

الطلب على الكهرباء في الكويت

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(قُدّم للنشر في ١٤١٣/٩/٣ هـ وقَبِل للنشر في ١٤١٤/٤/١٦ هـ)

ملخص البحث . تهدف هذه الورقة إلى تحليل الطلب على الكهرباء في الكويت وتقدير دوال الطلب القطاعية . وتشير الأدلة المقدمة إلى أن الزيادة في السكان مسؤولة عن حوالي ٦٠٪ من الزيادة في استهلاك الكهرباء خلال السنوات الماضية . وتوضح مروّجات الدخل والسعر المقدرة إلى أن الطلب على الكهرباء في الكويت غير مرّن فيما يتعلق بالتغيرات في الدخل وسعر الكهرباء .

electricity price. The difference in own-price elasticity for Kuwaiti and expatriate households further highlights that if the objective of government policy is to protect the welfare of nationals, then a uniform increase in electricity price for both population groups may not yield the desired results.

Concluding Remarks

The purpose of this paper has been to analyze demand for electricity in Kuwait. As such, it estimated separate demand functions for residential, industrial, commercial, and government sectors. While the demand function for the residential sector is based on cross-sectional data, the demand functions for the other three sectors were estimated using annual time series data. Given the unique characteristics of the country's population, separate demand functions were estimated for Kuwaiti and expatriate households within the residential sector.

The evidence presented in the paper shows that increase in population accounts for approximately 60 percent of the increase in electricity over the years. Furthermore, among the different sectors, the residential sector is the largest consumer of electricity, accounting for more than 60 percent of electricity consumed in the country. The income and price elasticities reported in the paper indicate that, in general, consumption of electricity in Kuwait is inelastic to changes in income and electricity prices. In other words, changes in the price of electricity will have a limited effect on the consumption of electricity. Among the different sectors, the response of the residential sector to changes in income and prices is found to be lowest relative to the other sectors.

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unity, suggesting that in Kuwait electricity is a necessity for all types of consumers. Among the different sectors, government's consumption of electricity is most sensitive to changes in income followed by the industrial, commercial and residential sectors. Furthermore, within the residential sector, the consumption of electricity by Kuwaiti households is found to be relatively more sensitive to changes in income compared to the expatriate households. The signs of own-price elasticities, as expected, are negative and less than unity, except for the commercial sector, indicating that, in general, consumption of electricity is price inelastic. In other words, change in the price of electricity will have little effect on electricity consumption in Kuwait. Among the different sectors, the response of the household sector to price changes is the least. Moreover, the estimated price elasticities are higher for Kuwaiti households compared with their expatriate counterparts, implying that the response of the Kuwaiti household to price changes is higher than those of expatriates.

Table 5. Electricity demand elasticities by sector.

	Residential	Industrial	Commercial	Government
Income Elasticity		0.68	0.33	1.02
Kuwaiti	0.43			
Expatriate	0.23			
Own-price Elasticity		-0.69	-2.11	-1.02
Kuwaiti	-0.45			
Expatriate	-0.02			

In general, the demand parameters presented in the paper indicate that, in Kuwait, the pattern of electricity consumption varies across sectors and population groups. In future, the consumption of electricity is not expected to increase sharply, possibly because of the saturation effect in the consumption. This information should be used in making plans and allocating resources to augment generation capacity. As for the impact of changing electricity price, the estimated parameters indicate that the consumption of electricity will not be significantly reduced if the government decides to increase the price. Particularly, consumption by the residential sector, which is the single largest sector, is highly insensitive to price changes. This implies that the authorities can significantly increase their revenue receipts by increasing

permanent income; the expenditure elasticity for the residential sector is referred to as the income elasticity. Furthermore, to avoid the identification problem, in the estimation, the equation for the 'miscellaneous' category, which includes expenditure not specified, transfer to other family members, and taxes, was dropped. Subsequently, to obtain the own-price elasticities, the γ_i was set to be zero.

Kuwaiti	Expatriate
$e = 0.599 + 0.004 * E$ (13.135) (7.782)	$e = 0.861 + 0.002 * E$ (12.15) (2.546)
$R^2 = 0.812, F = 82.91, df = 18$	$R^2 = 0.218, F = 6.3, df = 18$

Note: Numbers within parentheses are t-ratios.

