICATIONS:

Energy is an important component of household demand. Likewise, it is an important factor input in the production process. In case of ordinary commodities, supply follows demand but in case of energy the converse is true. The demand for energy, particularly in case of electricity and natural gas, is constrained by the supply/production capacity, which is limited in the context of Pakistan's scenario, i.e. whatever is supplied, the same is demanded. In other words, demand is not saturated due to shortage of electricity and gas supplies. Supply of energy (electricity, natural gas and petroleum products) is in the hands of government authorities like WAPDA, OGDC etc. and the prices are also determined by the government.

The problem of energy shortage requires serious policy actions on part of the government. Improvements in energy sector need particular attention. Some of the recommendations are given as under.

8. SUPPLY SIDE RECOMMENDATIONS:

Electricity

Electricity is the main source of energy having multiple uses. In fact, life in the absence of electricity is meaningless in the modern age. The government should focus on hydro power generation, which is the cheapest source. In this regard, construction of dams like Basha and Gomal Zam etc. which are not controversial should be accelerated for timely completion. This will not only increase power supply but also minimize the cost of production.

Currently the share of thermal power in total electricity generation is more than 60%. The thermal plants mainly use furnace oil and coal in the combustion process, which is not only costly but also lead to environmental degradation in form of CO2 emission. Therefore, electricity generation from thermal sources should be discouraged in the long term policies of power sector.

Electricity generated from alternate sources; (sources of clean and green energy) should be encouraged further. Suggestions of Alternate Energy Board and NEPRA are positive signals towards development of this sector. These suggestions need to be materialized and quick actions are needed to exploit wind, solar and biomass resources through establishments of new plants.

The transmission and distribution system of electricity is old and obsolete. The associated power losses, which stood more than 20%, are clearly indicating the inefficiency of the system. The system needs to be replaced by new and advanced mechanisms like construction of smart grid station and smart metering etc. The recovery of bills is another important issue. Distribution companies (Discos) are in dire need of implementation of effective management and governance in order to minimize the line losses. Private sector should be encouraged to join hands with government in generation and distribution. In particular, the distribution of electricity should be privatized to ensure efficiency minimize the losses due to theft and misuse.

Lastly, efficiency in energy utilization is utmost necessary and every effort should be made to eradicate the wastage. The culture of energy conservation should be developed. The government of Punjab has initiated public awareness program in this regard. Other provincial governments should follow this initiative in letter and spirit to develop energy conversation habits among the people.

Natural Gas

Natural Gas is important fuel in the energy mix and also environment friendly. In recent years, load shedding of natural gas in winter has been observed due to which people demonstrate protests and act violently. The pace of gas supply lags behind the ever increasing demand has resulted into this awkward situation.

Production from indigenous sources should be encouraged. Both local and foreign investor should be motivated through exemption of taxes and elimination of rigid policies of licensing etc.

Besides efforts in growth of locally produced gas, import from other countries is also important for catering the demand for natural gas. In this connection, early completion of Pak-Iran Gas Pipelines is need of the hour. Other projects like TAPI and import of LNG should be completed within the stipulated time.

Petroleum Products

Petroleum products are considered as blood in bodies of many countries. Petroleum is important for the development of industrial sector. Production from local sources of crude oil is not enough to handle local demand in Pakistan. Huge cache of money is paid on the import of oil.

Some important actions are needed like enhancement of capacities of local production and purchase of crude oil at concessional rates from global market. Currently Saudi Arabia supplies crude oil at preferential rates to Pakistan. Capacities of oil refineries should be enhanced and lastly power companies should be discouraged from excessive use of furnace oil.

Coal

The share of coal in energy mix is relatively low. The domestic production is fulfilling the maximum demand and the remaining is accomplished through importing. The reforms in this sector are needed by introducing licensing process, health safety measures for labors and introduction of latest techniques of mining.

