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世界能源消費類型之分析
—OECD及其他某些國家—

Pattern Analysis of Energy Consumption for The OECD and Some Other Countries

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摘 要

本文以 24 個 OECD 國家及其他 13 個國家，收集有關能源之資料，分析其能源消費之類型，並以因子與群落分析為主要工具，探討該 37 個國家之能源消費類型。

本研究由因子分析擬抽四個主成份作為經濟發展，能源進口依賴度，工業化及能源生產之指標。同時計算 37 個國家其四個主成份之樣本得點，並以此結果討論世界各國之能源消費特性與其類型，最後將各國能源消費之類型經由群落分析的方式分成幾個國家類型，因以表現出各國家類型之特性。

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I. INTRODUCTION

This paper investigates energy consumption patterns of the twenty-four OECD (Organization of Economic Cooperation and Development) and thirteen other countries by conventional multivariate techniques, including factor and cluster analyses. In general, energy consumption pattern of a country is affected by its economic development, energy supply and distribution, degree of industrialization, geography, climate, and so on.

To pursue economic progress and high living standards, every country in the world becomes more dependent on energy than ever before. But, fossil energy resources in the world are rare, and are unevenly distributed in general; an understanding of successful energy utilization programs in those countries with similar energy consumption pattern may provide good examples for a country to follow.

The principal purpose of this paper is. therefore, to analyze underlying energy-related structure of the collected data. Basically, interpretation of results and comparison between variables and between countries are techniques used to explain energy consumption patterns. Because the collected energy-related data are inherently multidimensional, it is appropriate to adopt multidimensional techniques [1,2,3,4] for the pattern analysis of energy consumption.

II. METHODOLOGY AND DATA COLLECTION

2.1. Methodology

Energy consumption pattern of a country is generally complex in nature. Selection of appropriate techniques to analyze this complexity lies in the ability to capture and simplify intrinsic properties inherent in energy consumption process.

Although limited by data unavailability, energy consumption pattern could be characterized by available multidimensional variables. These variables are interrelated in general. The analysis of interdependence for these selected variables is the emphasis of pattern analysis for energy consumption. Factor and cluster analyses of multivariate techniques are then chosen for use in this regard. However, it is realized that inherent structure represented by the collected data for samples may be suppressed by the usage of multivariate techniques.

Factor analysis, for its capability to synthesize multidimensional variables, i.e. energy-related variables in this paper, into a few common factors, is chosen for use to interpret energy consumption pattern by common factor or by country. Through the computation of sample factor scores for the selected countries, energy consumption pattern for each country could be described and compared with each other.

Based on the refined common factors resulted from factor analysis, the selected countries could be explicitly grouped through the exhibition of a dendrogram by use of cluster analysis. Attention is given to two principals: (1) the intra-group variance is minimized, and (2) the inter-group variance is maximized.

Details of the two multivariate techniques mentioned above could be found in textbook elsewhere. In the next section, data collected to accomplish the pattern analysis of energy consumption is presented.

2.2. Data Collection

Data collected for the selected countries come from publications by the Thirteenth Congress of World Energy Conference [6] held in 1986. Of the selected countries, twenty-four of them are OECD countries and thirteen of them are not, as listed in Table 1. In the selected thirty-seven countries, they include both developed and developing countries. It is one of our major interest to compare energy consumption patterns between the two country categories.

Energy-related characteristics for each country are represented by eleven variables. These variables include those that signify economic development (i.e. Gross Domestic Products (GDP) per capita, X1), that signify industrialization (i.e. solid-fuel consumption per capita, X5, petroleum-fuel consumption per capita, X6, gas-fuel consumption per capita, X7, and electricity consumption per capita, X8), that signify sources of energy supply (i.e. total amount of imported energy, X2, total amount of exported energy, X3, and degree of energy dependence, X4), and that signify utilization distribution of energy consumption (i.e. percentages of energy consumption by industrial, transportation and other sectors, X9 through X11, respectively). Fundamental data for these variables by country is provided in Appendix A.