All the coefficients have anticipated signs and are highly significant.⁽¹⁷⁾ The intercept terms are positive but their numerical values are small, implying the electricity is a necessity and that its existing consumption levels are low.

The results corresponding to demand functions for industrial, commercial and government sectors are presented in Table 4. Initially, all equations were found to have positive autocorrelation and thus were subsequently corrected by an appropriate autoregressive transformation. In all equations, the independent variables explain over 90 percent of the variation in the dependent variables. Because all equations take logarithm forms, the estimated coefficients are simply the demand elasticities. Most of the estimated coefficients are significant at the 5 percent level. The only exception is the equation of commercial consumption of electricity, where the coefficient of the commercial sector's value-added is significant only at 10 percent.

Table 4. Estimated consumption function for electricity for different sectors in Kuwait.

Sector	Intercept	Coefficient		R ²	DW	ρ*
		P	Y			
Commercial	8.76 (6.33)	-2.11 (-6.03)	0.33 (1.75)	0.98	1.53	0.77
Industrial	5.20 (2.20)	-0.69 (-2.49)	0.68 (2.30)	0.95	0.80	-
Government	2.48 (1.02)	-1.02 (-3.54)	1.02 (3.68)	0.99	1.27	0.78

Note: *ρ is serial correlation coefficient. Figures within the parentheses are t-ratios.

The income and price elasticities, obtained from the regression coefficients, are presented in Table 5.⁽¹⁸⁾ All the income elasticities given in the table are less than

(17) It has been found that, in most family budget studies, the error terms are heteroscedastic. In this study, however, the standard errors of the estimates reported were adjusted for the heteroscedasticity using the technique suggested by [8].

(18) As in most family budget studies, the total household expenditure is taken as a proxy for household's

Demand Functions for Industrial/Commercial/Government Sectors

The demand for electricity in commercial, industrial, and government sectors is estimated using time series data and the OLS method. The demand function for each sector is specified as follows:

$$\ln D_{Ei} = \alpha + \beta_i * \ln P + \phi_i * \ln Y_i + U_t$$

where D_{Ei} is the amount of electricity in million kWh consumed in sector i ; P is real price of electricity, which is simply the nominal price of electricity charged to users in these sectors (set to 1 fils per kWh) deflated by consumer price index (CPI); Y_i is the value-added generated in sector i ; and U_t represents a random error. All variables are in logarithm form.

Results and Analysis⁽¹⁵⁾

As the consumption patterns between the Kuwaiti and expatriate households differ, in the case of the residential sector, separate demand functions are estimated for the Kuwaiti and the expatriate households.⁽¹⁶⁾ The results of estimation for both Kuwaiti and expatriate households are as follows:

(15) The electricity demand function for the residential sector is estimated using cross-sectional data reported in the Family Budget Survey Report for the year 1986-87. The survey was conducted by the Central Statistical Office, Ministry of Planning, Kuwait. The survey based on a national sample, covered 4262 households comprising 1677 Kuwaiti households and the remaining 2585 expatriate households. The list of the commodities covered in the survey is quite comprehensive. For this study, however, they were grouped into 18 major categories, including electricity, food and drinks, clothing, miscellaneous, etc. The electricity demand functions for the industrial, commercial, and government sectors are estimated using annual time series data covering the period 1970 to 1987. The data on sectoral consumption of electricity were obtained from the statistical year book of the Ministry of Electricity and Water, whereas data on sectoral value-added and CPI were obtained from the national account.

(16) The consumption patterns among the Kuwaiti and the expatriate households have been analyzed by [7]. It has been shown that the consumption pattern differ significantly across the two population groups. These differences are found to represent both structural as well as behavioral differences. The impact of household size and types of dwelling on electricity consumption in Kuwait has been analyzed by [1] and the coefficients of both the variables are found to be significant. The significance of the coefficient of household size implies existence of economies of scale in the consumption of electricity. In this study, to examine the impact of household size on electricity consumption, a following simple regression was estimated for Kuwaiti households:

$$e_i = 0.453 + 0.005 * E + 0.016 * HS + 1.586 * Z$$

(2.848) (6.969) (0.606) (0.438)

$R^2: 0.891, F: 52.583, df: 16$

where HS is household-size. As it is, the evidence does not confirm the existence of economies of scale in household's consumption of electricity in Kuwait.

