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Impact of Electricity Shortage on Industrial Estate of Hayatabad

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Abstract
Energy shortfalls have significant negative impact on the industrial sector of the developing economies. The purpose of this study is to find out the magnitude of negative effects on firm's output due to ongoing lengthy energy load shedding.A primary data from 50 firms from HIE has been analyzed using Binomial Logistic Regression analysis and concluded that electricity shortfall negatively affect the output of all firms especially of smaller firms.Pakistan should focus on producing more cheap energy from hydroelectric power plants by building dams such as Kala Baagh dam and Bhaasha dam and should improve energy cooperation to invest in renewable energy resources. The proposed gas pipelines with neighboring countries should be completed to meet the ever growing demand for energy consumption.
Keywords: Electricity Shortage, Hayatabad Industrial Estate (HIE)

1. Introduction

Pakistan is a country that has been through military rule, political uncertainty and disputes with India, the sixth most populous country of the world and the second Muslim populous country in the world. It has five provinces, Punjab, Sindh, Khyber Pukhtounkhwa, Baluchistan and Gilgit Baltistan. Pakistan's GDP growth remains low due to inconsistent and uncertain policies, liberalization reforms, persistent power shortages and other macroeconomic challenges. The acute energy shortage, continuous power breaks down and government issues with independent power producers (IPPS) on payment have badly affected the sector's capacity in the power generation and distribution. The growth rate of the manufacturing sector has reduced from 8.48 percent in 2004-2005 to 1.99 percent in 2007-08. [Pakistan, government of (2001)].

Industrialization increases overall production in a country, which generates employment and hence a higher per capita income. It also helps in making favorable balance of payment which reduces inflation and the economy becomes stronger. All of these in turn increases the capital intensive industrialization in the country (Asia Umar Khan). Industries have an important role in the economic development of a country (E. Sanderson, 1992). It also increases the employment as well as increases GDP. The greater number of industries in the country, the greater is the production and hence higher employment opportunities (Rugman, Lecraw and booth, 1985). Large number of industries increase the ability of countries to export its products to other countries as well; this minimizes the balance of payment deficit (Brooke, 1996). (Martin, 1989) has concluded that under Developed countries can achieve real progress by efficient utilization of resources and raw materials. Tito (1970), studied the underdeveloped countries facing serious problem of unemployment, and suggest that this can be solved through industrialization. Industries are a source of providing employment to an individual as a result, their income rises and improve the standard of living.

Industrial estates in KP are special industrial zone Risalpur nature, export processing zone reappear, industrial state, Haripur, Gadoon Amazai, small industrial estate mardan, small industrial estate Kalabat, Haripur, small industrial estate Abottabad, small industrial estate mansehra, small industrial estate Kohat, small industrial estate Bannu, small industrial estate D. I. Khan, small industrial estate Charsadda and small industrial estate in Peshawar. The top industries of KP are Match, pharmaceutical, marble, and PVC pipes. According to martin (1980), the KP had unluckily no industrial base at the time of requirement such as water, power, transport, communication, and banking facilities. It is notable that about 702 industrial units have been closed (Directorate of Commerce and Labor KP, Peshawar).

Study Area

Hayatabad Industrial Estate (HIE), spread over an area of 693.036 acres. 71.790 acres of land are under different government department, including a grid station with a capacity of 132 KVA of electricity, labor colony, Mineral Testing Laboratory (MTL) and others.

(Sarhad Development Authority; SDA). It is divided into two main estates i-e large industrial estate and small industrial estate. The large industrial estate has a total of 206 industrial units covering a total area of 582.468 acres with an area of more than one

Acre, each having a total capital cost of Rs 4820.247 million, out of which 44 are closed down, whereas small industrial estate has a total number of 100 units with a total area of 34.462 acres, each having a capital cost of Rs. 242.479 million. Out of these, 9 are closed down. Rs 425.505 million capital loss has been occurred due to closed industrial units. The industrial estate is comprised of various kinds of industries such as dying chemicals, pharmaceuticals, textiles, matches, ghee, food, drinks, rubber, marble, wood, steel, and others (Directory of Industrial Establishment, 2007).

Significance of the Study

This study attempts to analyze the possible impact of electricity shortage on the performance of HIE and will enable us to suggest possible solutions. Numerous studies have been conducted on current energy crises and their impact on the industrial sector. As the output of industries is adversely affected by power shutdown and substitute use of alternative energy sources, like generators and UPS etc. Greatly increase the cost of production, which ultimately affect the producers and indirectly consumers.