Table 1. The Selected 24 OECD and 13 Other Countires

Code Number		Country Name	Code Number		Country Name
1		Argentina	20	*	Luxemburg
2	*	Australia	21		Malaysia
3	*	Austria	22		Mexico
4	*	Belgium	23	*	Netherland
5		Brazil	24	*	New Zealand
6	*	Canada	25	*	Norway
7	*	Denmark	26		Paraguay
8	*	Finland	27	*	Portugal
9	*	France	28	*	Spain
10	*	Germany	29	*	Sweden
11	*	Greece	30	*	Switherland
12		Hungary	31		Taiwan
13	*	Iceland	32		Thailand
14		India	33	*	Turkey
15		Indonesia	34	*	United Kingdom
16	*	Ireland	35	*	United States
17	*	Italy	36		Uruguay
18	*	Japan	37		Venezuela
19		Korea			

Note: * indicates an OECD country

Table 2. The Statistical Tabular for the Selected Eleven Variables

Variable	Name	Average	Std. Dev.	Coefficient of Var. (iii)
X1	GDP Per Capita ($)	6661.97	4833.92	72.56
X2	Total Amount of Energy Imported (PJ)(i)	1908.00	3195.24	167.47
X3	Total Amount of Energy Exported (PJ)	1065.64	1551.05	145.55
X4	Degree of Imported Energy Dependence (%)(ii)	13.47	82.42	611.76
X5	Solid-Fuel Consumption Per Capita (GJ)(iv)	13.59	26.48	194.89
X6	Petroleum-Fuel Consumption Per Capita (GJ)	48.08	32.75	68.12
X7	Gas Consumption Per Capita (GJ)	13.89	19.01	130.74
X8	Electricity Consumption Per Capita (GJ)	17.57	19.40	110.45
X9	Energy Consumption by Industrial Sector (%)	36.27	10.56	29.12
X10	Energy Consumption by Transportation Sector (%)	27.81	8.43	30.31
X11	Energy Consumption by Other Sectors (%)	35.39	11.30	31.92

Note: (i) indicates 10^{15} Joules.

(ii) Degree of Energy Dependence is equal to total amount of energy imported subtracted by total amount of energy exported and the divided by total amount of usable energy.

(iii) indicates standard deviation divided by arithmetic average times one hundred percent.

(iv) indicates 10^{9} Joules.

In Table 2, it summarizes the average, standard deviation, and variance by variable for the thirty-seven countries. It is seen that dispersion for most variables is substantially large. This phenomena suggests there exist large variation in unavailable or non-quantifiable variables, such as geography, culture, and climate, between countries. Degree of imported energy dependence (X4) is the largest in variation. It may be resulted from extremely uneven distribution of energy resources among countries in the world. Most countries on earth rely on different levels of energy importation. Moreover, a variety of economic development and energy consumption pattern widen the diversification of imported energy dependence.

In the next section, results for pattern analysis of energy consumption are summarized.

III. PATTERN ANALYSIS FOR ENERGY CONSUMPTION

In the analysis discussed below, SPSS/PC^{+} computer software [5] is used to implement factor and cluster analyses. Data collected for the eleven energy-related variables of the thirty-seven countries are input to the computer software for the purpose of obtaining common factors and sample scores, and grouping countries by the similarity of energy consumption pattern. Results are summarized for factor and cluster analyses individually.

3.1. Results of Factor Analysis

In the factor analysis, principal factor loading for the eleven selected variables is obtained by rotating principal components by Varimax method. The result is shown in Table 3. In the table, commonality of variables, eigenvalue, contributed rate, and accumulative contributed rate for the first four principal components are provided as well. The largest common factor loading for each variable is marked by a rectangle in the table. For instance, total variance for the first four principal components of the variable, X1, is 0.87756. Out of the total

Table 3. Rotated Principal Factor Loading by Variable

Variable	I	II	III	IV	Commonality
X1	.85628	.08448	.00286	.37040	.87756
X2	.04431	.15833	-.11954	.76745	.63030
X3	.15092	-.75854	-.01444	.50898	.85743
X4	-.15581	.86165	-.01490	.11225	.77955
X5	.21249	.38666	.61203	.20143	.60981
X6	.82940	.08461	.22371	.41203	.91488
X7	.35862	-.09599	.01078	.79196	.76513
X8	.93159	-.10779	.01910	-.09540	.88894
X9	.07968	.07045	.90126	-.10172	.83392
X10	-.20990	-.66223	-.01207	-.10904	.49464
X11	.08210	.42677	-.81916	.17613	.89092
Eigenvalue	3.34053	2.17095	1.97201	1.05959	—
Contributed Rate (%)	30.4	19.7	17.9	9.6	—
Accummulated Contributed Rate (%)	30.4	50.1	68.0	77.7	—

variance, variance of the first principal component is 0.7332 (i.e. 0.85628^2). It suggests that the first principal component (I) be used to interpret X1.