Demand Function for the Residential Sector

To estimate the demand functions and income and price elasticities for electricity consumed by the residential sector, we analyzed household consumption behavior and estimated a Linear Expenditure System (LES) first suggested by [3].⁽¹¹⁾ The LES, like other demand systems, is based on standard utility maximization behavior of the households, where the problem is how much to spend on various commodities a given amount of income per unit of time. Assuming that households decisions are made on a per capita basis, and that, except for income and prices, other factors do not affect consumption, the reduced form of the stochastic specification of the LES can be written as⁽¹²⁾

$$e_i = \alpha_i + \beta_i * E + \varepsilon_i \quad (1)$$

where e_i is average per capita expenditure on i^{th} commodity, e.g., electricity; E is average total per capita expenditure of the households; ε_i is the error term with usual classical properties; and (α_i, β_i) are the parameters to be estimated. The system of equations described by relation (1) is one of identical regressors, in which every left-hand side variable is regressed upon the same set of exogenous variables. Estimation of this system of equations by the Ordinary Least Squares (OLS) method is equivalent to the systems maximum likelihood estimation.⁽¹³⁾ From the above system, both expenditure (income) and own-price elasticities can be calculated according to the following formulae.⁽¹⁴⁾

Expenditure (income) elasticity: $\eta_{iE} = \beta_i * (\bar{E}/\bar{e}_i)$

Own-price elasticity: $\eta_{ii} = (1 - \beta_i) * (\gamma_i^* / \bar{e}_i) - 1$

where $\gamma_i^* = \alpha_i + \beta_i * \Sigma \gamma_i^*$ is the subsistence quantity of good i , if it is positive; $\Sigma \gamma_i^* = \Sigma \alpha_i / (1 - \mu)$; $\mu = \Sigma \beta_i$; and \bar{E} and \bar{e}_i , respectively, are average levels of total expenditure and expenditure on commodity i .

(11) For details, see [4, p.15].

(12) Since, in using cross-sectional data, it is assumed that all the households face the same prices, the price variable does not appear explicitly in the reduced form equation.

(13) See, for instance [5, pp. 207-212] and [6, pp. 153-161].

(14) As it is, the structure of the demand system described by (1) is under-identified since the reduced form equation yields $(2n - 2)$ parameters. A standard procedure to over-come this problem is to drop one of the equations and set one of the γ_i to be zero.

the decline in the share of the commercial sector in total consumption of electricity in the country can be attributed to negative growth during the 1980s in the value-added of both construction and wholesale and retail trade sectors.⁽⁹⁾

The Government Sector

Like the residential sector, the government sector requires electricity for cooling, heating, lighting, etc., and is an end-user of electricity. In Kuwait, it accounts for approximately 10 percent of the total electricity consumed in the country. This is less than the electricity consumed by the power stations or loss of electricity in the network. As for the industrial and commercial sectors, over the years, its share in total electricity consumption declined from 10.9 percent in 1970 to 9.7 percent in 1989. Because the main factor determining consumption of electricity by the government sector is the scale of operation of the government, this decline in the share of the government sector in total consumption of electricity can be attributed to the slowing down of economic activity in the government sector. Whereas since the 1970s, the value-added in the government sectors has been increasing at a positive rate, the growth during the 1980s was less than half of what it was during the 1970s, i.e., 2.84 percent compared with 7.32 percent. This slowing down of economic activity in the government sector reflects expansion in the government activities in the initial years following the oil boom and stagnation in the later stages because of no room for further expansion given the small size of the country and reaching the limit. It is likely that as the role of the government shrinks owing to emphasis on privatization of government services and public utilities, the share of the government sector in total consumption of electricity may decline further in the future.

Sector-Specific Demand Functions

This section outlines methodology for estimating sector-specific demand functions. We use cross-sectional data for estimating demand function for the residential sector and time series data for the other sectors.⁽¹⁰⁾ The estimates of income and price elasticities obtained from the estimated demand functions can be used to project future demand for electricity under alternative policy scenarios.

