The Energy Short Fall and its After Effects (A Case Study for Karachi City in context to Karachi Electric Supply Corporation)

Hasan, Syed Akif and Subhani, Muhammad Imtiaz and Osman, Ms. Amber

Iqra University Research Centre (IURC), Iqra university Main Campus Karachi, Pakistan

2012

Published in

Science Series Data Report (SSDR), 2012

The Energy Short Fall and its After Effects

(A Case Study for Karachi City in context to Karachi Electric Supply Corporation)

Muhammad Imtiaz Subhani
Iqra University Research Centre-IURC , Iqra University- IU,
Defence View, Shaheed-e-Millat Road (Ext.) Karachi-75500, Pakistan
E-mail: drsubhani@yahoo.co.uk
Tel: (92-21) 111-264-264 (Ext. 2010); Fax: (92-21) 35894806

Syed Akif Hasan
Office of Registrar, Iqra University- IU,
Defence View, Shaheed-e-Millat Road (Ext.)
Karachi-75500, Pakistan
E-mail: hasandrakif@gmail.com
Tel: (92-21) 111-264-264 (Ext. 1513); Fax: (92-21) 35894806

Amber Osman
Iqra University Research Centre-IURC , Iqra University- IU,
Defence View, Shaheed-e-Millat Road (Ext.) Karachi-75500, Pakistan
E-mail: amber.osman@yahoo.com
Tel: (92-21) 111-264-264 (Ext. 2010); Fax: (92-21) 35894806

Israr Khan
Iqra University Research Centre-IURC , Iqra University- IU,
Defence View, Shaheed-e-Millat Road (Ext.) Karachi-75500, Pakistan
Tel: (92-21) 111-264-264 (Ext. 2010); Fax: (92-21) 35894806

Muhammad Nayaz
Iqra University Research Centre-IURC , Iqra University- IU,
Defence View, Shaheed-e-Millat Road (Ext.) Karachi-75500, Pakistan
E-mail: muhammadnayaz@yahoo.com
Tel: (92-21) 111-264-264 (Ext. 2010); Fax: (92-21) 35894806

Abstract

This paper is an attempt to interrogate and examine the unstoppable short fall of energy which has been paralyzing the life of Karachi for decades. The monthly data for the period of Jan-2009 to Dec-2011 has been interrogated while using the Pearson correlation, Vector Auto regression (VAR) and Tobit model, to conclude the bottom line. The findings reveal that there is a vast difference between the actual demand and actual supply of energy i.e. energy shortfall for the various segments of Karachi city which include house hold and industrial consumptions both, and such overwhelming gap causes Load shedding for every now and then, and made the life of this city even difficult but this load shedding to overcome the stated gap does not reduce it empirically and historically. The paper also confirms that it is the short fall which decides the per unit price of energy use for both the households and industries.

Keywords: Energy, Electricity, Vector Auto Regression, Tobit Model, Energy Short Fall.

1. Introduction

The energy shortage crisis, which started in Pakistan as the whole, in FY2007, worsened during FY2008-FY2009 and FY2010, further straining the national budget and growth. The energy supply deficit reached 5,000 MW during summer peak in FY2009. Extended power outages, lasting more than 12 hours a day in some areas, and gas shortages during the four winter months have had a negative effect on people and businesses.

The paper aims at finding and estimating the demand and supply of Electricity in Karachi and its Gap. While concluding that whether or not load shedding as a better solution to tackle the Tsunami of energy short fall and what matters the most in deciding the unit prices of energy use at household, industrial and govt. sector. Karachi currently faced with a serious energy crisis to which inefficient use of available energy resources has The economic and social impacts of this Tsunami of energy short fall are felt across all sectors of national life. Although some of the economic issues confronting the country can be attributed to the global economic recession, but there are also various impacts that can be clearly linked to the shortfall in energy supply. These include, most importantly, the shutting down of industrial units or reduction in their production, resulting in, among other negative impacts, unemployment and reduced income for workers.

Although, the Government of Pakistan is trying to take various measures to overcome this issue, while, energy efficiency has also been identified as an effective, least-cost short and medium-term solution for an efficient economic growth. It is sensed that the improvement in energy supply may help in increasing employment and economic productivity, which contribute directly to the elimination of poverty and to improving the livings of commons. In addition to this, it may also reduce the adverse impact of power outages on social life, education, and on the quality of life in general.