In the same table, common factor loading signifies correlation between variables and their corresponding principal components. The larger is the common factor loading, the more contribution to the corresponding variable the principal component is. By consulting the contributed rates in the table, it is found that the first principal component can explain 30.4 percent of total variation; the second principal component can explain 19.7 percent; and, the first four principal components can explain 77.7 percent in total.

Of the principal components, the first may be interpreted as an indicator of economic development of a country. This indicator is found to be positively correlated with GDP per capita and various energy consumption per capital (including petroleum-fuel, and electricity energy consumption per capita). In general, the more advanced is a nation's economic development, the more energy resources per capita it consumes and the higher GDP per capita it has.

Of the second principal component, it may be regarded as an indicator of imported energy dependence. While a country exports more energy than its importation, imported energy dependence of this country is considered not heavy. It is correlated with percentage of energy consumption by transportation sector negatively.

An indicator of industrialization is deduced for the third principal component. Generally speaking, an industrialized country consumes more energy in industrial sector as well as of solid fuel than less industrialized countries.

The last principal component, for its manifestation of difference between imported and domestic energy types, can be interpreted as an indicator of diversification of energy production. If the indicator is large for a country, the country may need to exchange produced energy for other energy types in a large quantity with other countries. It is correlated with gas consumption per capita.

The interpretation of the four principal components provides an insight on the obtained principal components. Sample scores for the selected countries, as shown in Table 4, are then computed and used to investigate energy consumption pattern by country and by principal component.

Analyzed by principal component, nighteen countries are found to have negative factor scores for the first principal component. Six of them (Brazil, India, Malaysia, Paraguay, Thailand and Uruguay) have first factor scores lower than -1.00000 are Less Developed Countries (LDC). Thirteen of them have first facotr scores higher than -1.00000 are New Industrialized Countries (NIC). Taiwan, with a value of -0.55037, is ranking as the sixth in economic development among the NIC. Other eighteen developed countries are found to have positive first factor

Table 4. Factor Scores for the Thirty-Seven Countries

Country Name	Code No.	1st Factor	2nd Factor	3rd Factor	4th Factor
Argentina	1	-.87333	-.20356	-.14219	.11571
Australia	2	.83302	-2.54662	.45457	.26086
Austria	3	.04951	.76908	.24828	-.53088
Belgium	4	.54255	.97771	.14080	.21549
Brazil	5	-1.03743	-.14642	.04874	.28586
Canada	6	2.12865	-.43080	.39427	-.25711
Denmark	7	.05919	.77192	.65981	-1.12677
Finland	8	.54191	-.39570	-2.27344	-.47309
France	9	.39556	.57866	.19028	.39046
Germany	10	.79734	.83665	.85461	.37322
Greece	11	-.67024	-.00372	-.31056	.20594
Hungary	12	-.48243	1.08889	-.01430	.01050
Iceland	13	.85161	-.45425	-1.39737	-1.98628
India	14	-1.14949	.16931	-.58290	.40136
Indonesia	15	-.98484	-1.53199	.07207	.54599
Ireland	16	-.53699	.75482	.25505	-.45057
Italy	17	-.02423	.56026	-.04520	.80177
Japan	18	.64741	1.32032	.27938	1.31868
Korea	19	-.69027	1.04938	-.58331	.28253
Luxembourg	20	1.72810	.72284	-3.62248	1.55178
Malaysia	21	-1.07473	-1.63413	-.38624	.25635
Mexico	22	-.74539	-1.70624	.40076	.69629
Netherlands	23	.86683	.59240	1.90064	.92716
New Zealand	24	.61030	-.56726	-.80603	-1.05980
Norway	25	1.23613	-1.28339	.37456	-3.00748
Paraguay	26	-1.53907	-.55092	.86464	-.10851
Portugal	27	-.91134	.09708	-.81693	.25518
Spain	28	-.51851	-.14883	-.73569	.47095
Sweden	29	.61098	.50242	.13946	-1.89214
Switzerland	30	.47638	.97606	1.12233	-1.62848
Taiwan	31	-.55037	.76243	-.94693	.22562
Thailand	32	-1.29592	.46257	.69415	-.14088
Turkey	33	-.96825	1.06133	.40404	-.17252
United Kingdom	34	.51059	-.40451	1.04084	.78506
United States	35	2.60957	-.40835	1.50939	2.14383
Uruguay	36	-1.05180	.74318	.55395	-.42029
Venezuela	37	-.39101	-2.38060	.06095	.73420

scores. United States and Canada among these countries, have the highest factor scores, for their phenomena cold weather, high GDP per capita, and immense size, are very outstanding in economic development.