9. DEMAND SIDE RECOMMENDATION:

Finally, a few actions are needed on the demand side of energy. The population growth rate of Pakistan is high as compared to other South Asian countries. The reasons behind such growth in population are lack of education, lack of awareness, cultural issue and limited sources of entertainment etc. This growth badly affects the energy resources besides others sectors. A comprehensive policy of energy conservation is required with special focus on population growth for elimination of load shedding menace. Further, energy conservation habits are also needed to be adopted for efficient use of energy

Financial development is also responsible for increased energy demand, to a larger extent. Through recent years, commercial banks have been providing easy credit to households, particularly for purchasing automobiles. This has increased the number of vehicles which has exerted tremendous pressure on the existing roads and led to increased energy consumption. Provision of Metro bus scheme to the people is a good solution for this problem.

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Annexure 1 Correlation Matrix:

Name of Indicator	Credit to Private Sector to GDP ratio	Liquid liabilities to GDP ratio	M2 to GDP ratio	Stock Market Capitalization to GDP Ratio	Central Bank Assets to GDP	Deposit Money Bank Assets to GDP	Reserve to GDP Ratio	remittances to GDP	Gross savings to GDP	net inflows of FDI to GDP
Credit to Private Sector to GDP ratio	1.000	.642	.041	-.223	.226	.67	.25	.18	.59	.34
Liquid liabilities to GDP ratio	.642	1.000	.584	.364	-.089	.93	.38	.14	.65	.43
M2 to GDP ratio	.041	.584	1.000	.602	-.430	.91	.49	.21	.50	.54
Stock Market Capitalization to GDP Ratio	-.223	.364	.602	1.000	-.336	.54	.03	-.33	-.09	.43
Central Bank Assets to GDP	.226	-.089	-.430	-.336	1.000	.24	-.42	.42	.40	-.39
Deposit Money Bank Assets to GDP	.229	.684	.783	.692	-.253	1.000	.30	.13	.55	.41

Reserve to GDP Ratio	.035	.215	.359	-.043	-.619	.30	1.000	.27	.49	.35
remittances to GDP	-.109	-.343	-.035	-.296	.196	.13	.27	1.000	.58	-.31
Gross savings to GDP	.038	-.103	-.018	-.063	-.087	.56	.49	.58	1.000	-.07
net inflows of FDI to GDP	.318	.513	.664	.447	-.518	.41	.35	-.31	-.07	1.000

Annexure2 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.520
Bartlett's Test of Sphericity	Approx. Chi-Square	302.214
	Df	45
	Sig.	.000

Annexure 3 Rotated Component Matrix along with Weights

Name of Indicator	Component						Weights
	1	2	3	4	5	6	
Credit to Private Sector to GDP ratio	0.00	0.52	0.00	0.00	0.00	0.02	.13
Liquid liabilities to GDP ratio	0.12	0.31	0.02	0.01	0.02	0.00	.11
M2 to GDP ratio	0.24	0.00	0.06	0.03	0.04	0.10	.06
Stock Market Capitalization to GDP Ratio	0.26	0.03	0.00	0.00	0.09	0.02	.13
Central Bank Assets to GDP	0.02	0.04	0.32	0.01	0.08	0.17	.07
Deposit Money Bank Assets to GDP	0.29	0.04	0.00	0.01	0.00	0.02	.08
Reserve to GDP Ratio	0.00	0.01	0.55	0.00	0.02	0.00	.12
remittances to GDP	0.00	0.01	0.00	0.16	0.67	0.00	.12
Gross savings to GDP	0.00	0.00	0.01	0.77	0.07	0.00	.07
net inflows of FDI to GDP	0.06	0.04	0.03	0.00	0.01	0.67	.11
Percentage of Variance	38.25	18.88	15.82	12.30	5.66	4.38	
Cumulative Percentage	38.25	57.13	72.95	85.18	90.84	95.22	
Weight of every Component	0.29	0.19	0.18	0.12	0.12	.10	1