Objectives of the study

1. The main objective of the study is to find out the impact of electricity shortage on an industrial estate of Hayatabad.
2. To study the impact of electricity shortage on the output of the industrial estate.
3. To study its impact on the consumers.
4. To study its effects on the employees of the industrial estate.

2. Literature review:

Arif A, et al, (2006) has studied that Pakistan is facing the worst energy crises. Increase in oil prices at the world level is severely affecting the common masses, on the other hand the electricity shortage is creating a disturbance in the country. This is due to rise in the demand for electricity due to increase in production as well as the household income. Increasing the unit price will decrease the demand. That is why the price varies with different range of unit usage. Time series data from 1979-2006 has been used; ARDL model is used to investigate income and price elasticity of electricity demand. Results show that electricity demand is price inelastic in both short and long-run. In addition household size has a strong positive impact on electricity demand in Pakistan.

Sahir and qureshi, (2007) have studied the importance of Energy to the lifeline of an economy, the most important instrument of socioeconomic development and has been considered as one of the most important strategic commodities.

Haq, (2008), studied the relationship of demand for electricity and said that demand exceeds the supply and hence load shedding is a common phenomenon through power shutdown. Pakistan needs around 14,000 to 15000 MW electricity per day and the

Demand is rising by approximately 20,000 MW per day by 2010. Presently it can produce about 11,500 MW and the shortfall is about 3000 to 4000 MW per day. This badly affects the industry, commerce, daily life and posing risk to economic growth.

Arif, M, (2008), analyzed that in the advent of the year 2008, Pakistan faces a gap of 4500 MW between the demand and supply of electricity, registering a shortfall of 40 percent. It's an overview of key dimension of crises i-e growing gap between demand and supply, diminishing indigenous oil and gas reserves, rising energy cost and security concerns. Has been found that the total estimated hydropower potential is more than 42 GW out of which only 6.5 GW has been tapped so far. In terms of available solar energy, Pakistan is amongst the richest countries in the world, having an annual global irradiance value of 1900–2200 kWh/m^2. Despite that fact that the biomass play an important role in the primary energy mix by contributing to 36% of the total supplies, it has not managed to break into the commercial energy market. It also suggests hydropower, solar energy, biomass and wind power as sustainable energy options for the country.

Shah, S, (2009) studied the shortfall in the supply of electrical energy in Pakistan. Empirical data and preliminary calculations are used by forecasting it for the next 10-12 years. A brief review about the potential of Pakistan is given, to produce electricity and

Energy sources, it has importance of utilizing coal resources of Pakistan are also discussed in it. It is suggested that renewable energy sources such as solar energy and wind power can use to minimize the shortfall of effect in Pakistan.

Khan, M.A & Qayyum, A, (2009) analyzed the patterns of electricity demand in Pakistan over the period 1970–2006 using an autoregressive distributed lag technique to co-integration. Long run and short-run price and income elasticity are examined for the national level and for the three major consumers' categories—households, industry and agriculture. The overall results suggest that income and price elasticity possess expected signs at aggregate and disaggregate levels in the long run as well as in the short run. The error correction terms possess expected negative signs and are highly significant with reasonable magnitudes. Furthermore, the estimated long run and short-run electricity demand functions remain stable over the sample period. The results thus convey important information to the agents operating in the electricity market regarding the pricing policies and helps in planning the future strategy of electricity demand management.

Khan and Khan, (2010) say that in Pakistan, textile share 60 % of the country's exports, but due to some reasons its growth decreases day by day. Energy crises, high inflation and interest rates and political instability considered as main reasons of declining in the growth of textile. They further said that the government of the Pakistan can increase the growth of their textile sector by introducing the new technology via research and

development.

3. Research Design and Methodology:

In this study, primary data will be used because no work has been done on this topic before. The primary data will be collected through questionnaire and structured interviews. Structured interviews would be conducted with the owners of different industries

Sampling Technique

Cluster sampling will be used. The sample population will be divided into two clusters. Cluster A will contain small industries, while Cluster B will comprise of large industries.

Sample Population:

A sample population of 50 industries of HIE, comprising of small and large industries based on productivity and employees.

Sample Size:

A sample size of 50 will be selected, 25 from each cluster through convenient random sampling.

Data Collection Technique:

Data will be collected through questionnaires that consisted of two sections. The first section is intended to collect personal information of the participants, such as age, gender, qualification and designation. The section II is related to the impacts of

Electricity shortage on firm's productivity to alleviate the degree of impact factor. The participant's anonymity will be assured while collecting data.