Based on the indicator of imported energy dependence, a country may have energy resources for export and does not rely on imported energy if the indicator is negative for the country. Australia, Indonesia, Malaysia, Mexico, Norway and Venezuela are the countries that have little dependence on imported energy. They all export energy. On the other hand, Japan is shown to be heavily dependent on imported energy for its highest score in the indicator of imported energy dependence. It is, therefore, concluded that Japan is vulnerable to any energy crises if the energy consumption pattern in Japan remains unchanged.

Generally speaking, the indicator of industrialization is found to be correlated with developed countries. For instance, United Kingdom, United States, Switzerland, and Netherland have positive scores for this indicator. It is commensurate with the indicator of economic development. However, negative value of this indicator may signify high percentage of energy consumption in industrial sector. Luxemburg, Finland, Iceland, Taiwan, Portugal, New Zealand, Spain, Korea, and India belong to this category.

Analyzed by individual country, Taiwan, for instance, possesses a value of -0.55037 for the economic development indicator, suggesting that Taiwan be a new industrialized country. Despite of fast economic growth in this area, GDP per capita in Taiwan still remains at a level of 3,046 U.S. dollars, far behind that of developed countries. Compared with Korea, which has a value of -0.69027 for the economic development indicator, Taiwan is concluded to be more advanced in economic development than Korea.

Concerning imported energy dependence, Taiwan, with a value of 0.76243 for this indicator, is presumed to be dependent on imported energy very much. However, Japan (1.32032) and Korea (1.04938) are found to be more dependent on imported energy than Taiwan. In fact, Japan is already well-known for very advanced economic development with little energy resources.

By consulting with the indicator of diversification of energy production, Taiwan is found to be similar to Korea. Japan, on the other hand, is found to be heavily dependent on imported energy and is very much diversified in its own energy production.

Using the same procedures, energy consumption pattern for an individual country could be addressed explicitly. In the following section, the results of cluster analysis are summarized and interpreted.

3.2. Results of Cluster Analysis

The single linkage method (or the nearest neighbor method) is used for cluster analysis in order to classify the selected thirty-seven countries into several groups by a prescribed cutoff level. Basically, sample factor scores at the four principal components obtained from the factor analysis in last section is the basis for analysis. Distances between the thirty-seven countries are calculated and then compared with one another. The pair of countries with the least distance at each stage is grouped. The sequence for this merging process is shown in Table 5.

The first and the fifth samples (i.e. Argentina and Brazil, respectively), for instance, are classified into one group first and then merged with the eleventh sample (i.e. Greece) at the second stage. With respect to coefficients shown in the Table 5, countries in a group are considered very similar if they are put in the group at low value of the coefficient.

To reduce the effort required to tell grouping process, a dendrogram for the cluster analysis is exhibited in Figure 1. The thirty-seven countries are divided into seven groups with a coefficient of two, as marked by the dashed line in the figure. Of the seven groups, five of them comprise one country only. These countries include Luxemburg, United States, Norway, Canada and Finland. All of them are developed countries. Iceland and New Zealand constitute another group at the same cutoff level.

Table 5. Stages for Grouping in Cluster Analysis

Agglomeration Schedule using Single Linkage

Stage	Clusters Combined		Coefficient	Stage Cluster 1st Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	1	5	.095596	0	0	2
2	1	11	.117675	1	0	10
3	14	27	.183077	0	0	9
4	33	36	.192062	0	0	7
5	4	9	.213915	0	0	15
6	15	22	.218327	0	0	11
7	32	33	.236060	0	4	13
8	19	31	.237373	0	0	16
9	14	28	.267949	3	0	10
10	1	14	.295034	2	9	18
11	15	21	.312453	6	0	21
12	3	16	.330677	0	0	13
13	3	32	.355424	12	7	14
14	3	12	.399711	13	0	16
15	4	17	.401186	5	0	19
16	3	19	.442552	14	8	17
17	3	7	.524552	16	0	18
18	1	3	.590764	10	17	20
19	4	10	.619217	15	0	22
20	1	30	.681355	18	0	22
21	15	37	.697265	11	0	29
22	1	4	.855231	20	19	23
23	1	26	1.216410	22	0	24
24	1	29	1.233661	23	0	26
25	13	24	1.279036	0	0	31
26	1	18	1.364618	24	0	27
27	1	23	1.465510	26	0	28
28	1	34	1.826993	27	0	30
29	2	15	1.904801	0	21	30
30	1	2	1.990777	28	29	32
31	8	13	2.531626	0	25	32
32	1	8	2.730952	30	31	33
33	1	6	3.988054	32	0	34
34	1	25	4.879194	33	0	35
35	1	35	5.671985	34	0	36
36	1	20	8.578185	35	0	0

