ASSESSMENT OF ENERGY CONSERVATION AND AWARENESS PROGRAMS IN THE HOUSEHOLD SECTOR IN JORDAN

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ABSTRACT: This paper intends to devise a new methodology for evaluating energy conservation and awareness programs within residential consumers, in Jordan, based on expert computer knowledge-based systems and fuzzy set analyses. Computer-programmed surveys were carried out on a random sample of energy users, before and after they received a simple energy educational material. The fuzzy set logic technique enabled to condense a great many data into a small set of variable rules. Relative weights were given for each response and a cumulative grade was estimated. This in turn made the employed expert system effective in evaluating energy conservation programs. This filed study was carried out on a small sample of about 150 persons in the Hashemite University of Jordan in two steps. It helped to draw some important and useful conclusions about energy awareness and conservation practices in Jordan. The post-survey showed that a significant rise, of about 15%, of energy related knowledge was achieved, as compared to the initial results. Fuzzy set analyses suggest that some fluctuations in the relative rise of public awareness programs may be attributed to insufficient knowledge. Thus, through public awareness and demonstration programs as well as incentives, such as financial assistance and technical aid to encourage final energy consumers to employ the latest technologies and more energy-efficient equipment, energy demand can be controlled.

KEYWORDS: Households; Energy conservation; Public awareness; Programmed-survey; Fuzzy logic analysis.

BACKGROUND

Jordan lies in the heart of the Middle East region and has a rapid population growth of about 3.6% per annum (DoS, 2002). It is also poor in terms of natural resources, including energy, compared with neighbouring countries. Furthermore, its economy is instable and depends heavily on the general situation in the region, which is considered politically fragile and hostile for the last 55 years. The net effect of these factors is that the national energy demand has grown rapidly and it is expected to continue so. In order to meet the growing energy demand, the consecutive governments concentrated on the development of energy supply facilities, such as expansion of petroleum refining, storage and distribution of petroleum products as well as enlarging the capacity of power generation and electricity distribution networks.

At present, the country is importing crude oil and petroleum products to sustain its present way of life. This leads to a significant hard-currency drain on the economy, with an annual oil

bill exceeding 800 million US$ (MEMR, 2003). Such high value represented approximately 7.5% of the GNP in 2002. Equally important is the security of supply of energy needs. Crude oil security for the next few decades would be improved by constructing a new pipeline from Saudi Arabia or Iraq, as well expanding the current storage-capacity. Besides the conventional ways to address energy problem through supply augmentation, many measures should be considered in order to enhance efficiency of energy utilization and reduce demand. These include energy conservation schemes in all sectors, electrical demand side management; reduce conversion and distribution losses, more use of renewable energy sources, targeted training and public awareness programs. The demand for primary energy in 2002 was about 5.3 million tons of oil equivalent (toe), compared with 2.4 million toe in 1982, with a net increase of 230% (MEMR, 2003). In 1982, households' consumption was about 14.5% and industry consumed 20% of the total consumption. Twenty years later, the consumption increased to reach about 23% and 22% for households and industry, respectively - see Figure 1. In the latter, others include commercial and services, government and agricultural sectors. The higher increase in sharing ratio of the residential sector can be attributed to rapid growth in population and urbanization.

Recent official and independent forecasts suggest that the primary energy demand, in Jordan, will be equivalent to 6.7 million toe by the year 2015, and it may reach double the present rate between 2015 and 2020 (Arab Bank, 2002; NEPCO, 2002; MEMR, 2003; Jaber et al. 2001a). On the other hand, energy production from national resources, i.e. renewable and oil shale, will not exceed 10-12% in the year 2015 (Arab Bank, 2002; Jaber et al. 2001b; Jaber et al. 2003a). Hence, the country will still be forced to import most of its energy needs, unless there are large new crude oil and/or natural gas discoveries and production fields in the country. However, there are significant potential savings to be achieved in sectors of the economy by adopting proven more effective, higher-efficiency techniques. Thus, the government of Jordan should pay considerable attention to energy conservation programs in all sectors and develop the indigenous new and renewable energy sources in order to reduce the annual rate of energy consumption. Consequently, the bill of imported energy and pollutant emissions would decline.