2. Literature Review

The technical inefficiency of power sector of Pakistan has been investigated fewer times by the various authors.
Pakistan has been facing energy crises for many decades which have contributed turmoil in the socio economic conditions of this country. Energy is always a backbone for economical conditions of any country in this contemporary world. Shortages of power generation may cause many drastic effects on economic condition of any country. It worsened the economic condition of a country by decreasing agricultural production and industrial production both.

As mentioned, Pakistan now a day is confronting with the serious energy crises and the energy shortfall has increased many folds. In the year 2008 where industrial consumers were already suffering very badly with the energy crises, the then government announced an increase in the commercial tariff from Rs 8-10 per unit to 14 per unit. The domestic tariff was also increased from Rs 5-7 per unit to 8-10 per unit. At that time when KESC was already facing a devastating financial crises and they were not willing to generate electricity through furnace oil to maintain their revenue (Akram, 2008). Hence, the shortfall then increased during all proceeding years, as during 2010 the electricity demand was about 14000 to 15000 Mega watt per day, and the demand was shoot up to 20000 Mega watts per day (Haq & Husain, 2008).

Karachi Electric Supply Company has been providing electricity to about 20 million ordinary consumers (domestic users) and 4500 industrial consumers and the demand of electricity has been increasing with the passage of time not gradually. With the decrease in gas supply to KESC, the only option which is found seemingly open to produce energy, is furnace oil that is 3.5 times more costly than gas. The allocated quota of furnace oil for KESC is 276MMCFD during the last peak summer season which was never provided which is one of the reason for the extensive load shedding now. The price of Furnace oil in Pakistan shoots up to about 250 percent during the last two years from Rs. 26,400 to 66,247 per ton. Therefore, the oil based power generation has become highly expensive for this country. Every 25MMCFD reduction in gas

supply increases the tariff by 0.83 and a reduction in allocated quantity of 276MMCFD equated to 5.8- 6.8 percent increases to the current average consumer tariff (KESC Newsletter, 2011).

Karachi Electric Supply Company Limited is generating about 55% of energy of the total demand and the remaining 45 % is providing by the WAPDA and Independent Power Producers (IPPs), while the energy transmission has been in operation via 59 Grid Stations and 123 power transformers (http://www.kesc.com.pk/en/article/ourcompany/factsfigures.html).

Yazdanie and Rutherford (2010) interrogated the strengths and challenges for the power generation sector in Pakistan. They emphasized that solar and wing methods of power generation should be initiated in this country to meet its demand.

Muhammad and Ahmed (2009) commented that it is the responsibilities of the governments to take bold steps in identifying, creating and managing the methods for electric generation with the minimum cost expenditure. Muhammad and Ahmed (2009) further explained that there are many other methods for generating electricity like coal, gas, and oil, nuclear and hydro power in the countries like Pakistan. Yazdanie and Rutherford (2010) confirmed that Pakistan is the one who is producing 66% electrical power from fossil fuels (gas and oil), 30% from hydroelectricity and 3% from nuclear energy, but these are not the enough efforts for such a populations and problems growing country. On the other hand, Younos, Hill, and Poole (2009) confirmed that the United States is producing about 50% of electricity thorough coal. 25% through natural gas and remaining 25% generation is dependent on petroleum, Bio diesel and Solar Thermoelectric.

Yazdanie and Rutherford (2010) ironically commented that the centralized structure of power generation does not help or encourages for introducing the decentralized systems in Pakistan and there is no as such any institute or body which can so to speak as responsible for identifying and creating the ways of electric power generation or to increases it. He stressed that the workforce are neither properly trained nor they have knowledge to tackle this Tsunami. Whereas, Household is the biggest sector in Pakistan, which is consuming about 45.6% of electricity, while, 28.4% of the total energy is in industrial use. Residential consumers mostly consumed about 101 to 300 units of electricity per month (Nasir, Tariq, & Arif, 2009).