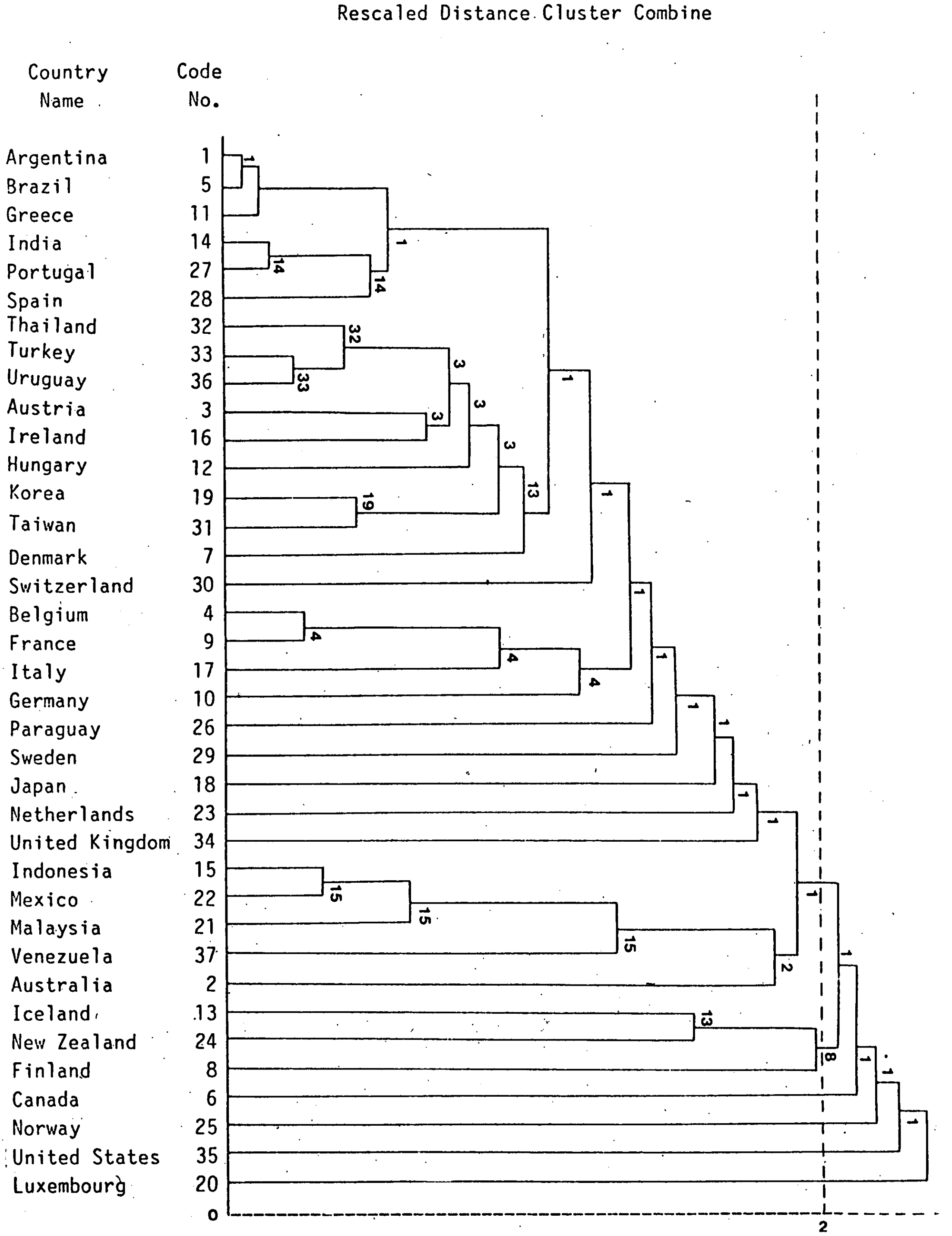

Figure 1. Dendrogram for the Selected Countries

The last group in the dendrogram is the emphasis of the discussion. This group can be further divided into five subgroups. The first subgroup includes Argentina, Brazil, Greece, India, Portugal and Spain. This subgroup could be characterized by low energy consumption per capita and warm weather.