Field Work/Data Collection:

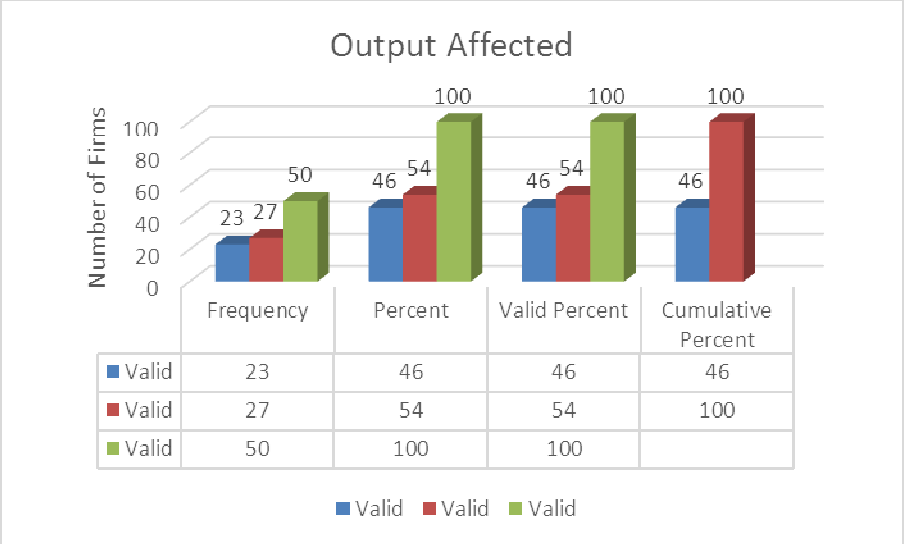
Research members will be trained and divided into two groups. Each group of two members will be assigned to collect data, one from small industries and one from large industries through questionnaires. Research members will be present on the spot to help with difficulty in questionnaire answering in order to collect accurate information.

Data Processing and Analysis:

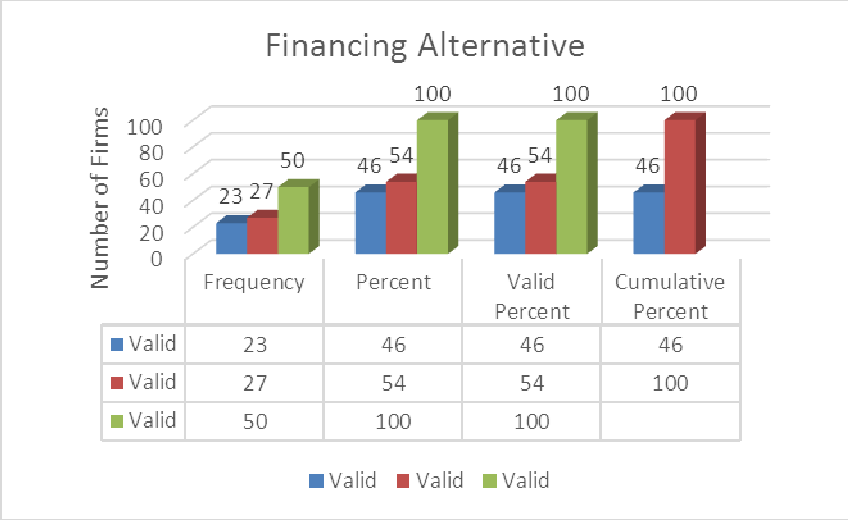
Collected data will be analyzed through different statistical techniques such as tables, diagrams, mean etc. using SPSS 20 and MS Excel for drawing results and making relevant conclusions.

Descriptive Results:

The output of the firms is negatively affected due to electricity shortages. 27 out of all 50 firms output decreased by electricity shortage for 2-4 hours. Among these, smaller firms are most affected.



Also 27 out of 50 firms borrow from external sources to finance the alternative energy resources. Most of the smaller firms are the among the borrowers. The level of effected output also depends on firm size and mode of finance. Financing through external sources negatively affect the outcome of affected output.



Model Specification:

A binomial logistic regression model is used as the dependent variable is dichotomous that to find out whether electricity shortage negatively affected the output or not. The outcome is coded as 1 and 0, where 1 indicates that the effect of electricity shortage on output is present and 0 indicate that the effect is not present. The model is,

$$P = \frac{\exp(\beta 0 + \beta 1\ X1 + \beta 2\ X2)}{1 + \exp(\beta 0 + \beta 1\ X1 + \beta 2\ X2)} \qquad (1)$$

Where P is the expected probability that power outage effect on firm output is present. By taking the natural log of equation 1, the outcome becomes the expected log of odds that the effect is present and the model will be linearized like a linear regression model.

