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Research Paper

Patterns and Determinants of Energy consumption in Karnataka

Economics

KEYWORDS : Energy, Electricity, Power Generation, Power Consumption and Disparities.

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ABSTRACT

Adequate and reliable and affordable energy is the pre-requisite for development. The study observed that installed capacity, power generation import of power and consumption have increased significantly in Karnataka. The forecast of these variables revealed that the power situation in Karnataka will not be changed even during the year 2020. It is identified that region and size of the families are the two important determinants of electricity consumption. It is also found that size of the family significantly influence the consumption at urban area. The power problem is more in rural area compared to urban area. Therefore, it is very much important to improve the power supply service in rural area in order to safeguard the life and development of rural people.

Introduction

Infrastructure if not the engine of growth it is the wheel of development (World Bank, 1994). Electricity being one of the important forms of energy plays a major role in promotion of the development. Adequate and reliable and affordable energy is the pre-requisite for development (Premakumara, 2012). In the present paper an attempt has made to analyze the patterns of energy consumption in Karnataka and an effort is also made to identify the disparities in consumption and pricing of electricity.

Review of Literature

Electricity plays a key role in all socio-economic activities. There is a long-held assumption that standard of living and quality of civilization is proportional to the quantity of energy a society uses. However imprecise it may be, most people still accept the steadfast formula: energy=progress=civilization (Williams, 2006). Pricing of energy is an important issue and many of the works have tried to understand the price fixation for electricity and found that in many of the cases electricity prices are fixed by regulatory authorities or governments by using marginal efficiency and marginal benefit principals. There are instances where in electricity prices are fixed on competitive bidding process (Clewlow & Strickland, 1999), (Huisman & Mahieu, 2001), In the mean time, to reduce the gap between electricity demand and supply finding the alternative energy sources is becoming a most needful one in order to ensure the sustainable development, (Aviles, 2011). Still there are unsolved issues related to risk management and private participation (Mauro, 1999). Hence, there are lots of scope for further research on the issues like sustainable energy sources, pricing, risk management and disparities in energy consumption particularly the electricity.

Methodology

The study uses analytical method with the help of statistical and econometric techniques. The study used both primary and secondary data. The time series data collected for the variables like installed capacity, power generation, import of power, T&D losses and consumption of power for the years 1997 to 2010. The primary data are collected from field survey in Karnataka both from urban and rural area. The regression models are used to assess the impact of income, size of the family, and region on consumption of electricity. The t-test, ANCOVA, and time series regression models are used to identify the significant differences and estimation of parameters. For the non stationary data the first difference integrated econometric models are used. The SPSS 16 software was used estimation and statistical tests. Due to time and resource constraints the study restricted to electric power and area limited to Mandya only.

Table 1: Regression Trend Result for Major Variables

Description	IC	Generation	Import	T&D Losses	Consumption
Intercept	-	13270	5206	29.22	-
t-value	-	8.809	4.82	8.09	-
Sig.	-	0.000	0.00	0.00	-
Co-eff	-	1178	557	-0.09	-
t-value	-	6.657	4.39	-0.23	-
Sig.	-	0.000	0.00	0.81	-
R-squared	0.91	0.78	0.61	0.00	0.92
D-W value	0.50	1.113	0.78	0.51	0.51

Source: computed by authors

In the above table I have presented the regression trend results for the major variables. Since R-squared values are higher than the D-W values the generation of power, import of power and T&D losses were found to be stationary time series data and installed capacity (IC) and consumptions are found to be non stationary data, as a matter of fact the results will be spurious (Damodar & Sangeetha, 2007). Therefore, the results are presented only for stationary data. The models for generation of power, import of power and T&D losses are relatively good fitted with high R-squared values. All the three intercepts are accepted at one percent level. The co-efficient values of generation of power and import of power are accepted at one percent level. Whereas, the co-efficient of T&D losses is not accepted since the t-value is very low. Hence, it can be argued that the power generation will be increased by 1178 million units and import of power will be increased by 557 million units every year.

Table 2: The First Difference Integration Model Results

Description	Installed Capacity	Consumption
Intercept	65.4 (2637)	316.3 (11543)
t-value	0.355	0.458
Sig.	0.729	0.656
Co-efficient	46.326 (379.182)	161.148 (1459)
t-value	1.994	1.853
Sig.	0.071	0.091
R-squared	0.266	0.238
D-W value	2.345	2.504

Source: computed by authors

In the above table I have presented the first difference integrated model (where the change in the variable is the function of difference between t time period and t-1 time period) results for the variables installed capacity and consumption of power. Since R-squared values are lower than the D-W values the results will not be spurious and there are the first difference stationary data. Both the co-efficient values are accepted at ten percent level. Hence, it can be argued that the installed capacity will be increased by 379.182 MWs and consumption of power will be increased by 1459 million units every year.