The second subgroup is made up of two countries, Taiwan and Korea. The two countries have long been well-known for their fast economic growth in new industrialized countries and large quantities of products exported so that they become models for other developing countries to follow. Energy cömsumption pattern for the two countries could be characterized by large quantities of energy importation and wide diversification of energy production.

Of the third subgroup, it comprises of Turkey, Uruguay, Thailand, Austria, Ireland and Hungary. Most of the them are developing countries except Austria. Some of developed countries in Europe, such as Belgium, France, Italy and Germany, are gathered into the fourth subgroup for their similar high degree of energy dependence and high industrialization.

The last subgroup includes those countries that export large amount of energy to other countries. Indonesia, Mexico, Malaysia, and Venezuela are the four countries in this subgroup and all of them are developing countries.

In summary, energy consumption pattern by individual country or by country group could be investigated and compared through the interpretation of principal components and sample scores obtained in factor analysis and through the grouping of countries in cluster analysis at a given cutoff level. It is concluded that the methods used above provide a simple mechanism to analyze energy consumption patterns for selected countries with accessible energy-related data in nation level and is, therefore, appropriate for pattern analysis of energy consumption.

IV. CONCLUSION

This paper uses multivariate techniques, including factor and cluster analyses, to analyze the energy-related data collected for the twenty-four OECD and thirteen other countries. By using of interpretation and comparison, energy comsumption pattern by individual country and by country group is reasonably exhibited in the earlier sections. However, the discussion of the results is limited by data unavailability and non-quantifiable variables, such as climate, geography, and life style.

Despite the ability of multivariate techniques to provide deep insight on the underlying structure of the collected data set, they also destroy the rich structure of the data set so that the interpretation to complex structure and opportunity to impose desirable controls are limited [1]. Hence, it is recommended to perform Q-connectivity analysis to understand the structure properties of relation between sets. With a nature of utilizing relation rather than functions, the Q-analysis is more flexible in operational definition of system structure than multivariate techniques.

It is hoped that this paper could highlight general energy consumption patterns for the data collected.

REFERENCES:

1. J. R. Beaumont and C. D. Beaumont; "A Comparative Study of Multivariate Structure of Towns"; Environmental and Planning B, Vol. 9; 1982.
2. D. M. Groves and C. A. Roberts; "Principal Component and Cluster Analysis of 185 Large Towns in England and Wales"; Urban Studies 17. pp 77-82; 1980.
3. M. P. Mather and S. Openshant; "Multivariate Methods and Geographic Data"; The Statistician 23, pp 283-308; 1974.
4. B. S. Euritt: "Unresolved Problems in Cluster Analysis"; Biometrics 35, pp 169-182; 1979.
5. Marija J. Norusis; "SPSS/PC+: SPSS for the IBM PC/XT/AT"; Marketing Department, SPSS Inc; 1986.
6. "National Energy Data", The Thirteenth Congress of World Energy Conference, October 5-11, Cannes, France; 1986.