In contrast, in developed countries 15 to 20 percent energy is consumed by the House hold sector, Dzioubinski and Chipman (1990) confirmed that the energy efficient devices and equipments in the house hold sector decreases the demand/ consumptions for electricity for the developed world, and gives fruits to both the common consumers and the sates of that world. Dzioubinski and Chipman (1990) further investigated the North America, Europe, Africa, South America and Asia for their per capita House hold energy consumption. They revealed that in early 1970's North America region had the much higher per capita house hold electricity consumption, but this trend thereafter decreased down with the passage of time due to many reasons, one of the most important reasons was the introduction of energy efficient appliances used by the households while, Asia comes at the end when considering the per capita house hold electricity consumption as in this region efficient energy devices are not so common among energy users.

3. Propositions and Hypotheses

On the basis of the literature cited above we formulated following hypothesis to interrogate the proposition of this paper.

H1: There is a Gap between the demands for electricity for Karachi region and Supply for electricity by KESC.
H2: There is an association between the demands for electricity power for Karachi region and supply for electricity by KESC.
H3: There is an association between the demands for electricity for Karachi region and gap between the demand & supply for electricity by KESC.
H4: There is an association between demands for electricity and Load shedding of Electricity for Karachi region.
H5: The load shedding reduces the gap between the demand & supply for electricity in the Karachi region.

H6: The gap between the demand and supply for electricity at the p order predicts the KESC per unit prices for domestic use at the current order.
H7: The gap between the demand and supply for electricity at the p order predicts the KESC per unit prices for industrial use at the current order.
H8: The gap between the demand and supply for electricity at the p order predicts the KESC per unit prices for govt. use at the current order.

4. Methodology of Research

4.1 Description of Data and Econometrical Methodology

To interrogate the insufficiency in the power sector the monthly data for the indicators which include, Demand for electric power for Karachi region, Supply for electric power by KESC, Load Shedding of electricity by KESC, KESC per unit Price for domestic Consumers, KESC per unit Price for Industrial Consumers and KESC per unit Price for Government Consumers for the period from January 2009 to December 2011 have been collected. The propositions of this paper are investigated by deploying the Pearson correlation, Scaled OLS (Tobit Model) and Vector Auto Regression (VAR).

The Tobit model is used to reveal the possibility of variation in load shedding for the current order due to the variation in the gap between the demand and supply for electric power at the same current order. While, VAR is applied to find the possibility of variations in the KESC per unit prices for domestic, industrial, and government consumptions at the current order due to the variations in the gap between the demand and supply for electric power at the p order (p= 1, p=2).

5. Findings and Results

5.1 Descriptive Findings

Table 1 reveals that there is gap (difference) between the demands for electricity for Karachi region and supply for electricity by KESC as the difference (i.e. gap= 175130.1) was found significant at $p < 0.05$, for last 36 months hence we are failed to reject the H1 (i.e. There is a Gap between the demands for electricity for Karachi region and Supply for electricity by KESC).

5.2 Findings of Pearson Correlation

According to Correlation output matrix as shown in table 2 the supply and demand of electricity for Karachi region was found strongly and significantly associated with each other (i.e. r= 0.939 at p= 0.000), hence we are failed to reject the H2 (i.e. There is an association between the demands for electricity power for Karachi region and supply for electricity by KESC). The table 2 also revealed that here is a significant association between the demands for electricity and gap between the demand & supply for Karachi region (i.e. r= 0.513 at p= 0.010) hence we are also failed to reject the H3. While, it is also found out that demands for electricity and the load shedding for Karachi region is also significantly related with each other (r= 0.465 at p= 0.022), hence we are failed to reject the H4 (i.e. There is an association between demands for electricity and Load shedding of Electricity for Karachi region) as well.

5.3 Findings of Tobit Model

The Tobit estimates which are explained in table 3, revealed that The load shedding does not reduce the gap between the demand & supply for electricity in the Karachi region (i.e. Tobit Coef. = 1449.565 at p= 0.1197> 0.05), hence, we fail to accept the H5 (i.e. the load shedding reduces the gap between the demand & supply for electricity in the Karachi region).

5.4 Findings of Vector Auto Regression

The table 4, explains the VAR estimations for p order (p=1, p2), to assess the H6, H7 and H8. VAR estimates revealed that the gap between the demand and supply for electricity at the p order (p=2) affects its per unit price for domestic use significantly (i.e. t= 1.5), which indicates that the per unit price for domestic use for electricity is explained by the gap between the demand and supply for electric power at the p order

(when p=2), hence, we are failed to reject the H6. Similarly, the gap between the demand and supply for electricity at the p order (p=2) also affects its per unit price for industrial use significantly (i.e. t= 1.53647), hence, we are also failed to reject the H7. Meanwhile, the gap between the demand and supply for electricity at the any order (p=1, p=2) does not affect it's per unit price for govt. use (i.e. t= 0.2282), hence, we fail to accept the H8.