Researcher also forecasted the values for the year 2020 by using the co-efficient values. During the year 2010 the installed capacity was 8616.26 and it will be increased to 11737.37 MWs. During the year 2010 the generation of power was 29161 million units and it will be increased to 41542 million units. During the year 2010 the import of power was 10495 million units and it will be increased to 18574 million units. During the year 2010 the T&D losses were 21.96 percent and it will be increased to 26.844 percent. During the year 2010 the consumption of power was 33971 million units and it will be increased to 46559 million units. Hence it can be argued that the present situation will be continued even during the period 2020.

Disparities in Power Consumption
In the following table researcher has given information about the urban rural bias in power consumption, price and load shedding. The following table prepared with the help of field study data. The table 3 presents the group statistics about the three parameters and the table 4 presents the t-test results.

Table 3: Group Statistics

Parameters	Region	N	Mean	Std. Deviation
Price	Urban	50	3.7866	1.32965
	Rural	50	2.8794	.79693
consumption	Urban	50	188.34	203.61394
	Rural	50	93.66	64.26305
Load shedding	Urban	50	2.82	1.06311
	Rural	50	9.56	2.90081

Source: Computed from field survey data.

It is found from the above table that the average price per unit of consumption at urban area is 3.79 rupees and in rural area it is 2.88 rupees. Hence there is a gap between urban and rural areas in price charged for power consumption. The average power consumption in urban area is 188.34 units and it is 93.66 units in rural area. Hence power consumption is more in urban area. The average load shedding in urban area is 2.82 hours and in rural area it is 9.56 hours. Hence load shedding is more in rural area.

Table 4: Independent Samples Test

Parameters		Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig
Price	Equal	3.33	.07	4.13	98	.00
	not			4.13	80.1	.00
consumption	Equal	3.40	.06	3.13	98	.00
	not			3.13	58.6	.00
Load Shedding	Equal	50.3	.00	-15.4	98	.00
	not			-15.4	61.9	.00

Source: Computed from field survey data.

The above table presents the t-test results for the said parameters to identify the significant difference between urban and rural areas in terms of power price, power consumption and load shedding. The equal variances are not assumed for all the parameters at ten percent level. There is significant difference between urban and rural areas in terms of power consumption, price of power and load shedding at one percent level. Therefore, the average power consumption and price per unit of power are more comparatively in urban area than rural area. However, the load shedding is significantly quite high in rural area. The power problem is more in rural area compared to urban area. The reliability of power and adequacy is more in urban area compared rural area. Hence, there is valid reason to fix higher prices to urban power consumption. However, it is very much important to improve the power supply service in rural area in order to safeguard the life and development of rural people.

Impact Analysis
In the following section as attempt has been made to estimate the impact of income of the family, size of the family and region (Urban and Rural) on consumption of power. For the analysis researcherhave used cross-section field survey data and used ANCOVA model. Where the consumption is a dependent variable and the income of the family, size of the family and region are independent variables.

Table 5a: Aggregated Model Summary					
Model	R	R Square	Adjusted R Square		
1	.814a	.663	.652		
a. Predictors: (Constant), income, size, Region					

Table 5b: Aggregated Regression Results					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-159.91	46.7		-3.42	.00
Region	83.416	24.4	.266	3.40	.00
size	13.683	6.24	.133	2.19	.03
income	.003	.000	.931	12.025	.000
Dependent Variable: consumption					

The above tables 5a and 5b present the regression results along with necessary tests. It is found from the result that the model is relatively good fitted with good R-squared value. The intercept and the coefficient parameters are accepted at five percent level significance. According the results the region is a dummy variable and its co-efficient presents the difference between urban and rural in terms of power consumption. The difference in power consumption between urban and rural is 83.42 units and this difference is accepted at one percent level. If the family size increased by one person the demand for power consumption will be increased by 13.68 units and it is accepted at one percent level. Income of the family has got very little influence even though it is statistically significant. Therefore, region and size of the family play major role in the quantity of power consumption.