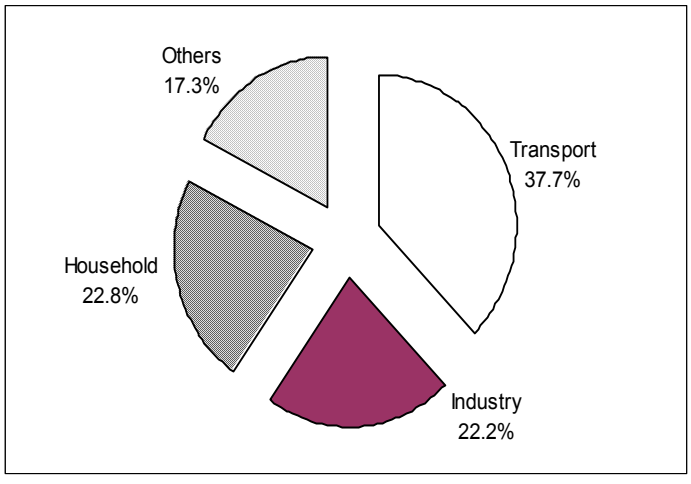

Figure 1. Sectorial energy consumption in 2002

In this paper, an expert knowledge-based computer system methodology, using fuzzy sets, to evaluate energy conservation programs and public awareness campaigns in the residential sector is developed. A special questionnaire and leaflets about energy situation and importance of energy conservation were designed and distributed in order to carry out the field survey among different categories of the society. This proposed methodology presents a new generic tool for qualitative judgments of such activities.

ASSESSMENT OF ENERGY CONSERVATION PROGRAMMES

Worldwide many efforts have addressed the evaluation of energy conservation and public awareness programs. It was estimated that the expected benefit from public awareness programs in developed countries to be between 10% and 30% (Macey, 1991; Wilhite and Ling, 1995; Martinot and Borg, 1998; Mullaly, 1998; Phylipsen et al., 2002). Such reduction represents the combined effects of public campaigns and education on careful energy use, enforcement of efficiency related regulations and clear tariff structures for various forms of energy. Other researchers, in developing countries, have studied the effects of socio-economics and behaviour of people on efficient energy use in the home (Bensel and Remedios, 1995; Alam et al., 1998; Eiswerth et al., 1998; Davis, 1998; Xiaohua and Zhenmin, 2002). The main conclusion was that there is an evidence of excessive energy use and wasteful energy consumption behaviour, even in poor households, due to lack of public awareness and lack of state sponsored energy conservation programs. Unfortunately, in Jordan and neighbouring Arab states, such studies are not available because energy problem is not taken seriously, yet. This study is deemed to fill part of the gap in information related to energy awareness campaigns and provide energy planners and policy makers with basic data that is required for future careful energy planning, conservation and public awareness programs.

During the period 1985 to 1995, several comprehensive studies were carried out with close cooperation of international donors and energy agencies in order to investigate energy conservation potential in different sectors. These include main manufacturing industries, commercial institutions and public services, large road-transport companies and the residential sectors (MEMR, 1987a&b; MEMR, 1986; MEMR, 1991; World Bank, 1993; Bengerh, 1993; MEMR, 1997). The conclusions of these studies were encouraging: it has been estimated that up to 10%, which corresponds to approximately 80-100 million US$ annually, at prevailing oil unit prices, of the Jordan's total energy consumption could be saved by implementing economically justifiable measures. About 5 to 15% in transportation, 10 to 30% in industries especially medium and small sized industries and up to 20% in each of the household and commercial sectors. The most attractive energy conservation measures include better thermal insulation, improved demand-side management, good house-keeping measures, operation and maintenance optimization, appropriate staff-training and public awareness. Most of these energy-thrift measures incur little or no capital-costs with average simple payback periods of less than 14 months (Aburas and Fromme, 1991; Jaber et al., 1993; Mohsen and Akash, 2001; Jaber, 2002a,b&c; Jaber et al., 2003b). The advantages of such schemes include: (i) reducing the burden on the economy through raising the efficiency; (ii) creating more jobs for engineers and the skilled work-force; (iii) decreasing emissions to the environment; and (iv) less capital investment being needed for future energy projects.