(9) In Kuwait, during the 1980s, the value-added in the construction and wholesale-cum-retail trade sectors, respectively, declined at an average annual rate of 4.4 percent and 10.9 percent.

(10) While it is preferred to use the same types of models for all the sectors, the choice of the model was made on the basis of available data. Although this reliance on different models may entail loss of efficiency, the degree of such loss, if there is any, is likely to be small because one of the sectors, i.e., the residential sector, accounts for approximately 65 percent of the electricity consumed in the country. Contrary to the demand elasticities derived from time series data, the demand elasticities estimated using the cross-sectional data are interpreted as long-run-elasticities.

The Industrial Sector

Unlike the residential sector, the industrial sector is not an end-user of electricity. Electrical energy in the industrial sector is used mainly as input in production process. In general, however, electricity constitutes only a small fraction of the total cost of the industrial sector. In Kuwait, before August 1990 invasion there were 2437 industrial consumers of electricity and, in terms of total electricity consumed, the industrial sector is the second largest consumer of electricity that accounts for approximately 20 percent of the total electricity consumed in the country. During the last two decades, however, because of a decline in the level of economic activity in the country, its share in total electricity consumption has decreased. Because of the artificially low price, electricity cost as a percentage of total industrial cost has not exceeded one percent. Furthermore, the pattern of electricity consumption in Kuwait's industrial sector has been highly biased toward large firms producing industrial goods. According to one estimate, about 98 percent of all manufacturing firms consume less than 18 percent of the total industrial consumption of electricity, and only four large firms, representing only 0.11 percent of the total number of firms, consume around 71 percent of the total industrial consumption of electricity.⁽⁷⁾

In general, the amount of electricity consumed in the industrial sector determined by the level of economic activity and the price of electricity. In Kuwait, while the government-fixed low electricity price has encouraged higher electricity intensity, a decline in the level of economic activity has resulted in a decrease in the share of the industrial sector in total electricity consumed in the country.

The Commercial Sector

In Kuwait, the commercial sector consists of wholesale and retail trade, construction, and services. It is largely an end-user of electricity. In terms of its share in total electricity consumed in the country, the commercial sector in Kuwait is not large. Compared with other sectors, i.e., residential, industrial, and government, it is the smallest sector in the country.⁽⁸⁾ Over the years, the share of the commercial sector in total electricity consumption declined from 9.7 percent in 1970 to 7.6 percent in 1989. Within the commercial sector, the retail trade accounts for 64.5 percent of the electricity consumed in the commercial sector, followed by wholesale trade (20.1 percent) and construction (15.4 percent). As the consumption of electricity in the commercial sector is determined by the level of economic activity in the sector,

(7) See, [2].

(8) In terms of total number of consumers, however, the commercial sector in Kuwait, with a total of 173609 consumers or 66.5 percent of the total electricity consumers in the country, is relatively the largest sector.

electricity consumed, is the single largest and growing end-use consumer of electricity. Since 1970, its share in total electricity consumed in the country has increased consistently. A number of factors, including improved housing, higher per capita income, low and subsidized electricity prices and increased intensity of appliance usage, are believed to have contributed to this increase.⁽⁴⁾ Air-conditioning alone accounts for approximately three-quarters of the electricity consumed by the residential sector. This is because summer in Kuwait lasts from April through October and, during these months, average shade temperature is 48 degrees Celsius. This has also led to sharp seasonal fluctuations and demand peaks in the third quarter of the year. Rising per capita income together with government-fixed low electricity prices have led to a gradual and consistent decline in the share of expenditure on electricity in total household expenditure from 1.2 percent in 1972/73 to 0.9 percent in 1986/87.⁽⁵⁾

In 1986/87, the overall average residential electricity consumption was 3380 kWh per month. Depending on the type of house, this average varied from 7110 kWh per month for private villas, 4710 kWh per month for limited/middle-income houses, and 1920 kWh per month for apartments. There are conspicuous variations in electricity consumption within each housing category. For instance, the top decile of households in private villas use 16.4 times the electricity consumed by the bottom decile in the same category. The corresponding figures for limited/middle-income houses and apartments, respectively, are 12.9 and 18.7.⁽⁶⁾