6. Discussions and Conclusion

This paper confirms that there is a huge and significant energy shortfall i.e. gap between the demand for electricity for Karachi and the supply of electricity by Karachi electric supply corporation (KESC) which is being increased day by day as the energy consumptions are increased. The overwhelming energy deficit/ shortfall has destroyed the lives of Karachites along with the businesses which are being operated from this city and hence the biggest business hub of Pakistan which also a metropolitan city is at stake. This paper also confirms that the load shedding/ long electrical break down cannot reduce the energy shortfall / deficit; the careful consumptions of electricity and an increase in energy production can be the solution to tackle this menace. This paper further reveals that the shortfall/ energy deficit for p- order (p = -2) i.e. energy shortfall for the month before the immediate last month empirically contribute in setting the per unit price of energy for both domestic and industrial use.

7. Policy Implication

As it has addressed that the careful use of energy and the prompt measures to enhance the energy productions can handle the earth quake of energy shortfall for this metropolitan city and mini Pakistan. While, for the careful domestic and industrial energy use, Govt. should import efficient appliances for house hold and industrial consumers, whereas, to increase the energy productions Government should build the Dams to meet the energy demand and to generate cheap energy. Government should also grant special funds for the utilizing coal, as it is the cheapest source for energy production.

References

Akram, F. (2008). Entangled in energy web, The Nation. Retrieved May 12, 2008, from http://www.nation.com.pk/pakistan-news-newspaper-daily-englishonline/Business/12-May-2008/Entangled-in-energy-web/1.

Dzioubinski, O., & Chipman, R. (1999). Trends in consumption and production: Household Energy Consumption, *DESA Discussion paper*, 6. (www.un.org/esa/papers.htm).

KESC News Letter. (2011). Retrieved December 20, 2011, from http://www.kesc.com.pk/en/newsletter/ourcompany/ourazm/azmnewsletters/the-newsletter-of-kesc-issue-november-2011.html

Muhammad, A., K., & Ahmed, U. (2009). Energy Demand in Pakistan: A Disaggregate Analysis Pakistan Institute of Development Economics Islamabad Pakistan. http://ideas.repec.org/p/pra/mprapa/15056.html

Nasir, M., Tariq, M., S., & Arif., A. (2009). Residential Demand for Electricity in Pakistan. *Pakistan Development Review*, 47(4), 457-467.

Haq, Noor Ul., & Hussain, K. (2007). Energy Crisis in Pakistan. Retrieved December 10, 2011 from http://ipripak.org/factfiles/ff99.pdf.

Yazdanie, M. & Rutherford, T. (2010). Renewable Energy in Pakistan: Policy Strengths, Challenges & the Path Forward.

Younos, T., Hill, R., & Poole, H. (2009). Water dependency of energy production and power generation systems, *Virginia water resource research center*, VWRRC special report no.SR46-2009.

Table 1: Means (AM) for 1:2009- 12:2011 for the Key Indicators

Demand	1,434,386.07 (MV)
Supply	1,259,255.95 (MV)
Gap	175,130.12 (MV) at $p < 0.05$
Load shedding	138.29 (Hours)
Per Unit Price for domestic use	8.54 (Rs.)
Per Unit Price for industrial use	9.51 (Rs.)
Per Unit Price for government use	9.95 (Rs.)

Table 2: Associations between the key indicators for the p order (p=1)

		Demand for Electric Power for Karachi region
Demand	Pearson Correlation	1
	Sig. (2-tailed)	
Supply	Pearson Correlation	0.939**
	Sig. (2-tailed)	0.000
Gap	Pearson Correlation	0.513*
	Sig. (2-tailed)	0.010
Load-shedding	Pearson Correlation	0.465*
	Sig. (2-tailed)	0.022

Table 3: Tobit estimates for the gap between the demand and supply for electric power at the current order and load shedding for the same current order.

Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Dependent Variable: GAP
Convergence achieved after 5 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
LOADSHED	1449.565	931.5998	1.555995	0.1197
C	-25335.62	129897.3	-0.195044	0.8454
Error Distribution				
SCALE:C(3)	81238.21	11725.73	6.928203	0.0000

Mean dependent var	175130.1	S.D. dependent var	87070.71
S.E. of regression	86792.22	Akaike info criterion	25.69816
Sum squared resid	1.58E+11	Schwarz criterion	25.84542
Log likelihood	-305.3779	Hannan-Quinn criter.	25.73723
Avg. log likelihood	-12.72408		

Table 4: VAR estimates for KESC per unit prices for domestic, industrial, and government use at the current order and the gap between the demand and supply for electric power at the p order (p= 1, p=2).

DV= KESC per unit prices for domestic consumption/ use. IV= gap between the demand and supply for electric power at the p order (p= 1, p=2).		DV= KESC per unit prices for Industrial consumption/ use. IV= gap between the demand and supply for electric power at the p order (p= 1, p=2).		DV= KESC per unit prices for Govt. consumption/ use. IV= gap between the demand and supply for electric power at the p order (p= 1, p=2).	
	PER UNIT PRICE FOR DOMESTIC USE		PER UNIT PRICE FOR INDUSTERIAL USE		PER UNIT PRICE FOR GOVT. USE
PRICEDOM(-1)	0.630627	PRICEIND(-1)	0.500156	PRICEGOV(-1)	0.475870
	(0.24088)		(0.20465)		(0.22765)
	[2.61798]		[2.44396]		[2.09036]
PRICEDOM(-2)	0.209136	PRICEIND(-2)	0.604241	PRICEGOV(-2)	0.250802
	(0.23281)		(0.22276)		(0.23613)
	[0.89832]		[2.71254]		[1.06215]
GAP(-1)	3.31E-07	GAP(-1)	-1.55E-06	GAP(-1)	2.61E-06
	(1.8E-06)		(1.7E-06)		(3.3E-06)
	[0.18814]		[-0.89573]		[0.77940]
GAP(-2)	2.60E-06	GAP(-2)	2.76E-06	GAP(-2)	7.92E-07
	(1.7E-06)		(1.8E-06)		(3.5E-06)
	[1.50000]		[1.53647]		[0.22820]
C	1.069876	C	-0.926928	C	2.235973
	(0.66601)		(1.05005)		(1.97200)
	[1.60640]		[-0.88275]		[1.13386]
R-squared	0.935533	R-squared	0.913685	R-squared	0.661531
Adj. R-squared	0.920364	Adj. R-squared	0.893375	Adj. R-squared	0.581891
Sum sq. resids	2.467538	Sum sq. resids	2.653897	Sum sq. resids	11.15598
S.E. equation	0.380985	S.E. equation	0.395110	S.E. equation	0.810083
F-statistic	61.67475	F-statistic	44.98799	F-statistic	8.306531
Log likelihood	-7.150613	Log likelihood	-7.951500	Log likelihood	-23.74691
Akaike AIC	1.104601	Akaike AIC	1.177409	Akaike AIC	2.613356
Schwarz SC	1.352565	Schwarz SC	1.425373	Schwarz SC	2.861320
S.D. dependent	1.350057	S.D. dependent	1.210007	S.D. dependent	1.252808
Meandependent	8.704091	Meandependent	9.593182	Meandependent	10.02045

Where, SE are in ( ), and Trace Stats are in [ ]

Table 5: Hypotheses Assessment

Hypotheses	Empirical Conclusion
H1: There is a Gap between the demands for electricity for Karachi region, Supply for electricity by KESC.	Accepted
H2: There is an association between the demands for electricity power for Karachi region and supply for electricity by KESC.	Accepted
H3: There is an association between the demands for electricity for Karachi region and gap between the demand & supply for electricity by KESC.	Accepted
H4: There is an association between demands for electricity and Load shedding of Electricity for Karachi region.	Accepted
H5: The load shedding reduces the gap between the demand & supply for electricity in the Karachi region.	Rejected
H5: The gap between the demand and supply for electric power at the p-order predicts the KESC per unit prices for domestic use at the current order.	Accepted
H6: The gap between the demand and supply for electric power at the p-order predicts the KESC per unit prices for industrial use at the current order.	Accepted
H7: The gap between the demand and supply for electric power at the p-order predicts the KESC per unit prices for govt. use at the current order.	Rejected