In the residential sector, few specific filed studies were conducted to determine the energy consumption trends and the effects of different variables, such as socio-economic factors, building design and orientation on energy consumption. Also, the potential for energy conservation and using renewable energy as an alternative source in the household sector in Jordan were considered (MEMR, 1987; MEMR, 1997). The crucial findings of such investigations are that only a small percentage, i.e. 5%, of houses have had their external walls thermally insulated and more than half, i.e. 53%, of households suffer from dampness, especially in poorly ventilated homes. This leads to mould growth on cold walls and health hazards for the inhabitants. More importantly is that approximately 65% of the population has no conception of formal energy conservation measures, which is a strong evidence of the amount of energy waste and inefficiency (Aburas and Fromme, 1991; Jaber, 2002b). But it is worth noting that none of these studies addressed householder energy use behaviour and its

influence on final consumption. This indicates that current policies for motivating people to use energy in an efficient way are not particularly successful. Such policies should be reviewed to ensure that the end user could understand and apply any pertinent guidelines more easily. As a result, the government acted, in a slow and ambiguous way, to improve energy efficiency and undertook only few actions in this regard due to the shortage of financial resources. It took the first step by establishing an energy efficiency section, and founding regional energy and electricity information and advisory offices, in the 2nd half of 1980s. These aimed to focus on improved energy management in the major sectors of the economy through encouraging the public to utilize energy sources with reduced losses compared with past and present practice. Unfortunately, these offices were closed recently and their activities stopped: no real actions had been taken during the last few years with respect to promoting the achievement of higher energy efficiencies. Nevertheless, in the early 1990s, a new regulation, which made it compulsory to improve to prescribed standards, the thermal insulation of new buildings was issued. In a recent paper, the major obstacles inhibiting the adoption of energy conservation measures were discussed (Jaber, 2002c). The most important barriers are the lack of know-how, inadequate incentives, poor public awareness and limited budget allocated, by the government, for advocating the sound energy management programs. There is also ignorance among the management of industrial companies, and commercial and transport organizations concerning: (i) importance of the energy issue and the economy's dependence on the availability of energy; (ii) direct and indirect benefits of implementing energy conservation measures on personal and national levels; and (iii) availability of funding for energy conservation projects. Moreover, in Jordan, it is a common practice to import second-hand or written off appliances, vehicles, machinery, plant and even spare-parts from Europe, e.g. Germany, or Southeast Asia, e.g. South Korea and Japan. Thus, Jordanians tend to employ relatively inefficient and obsolete equipment and vehicles.

As discussed previously, energy conservation studies and programs have been implemented in Jordan with the aim of enhancing public awareness and energy efficiency. Techniques used to evaluate these programs were based on descriptive statistics and field surveys (MEMR, 1987; 1997; 1999; 2000). Analysis of results was based on data presentation and synthesis. The out come of these studies was a list of cross-tabulations and frequencies. Thus, it was extremely difficult for analyst or policy maker to come up with sound conclusions about energy conservation programs. On one hand, analysts must first understand the motivation for household-level behaviour and complexity of interactions between social, economic and technological elements of the energy use equation. On the other hand, evaluation of energy conservation programs and/or public awareness campaigns offers a challenge for analysts due to many factors. The most important are: (i) there is no way to measure previous or accumulated knowledge for individuals about energy-related information prior to the conduct of the initial survey; and (ii) many parameters are involved in the correlation of the change of energy knowledge and other independent variables such as age, education and socio-economic conditions.

Some efforts were made to model the amount of energy saved due to conservation programs by developing regression models (Capasso et al., 1994; Boonekamp, 1997; Bensel and Remedios, 1994; Eiswerth et al., 1998; Mullaly, 1998). These models tend to present part of the full picture, due to lack of information and large number of independent variables, such as age, income, location, climate conditions, psychological variables, etc. Expert and decision support systems are used to synthesize data and assist in finding solutions for real and complex problems. Different expert systems were used to predict energy and/or electricity consumption in various sectors, including households world wide (Macey, 1991; Capasso et

al., Bensel and Remedios, 1994), to forecast water consumption (Spur and Specht, 1992; An et al., 1997; Al-Jayyousi and Mamlook, 2003), and to predict traffic volume at intersections and accidents (Awad and Janson, 1998; Awad et al, 2003), as well as evaluating energy systems (Mamlook et. al. 2001a&b).

The prime aim of this article is to develop a methodology to evaluate the effectiveness of energy conservation programs. It intends also to measure the significance or the impact of the energy public awareness campaigns carried out through energy conservation programs among ordinary energy consumers in Jordan.