Appendix A Energy-Related Data by Country

Country Name \ Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
Argentina	2,230	119.00	66.00	2.60	2.43	24.98	10.63	4.35	36.83	32.52	30.65
Australia	11,890	396.00	5,383.00	-149.76	12.76	75.19	24.17	23.27	37.83	41.29	20.88
Austria	9,140	694.69	45.39	58.40	13.33	46.97	17.63	16.99	31.06	24.92	44.02
Belgium	8,430	2,077.00	722.00	77.43	17.86	61.68	34.29	17.04	36.59	18.22	45.19
Brazil	1,710	1,758.00	433.00	20.06	1.98	14.47	0.82	4.24	34.79	33.76	31.45
Canada	13,140	1,327.00	2,982.00	-17.43	21.04	115.40	66.64	51.88	37.89	23.34	38.77
Denmark	11,290	760.00	154.00	85.11	3.92	71.18	1.18	16.86	22.74	31.58	45.68
Finland	10,830	709.00	137.00	52.19	8.78	75.59	4.29	34.53	65.67	21.39	12.94
France	9,860	5,388.00	629.00	59.04	9.12	57.93	17.09	15.84	36.47	25.74	37.79
Germany	11,090	6,469.00	1,050.00	49.17	14.23	68.26	26.33	19.78	28.93	24.52	46.55
Greece	4,155	700.99	228.23	64.70	24.07	45.81	0.34	2.70	32.54	37.89	29.57
Hungary	2,050	583.10	65.30	43.06	17.64	25.78	16.68	9.40	36.98	14.79	48.23
Iceland	9,380	24.00	0.00	28.24	15.00	105.00	0.00	65.00	48.15	29.63	22.22
India	260	839.00	312.00	9.72	2.16	2.00	0.14	0.61	46.43	20.78	32.79
Indonesia	540	229.00	3,106.00	-156.10	0.07	5.29	1.47	0.49	43.77	27.82	28.41
Ireland	4,950	196.00	21.00	52.27	19.80	35.64	4.53	9.62	28.05	26.83	45.12
Italy	6,440	5,433.00	464.00	-84.61	4.93	43.61	15.49	10.72	39.71	26.40	33.89
Japan	10,390	13,181.00	106.00	85.41	10.76	56.28	6.93	15.27	39.25	20.72	40.03
Korea	2,090	1,636.00	146.00	69.59	17.10	22.07	0.05	4.12	44.23	14.12	41.65
Luxembourg	13,160	127.91	2.09	95.25	164.94	114.10	31.63	11.30	60.76	19.79	19.45
Malaysia	1,990	267.00	984.00	-118.51	0.73	18.53	0.40	2.80	41.84	40.65	17.51
Mexico	2,060	66.00	3,862.00	-72.65	1.06	25.42	6.08	3.05	35.93	39.21	24.86
Netherlands	7,240	3,387.00	3,330.00	2.27	6.43	49.71	62.64	15.29	24.35	17.10	58.55
New Zealand	8,347	140.45	14.63	23.72	20.77	48.60	32.31	61.16	42.87	34.15	22.98
Norway	13,750	288.00	2,410.00	-245.89	10.61	74.29	0.96	76.22	36.90	20.39	42.71
Paraguay	1,250	24.35	0.26	28.63	0.00	6.01	0.00	0.91	17.18	51.97	30.85
Portugal	1,970	460.32	26.83	81.34	4.45	27.18	0.23	5.96	44.40	29.42	26.18
Spain	4,470	2,438.00	522.00	61.91	5.87	37.23	1.69	9.28	45.23	31.15	23.62
Sweden	11,880	1,047.00	311.00	34.31	6.00	78.00	1.38	46.25	32.00	24.50	43.50
Switzerland	15,990	635.20	103.70	55.44	4.72	72.40	7.72	21.85	17.90	29.02	53.08
Taiwan	3,046	1,278.29	90.40	88.78	8.10	30.85	2.51	9.14	49.50	16.40	34.10
Thailand	850	451.62	1.77	49.35	5.34	7.56	0.00	1.31	22.95	33.97	43.06
Turkey	1,415	768.28	72.73	43.94	15.07	14.56	0.03	2.57	28.98	20.63	50.39
United Kingdom	8,530	3,146.00	4,096.00	-11.81	11.45	46.89	29.25	14.52	31.76	26.29	41.95
United States	15,490	13,463.00	4,009.00	12.22	13.49	127.97	67.48	34.32	31.01	34.29	34.70
Uruguay	1,970	56.80	17.50	28.60	6.49	14.35	0.00	3.75	26.84	25.20	47.96
Venezuela	3,220	31.00	3,525.00	-176.82	0.35	32.06	20.88	7.53	43.52	38.39	18.09

Note:
X1 -- GNP Per Capita, ($)
X2 -- Total Amount of Energy Imported, (PJ)
X3 -- Total Amount of Energy Exported, (PJ)
X4 -- Degree of Imported Energy Dependence, (%)
X5 -- Solid-Fuel Consumption Per Capita, (GJ)
X6 -- Petroleum-Fuel Consumption Per Capita, (GJ)
X7 -- Gas Consumption Per Capita, (GJ)
X8 -- Electricity Consumption Per Capita, (GJ)
X9 -- Percentage of Energy Consumption by Industrial Sector (%)
X10 -- Percentage of Energy Consumption by Transportation Sector (%)
X11 -- Percentage of Energy Consumption by Other Sector (%)