(4) For more details, see [1]. To ascertain the impact of appliance intensification on the consumption of electricity, a simple regression was estimated for Kuwaiti households using 1986/87 family budget survey data:

$$e_i = 0.531 + 0.005 * E + 2.729 * Z$$

(5.717) (11.73) (0.899)

R²:0.895, F:81.734, df:17

where e_i is average per capita expenditure of households on electricity, E is average per capita total expenditure of the households, and Z is share of expenditure on electrical appliances in total household expenditure, taken as a proxy for appliance intensification. The evidence indicates that, while appliance intensification does have a positive affect on expenditure on electricity, the impact is not statistically significant. This could be because electricity consumption is highly subsidized in Kuwait or income, which is the driving factor behind both increased electricity consumption and appliance intensification, is capturing the effect on the later variable.

(5) In Kuwait, the nominal price of electricity, which was fixed in June 1966 is 2 fils per kWh for ordinary consumers and 1 fil per kWh for some industrial companies. Between 1953, when it was 27 fils per kWh, and 1966, it had declined consistently for all the consumers.

(6) For details, see [1].

country, however, is influenced by, among other things, the purchasing power of the consuming unit, the price of the commodity, and the population.⁽³⁾ Irrespective of whether required for end-use or intermediate-use, electricity performs a variety of functions for its potential consumers. In terms of its broad characteristics and the need to consume electricity, it has been customary to categorize consumers into four groups: residential, industrial, commercial, and government, and analyze the consumption pattern of each one of them separately.

Among the different sectors (residential, industrial, commercial and government) in Kuwait, on average, the residential sector consumes more than 50 percent of total consumption. Table 3 indicates that, in Kuwait, the share of the residential sector in total electricity consumption is almost double that in developed countries. In both the developed and the Latin American countries, it is the industrial sector that is the single largest consumer of electricity. Furthermore, since 1970, the share of the residential sector in total electricity consumption in Kuwait has increased from 55 percent to 62.5 percent and that of the other three sectors has decreased consistently. In general, this is in line with trends observed in the developed countries, except that the share of the commercial-cum-government sector in total electricity consumption has been increasing in the developed countries.

Table 3. Cross-country comparison of composition of electricity consumption.

Countries	Kuwait			Developed countries			Latin American countries
	1970	1980	1989	1973	1985	1988	1988
Sector / Year							
Residential	55.13	58.93	62.46	29.39	31.67	31.51	23.90
Industrial	24.26	22.25	20.24	48.00	41.72	40.90	51.10
Commercial	9.69	8.01	7.63	20.15*	24.36*	25.41*	24.90*
Government	10.92	10.80	9.67				

* Includes consumption by government sector.

The Residential Sector

In the present setup and life style, the residential sector uses electricity to satisfy its vital basic needs, such as heating, cooling, lighting, cooking and washing. In Kuwait, the residential sector, which consumes approximately 63 percent of the total

(3) While population is taken as a scale variable affecting total consumption, income and prices influence per capita consumption.

Table 2. Seasonal pattern of electricity consumption in Kuwait.

Yearly Ave.	January		February		March		April		May		June								
	Max	Gap %	Max	Gap %	Max	Gap %	Max	Gap %	Max	Gap %	Max	Gap %							
1980	1033.13	930	103.13	9.98	865	168.13	16.27	750	283.13	27.40	1005	28.13	2.72	1515	-481.88	-46.44	1940	-906.9	-87.78
1981	1159.58	930	229.58	19.80	880	279.58	24.11	815	344.58	29.72	1055	104.58	9.02	1595	-435.42	-37.55	2015	-855.4	-73.77
1982	1351.88	1060	291.88	21.59	1110	241.88	17.89	930	421.88	31.21	1220	131.88	9.75	1960	-608.13	-44.98	2290	-938.1	-69.39
1983	1454.38	1320	134.38	9.24	1135	319.38	21.96	990	464.38	31.93	1155	299.38	20.58	2080	-625.63	-43.02	2580	-1125.6	-77.40
1984	1596.67	1270	326.67	20.46	1190	406.67	25.47	1115	481.67	30.17	1545	51.67	3.24	2110	-513.33	-32.15	2695	-1098.3	-68.79
1985	1770.21	1390	380.21	21.48	1370	400.21	22.61	1340	430.21	24.30	1630	140.21	7.92	2550	-779.79	-44.05	2940	-1169.8	-66.08
1986	1936.25	1495	441.25	22.79	1460	476.25	24.60	1375	561.25	28.99	1700	236.25	12.20	2605	-668.75	-34.54	2960	-1023.8	-52.87
1987	2083.75	1610	473.75	22.74	1490	593.75	28.49	1490	593.75	28.49	1850	233.75	11.22	2995	-906.25	-43.49	3275	-1191.3	-57.17
1988	2306.25	1975	331.25	14.36	1800	506.25	21.95	1650	656.25	28.46	2620	-313.75	-13.60	3500	-1193.08	-51.76	3900	-1593.8	-69.11
Avg.			18.05			22.60				28.96				7.01					-69.15