$p/(1-p) = \beta 0 + \beta 1\ X1 + \beta 2\ X2$

Where

$P/(1-p)$ = expected log odds

X1 = electricity load shading

X2 = Firm Size (Categorical independent variable)

In logistic regression analysis, the coefficient β shows the change in expected log odds for a one unit change in the independent variable, holding all other independent variables constant. Taking antilog of an estimated regression coefficient will result in odds ratio exp (β).

Results and Discussions:

Classification table[a, b]

	Observed		Predicted		
			Output Affected		Percentage Correct
			No	Yes	
Step 0	Output Affected	No	0	23	.0
		Yes	0	27	100.0
	Overall Percentage				54.0

a. The constant is included in the model.

b. The cut value is.500

The classification table shows the description of percentage of the firm's output affected by the power outage. Overall, 54 percent of firms were affected.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	43.366[a]	.401	.536

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than.001.

The Nagelkerke R Square value of.536 shows that 53.6 % firms' output affected is explained by the power outage. The lower value of R Square is due to the data on load shading duration. Electricity load shading of 2 hours/day during working hours have not prominent effect on firm's productivity, especially large firms as compared to 4 hours of load shading.

Classification Tablea

	Observed		Predicted		
			Output Affected		Percentage Correct
			No	Yes	
Step 1	Output Affected	No	20	3	87.0
		Yes	5	22	81.5
	Overall Percentage				84.0

a. The cut value is.500

The overall percentage value is 84.0 %, which shows that predicted classified values of the null model is 84 % accurate.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	25.628	1	.000
	Block	25.628	1	.000
	Model	25.628	1	.000

The Omnibus test of model coefficient p-value indicate a significant effect of the predictor on the outcome dependent variable as resultant Chi-square values are same with p-values less than the significance level.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Loadshedding	1.689	.396	18.155	1	.000	5.416	2.490	11.781
	Constant	-4.765	1.174	16.468	1	.000	.009		

a. Variable(s) entered on step 1: Loadshedding.

The variables in the equation results predicted logistic coefficient (β) is different than zero with a value of 1.689 which statistically significant from the Wald Test p-value is.000. This positive logit (log of odds) indicates that the odd of output affected increases with increase in load shading. The exp (β) (odds ratio) is greater than 1 to 5.416. The odds ratio is the multiplicative change rate calculated by raising the log odds base to e^{β}, as $e^{1.689}$ = exp(β) of 5.416. This gives the percentage change in the odds of output affected calculated by

Odds ratio – 1 × 100

5.416 – 1 × 100 = 441.6 %

Power outage increases the negative effect on output.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	FirmSize(1)	-3.651	.822	19.703	1	.000	.026	.005	.130
	Constant	1.658	.546	9.239	1	.002	5.250		

Variable(s) entered on step 1: Firm Size.

Similarly the log odds of firm size when the firm is large is -3.651 with exp (β) less than 1 (0.26) indicates that larger the firm size, lesser will be logged odds of output affected and smaller the firms, the odds of output affected increases by 5.250. It shows that smaller firms are 5.250 times more affected than larger firms.

Conclusions

This study assesses the ongoing power shortage and its impact on HIE Peshawar. The study was done by analyzing the magnitude of output affected of large size firms and small size firms due to electricity shortages of 2 hours and 4 hours. It is concluded that larger firms which has greater market, assess to national and neighboring Afghanistan are not much affected by 2 hours of electricity load shading per working day as the odds ratio is less than 1 with.026. The electricity shortage of 4 hours does affect the output by 441.6 % calculated for all firms.

Another aspect of larger magnitude of effect on smaller firms is the incapability of acquiring alternative energy sources like generators. Smaller firms are seeming to face financial constraints in it. The smaller firms are much more prone to power outage and has a negative effect on output. (Hunt Alcott, Allan Collard-Wexler, and S.D O'Connell)

Limitations

Due to time and resource constraints, an extensive study could not be done. Further research studies are needed to be carried out to fill the gaps in order to find about the relationship of energy importance to the growing manufacturing sector.

Recommendations

KPK as a major energy producer should not be deprived of its share in energy or in monetary terms. Nonpayments of royalties by the Federal Government on gas, hydal power and oil caused a loss of Rs 250 Billion per year to KPK. Such huge amounts could assist in sorting out of energy problems in KPK. On a grander scale, Pakistan should consider constructing dams such as Kala Baagh Dam and Bhaasha Dam. International and Regional energy cooperation need to improve to invest in proposed projects and in renewable energy resources in solar, tidal and wind energy. Pakistan, India and Iran gas pipeline and with Turkmenistan and Afghanistan gas pipeline projects should be completed to meet the growing demand for energy consumption.

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