Table 6a: Model Summary for Urban				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.863a	.745	.734	104.97197
a. Predictors: (Constant), income, size of the family				

Table 6b: Regression Results for Urban					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
(Constant)	-189	48.85		-3.8	.00
Size	45.9	12.036	.292	3.81	.000
Income	.002	.000	.738	9.6	.00
Dependent Variable: urban consumption					

The above tables 6a and 6b present the regression results along with necessary tests. An attempt has made to estimate the impact of income of the family, size of the family on consumption of power in urban area. Where the consumption is a dependent variable and the income of the family and size of the family are independent variables.

It is found from the result that the model is relatively good fitted with good R-squared value. The intercept and the coefficient parameters are accepted at one percent level of significance. According the results if the family size increased by one person the demand for power consumption will be increased by 45.92 units in urban area and it is accepted at one percent level. Income of the family has got very little influence even though it is statistically significant. Therefore, in urban area size of the family significantly influence the power consumption.

Table 7a: Model Summary for Rural

	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.272a	.074	.035	63.13310
	Predictors: (Constant), income, size of the family			

Table 7b: Regression Results for Rural

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	61.435	33.01		1.861	.069
size	-3.908	5.307	-.105	-.736	.465
income	.005	.003	.270	1.896	.064
Dependent Variable: consumption					

The above tables 7a and 7b present the regression results along with necessary tests. An attempt has made to estimate the impact of income of the family, size of the family on consumption of power in rural area. Where the consumption is a dependent variable and the income of the family and size of the family are independent variables.

It is found from the result that the model is not good fitted with good R-squared value. The intercept and the coefficient parameters are not accepted at one percent level of significance. Therefore, in urban area size of the family or income of the family not significantly influence the power consumption. Hence there are other factors which determine the power consumption in rural area.

Conclusion

The present study analyzed the pattern of power generation and power consumption in Karnataka. It is found that the installed capacity, power generation import of power and consumption have increased significantly. The power consumption is higher than the power generation in Karnataka. As a matter of fact Karnataka importing power from other states. The T&D losses are also high in Karnataka. The forecast of these variables revealed that the power situation in Karnataka will not be changed even during the year 2020.

It is identified that region and size of the families are the two important determinants of electricity consumption. It is also found that size of the family significantly influence the consumption at urban area. There is significant difference between urban and rural areas in terms of power consumption, price of power and load shedding at one percent level. Therefore, the average power consumption and price per unit of power are more comparatively in urban area than rural area. However, the load shedding is significantly quite high in rural area. The power problem is more in rural area compared to urban area. The reliability of power and adequacy is more in urban area compared rural area. Hence, there is valid reason to fix higher prices to urban power consumption. However, it is very much important to improve the power supply service in rural area in order to safeguard the life and development of rural people.

REFERENCE

Adams, F. G., & Shachmurove, Y. (2007). Projections of Chinese Energy Demands in 2020. Philadelphia: Penn Institute for Economic Research. | Aviles, L. (2011). Electric Energy Access in European Law: A Human Right? Retrieved 2012, from http://ssrn.com/abstract=2008887 | Clewlow, L., & Strickland, C. (1999). Valuing Energy Options in a One Factor Model. Sydney, Australia: School of Finance and Economics. | Damodar, N. G., & Sangeetha. (2007). Basic Econometrics. New Delhi: Tata McGraw-Hill Publishing Company Ltd. | Geman, H., & Roncoroni, A. (2006). Understanding the Fine Structure of Electricity Prices. Journal of Business, vol. 79, no. 6 . | Huang, R. D., Masulis, R. W., & Stoll, H. R. (1996). Energy Shocks and Financial Markets. Journal of Futures Markets 16(1), available at SSRN-id900741 . | Huisman, R., & Mahieu, R. (2001). Regime Humps in Electricity Prices. Rotterdam: Rotterdam School of Management. | Mauro, A. (1999). Price Risk Management in the Energy Industry: The Value at Risk Approach. The XXII Annual International Conference. Rome: The InternationalAssociation for Energy Economics. | Premakumara, G. (2012). Power sector Restructuring and Reforms: From Government Failure to Market Failure. Germany: LAP. | Rajagopal, D., & Zilberman, D. (2007). Review of Environmental, Economic and Policy Aspects of Biofuels. California Berkeley: The World Bank. | Scarpa, E., & Manera, M. (2006). Pricing and Hedging Illiquid Energy Derivatives. Milan: Fondazione Eni Enrico Mattei. | Williams, J. C. (2006). History of Energy. The Franklin Institute, available at SSRN. | World Bank. (1994). Infrastructure: World Development Report. Washington: World Bank.