Yearly Ave.	July		August		September		October		November		December								
	Max	Gap %	Max	Gap %	Max	Gap %	Max	Gap %	Max	Gap %	Max	Gap %							
1980	1033.13	1580	-546.9	-52.93	1760	-726.9	-70.36	1640	-606.9	-58.74	1135	-101.9	-9.86	835	198.1	19.18	905	128.1	12.40
1981	1159.58	2185	-1025.4	-88.43	2065	-905.4	-78.08	1980	-820.4	-70.75	1340	-180.4	-15.56	940	219.6	18.94	915	244.6	21.09
1982	1351.88	2350	-998.1	-73.83	2260	-908.1	-67.18	2275	-923.1	-68.28	1595	-243.1	-17.98	1015	336.9	24.92	1235	116.9	8.65
1983	1454.38	2520	-1065.6	-73.27	2560	-1105.6	-76.02	2470	-1015.6	-69.83	1475	-20.6	-1.42	1230	24.4	15.43	1200	254.4	17.49
1984	1596.67	2820	-1223.3	-76.62	2570	-973.3	-60.96	2550	-953.3	-59.71	1910	-313.3	-19.62	1320	276.7	17.33	1465	131.7	8.25
1985	1770.21	2925	-1154.8	-65.23	2965	-1194.8	-67.49	2865	-1094.8	-61.85	2005	-234.8	-13.26	1405	365.2	20.63	1485	285.2	16.11
1986	1936.25	3200	-1263.8	-65.27	3260	-1323.8	-68.37	3160	-1223.8	-63.20	2515	-578.8	-29.89	1555	381.3	19.69	1670	266.3	13.75
1987	2083.75	3525	-1441.3	-69.17	3365	-1281.3	-61.49	3305	-1221.3	-58.61	2505	-421.3	-20.22	1640	443.8	21.30	1625	458.8	22.02
1988	2306.25	3800	-1493.8	-64.77	3920	-1613.8	-69.97	3850	-1543.8	-66.94	3480	-1173.8	-50.89	2510	203.8	-8.83	2000	306.3	13.28
Avg.			-69.95			-68.88			-64.21			-19.86			16.51			14.78	



Fig. 1. Average monthly consumption of electricity in Kuwait.

The evidence presented in Table 1 indicates that the sharpest increase in the consumption of electricity occurred during the 1960s and, over the years, average annual growth has slowed down considerably. For instance, growth in total consumption of electricity during the 1980's was only 40 percent of what it was during the 1960's. This increase in the total annual consumption was due to an increase in the population as well as per capita consumption. The available evidence indicates that more than 50 percent of the growth in total annual consumption of electricity was due to an increase in the total population. For instance, on average, 42 percent of the growth in total consumption of electricity during the period 1960-1990 was due to increase in per capita consumption. Over the years, while growth in per capita consumption of electricity slowed down, reflecting a possible saturation effect, the share of growth in per capita consumption in total annual consumption increased steadily, indicating that growth in per capita consumption has been consistently more than growth in the population.

Table 1. Growth in consumption of electricity in Kuwait (percentages).

Year	Total	Per capita
1960-1990	16.54	6.93 (41.90)
1960-1970	24.42	9.35 (38.29)
1970-1980	15.09	5.90 (39.10)
1980-1990	9.89	5.44 (55.00)

Note: Figures within parentheses are shares of growth in per capital consumption in growth in total consumption.

Because of harsh climatic conditions, annual consumption of electricity in Kuwait is distributed unevenly across different months within a given year. Table 2 shows that during the hottest months of the year (June - September), the maximum consumption of electricity registered on a particular day of the month is, on average, 65-70 percent higher than the yearly average. Fig. 1 shows that, with the beginning of summer, monthly consumption of electricity starts rising from March and is highest in the month of August. Thereafter, as monthly temperature starts dropping, monthly consumption also declines and is lowest in the month of March. Over the years, as income level and population has increased, there has been an upward parametric shift in the monthly consumption curve.

In general, the need to consume any commodity is determined by the type and the number of functions it performs for the consuming unit, and whether it is required for end-use or intermediate-use. The actual consumption or demand in the

round-the-clock availability of this commodity to everyone in the country. The decision whether to expand the existing production capacity of electricity is determined, among other things, by its future demand. In this respect, over the last more than four decades, the total consumption of electricity has increased many-fold. For instance, between 1960 and 1990, total consumption of electricity increased almost 44 times, averaging an annual growth rate of 20.5 per cent. This increase in total consumption was due to an increase in per capita consumption as well as population.⁽¹⁾ Currently, in Kuwait, the annual per capita consumption of electricity is 8.7 thousand kWh. A number of factors are believed to have influenced the sharp increase in the per capita consumption of electricity in Kuwait. This paper analyzes factors that have influenced consumption of electricity in Kuwait, and estimates sector-specific demand functions.

The remainder of this paper is organized as follows: Section II is devoted to review of the historical trends and composition of electricity consumption in terms of consumption by different sectors, viz. residential, industrial, commercial and government. Methodology for estimating sector-specific electricity demand functions is outlined in Section III. Section IV presents and discusses the results. Finally, Section V summarizes the main findings.

Trends in the Consumption of Electricity in Kuwait

In response to a sharp increase in the level of income, massive urban development, a drastic shift in the life-style patterns, and increased use of electric appliances, particularly during the 1970s and 1980s, total annual consumption of electricity in Kuwait increased from 249 million kWh in 1960 to 21085 million kWh in 1989. Currently, annual per capita consumption of electricity in Kuwait is 8.7 thousand kWh. Compared with an average annual growth rate of 3.1 percent for electricity consumption in the developed countries, the average annual growth rates of electricity consumption in Kuwait are much too high. The difference is partly due to the low base in the initial years and partly because of the welfare orientation of the government's economic policies, where electricity consumption is highly subsidized.⁽²⁾

(1) Between 1960 and 1990, while Kuwait's population increased almost seven times, the increase in per capita consumption of electricity was six-fold.

(2) In Kuwait, electricity consumers are charged a flat rate of 2 fils for every kWh of electricity consumed. Compared with the cost of supplying electricity, which depending on the price of oil, has varied from around 26 fils per kWh in 1984/85 to a little over 14 fils per kWh in 1988/89, this amounts to a subsidy of 86-92 percent of the cost of supplying electricity.

Demand for Electricity in Kuwait

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Abstract. This paper analyzes demand for electricity in Kuwait and estimates sector-specific demand functions. The evidence presented indicates that increase in population accounts for approximately 60 percent of the increase in electricity consumption over the years. The estimated income and price elasticities indicate that, in general, consumption of electricity in Kuwait is inelastic with respect to changes in income and electricity price.

Introduction

One of the major concerns of government's economic policy in any country is to make and implement plans to augment domestic production and supply of essential commodities and services to meet expected demand. Under normal circumstances, demand for most commodities and services rises with economic growth and necessitates the importance of developing the sector/industry to increase the supply. Since priorities and investment targets have to be based on demand forecasts, among other things, good knowledge of the factors influencing demand and reliable estimates of parameters describing consumers' behavior and consumption patterns are a prerequisite. The two parameters considered to be the most important for projecting future demand for any commodity or service are income and price elasticities.

In Kuwait, the government is responsible for supplying electricity to the population. Over the years, it has invested substantial amounts of resources to ensure

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