FUZZY LOGIC AND THE EXPERT SYSTEM

In this investigation, the main goal is to determine if ordinary energy users, in Jordan, possess sufficient knowledge about the energy problem and conservation measures. This main goal was broken down into different areas of energy knowledge. These include knowledge of individuals about energy resources, consumption, conservation, pollution and environment as well as policy and pricing issues.

Consultations and focused group meetings with energy experts, from concerned public agencies and private enterprises, were conducted to assign weights to each area, as outlined below, based on its relative importance in terms of energy management and conservation. The energy experts used subjective and qualitative judgments based on the energy situation in Jordan. The need for fuzzy rules was evident due to the interaction effects of many parameters, such as the level of education and background. Moreover, acquiring of knowledge regarding energy consumption, conservation and environment are both diverse and incremental. It should be mentioned that the linkage between the language in the survey and the rules are characterized by being fuzzy. The pre and post surveys addressed six areas, as shown in Appendix A. To reach the main goal, some of supporting facts specific to each situation were gathered from experts in energy management and conservation in Jordan. Then, a survey was developed to cover all the above energy-related fields, as presented in Appendix A. Each of the weighted facts in each area defines the minimum necessary knowledge about energy situation, consumption, conservation, pollution and prices in Jordan. The inability for a respondent to achieve a high score in a certain area indicates a problem in a respondent's knowledge adequacy in this area. The sub-scores (s_1 to s_6) shown in Appendix A were developed by classifying and grouping subsets of questions to address each of the predefined areas, based on energy experts' opinion. The sub-weight for each question in each area was determined based on the relative significance of the question. The total of the sub-weights in each area will add up to the weight assigned by energy experts (W_1 to W_6).

To develop the survey, each question was assigned a weight in terms of the response and each fact about energy was expressed in a question. Hence, the level of knowledge for energy and electricity consumers in Jordan can be assessed. The responses from ordinary energy users are collected in a database to be analyzed and evaluated. The developed expert computer program will ask these questions and accumulate the necessary data to examine and measure respondents' level of knowledge about a specific problem. When running the program, a dialogue will appear on the personal computer screen that will ask questions.

Responses to these questions will provide the relevant data concerning the energy-related knowledge for individual consumers' in Jordan. The respondent is asked to answer each question by entering one of the three fuzzy values. As shown in Figure 2, these three fuzzy values are: **H:** Highly significant; **S:** Significant; **N:** Non-significant.

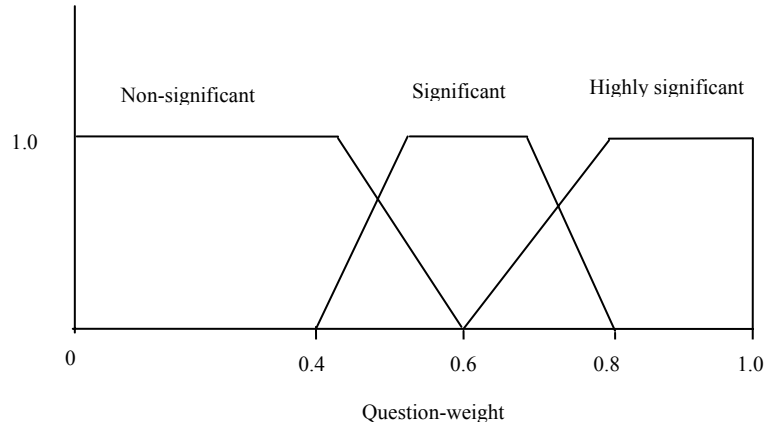

Figure 2. Membership function for the fuzzy variable

Incorrect answer to any of the questions in any area indicates that energy consumer is lacking sufficient energy-related knowledge. This response, in turn, will be reflected in the weight assigned. The total weight for each question represents the total score attained by each respondent. This score is used to determine the level of respondent's energy-related knowledge. Then, heuristic rules to the outcome of the pre survey were designed. These, fuzzy if-then, rules were determined using four fuzzy values as shown in Appendix A. These rules aim to evaluate the level of energy-related knowledge for ordinary energy consumers. The rules are:

- Rule 1: If a respondent total score is greater than large percentage (E), then the respondent's energy-related knowledge is excellent.
- Rule 2: If a respondent total score is greater than medium percentage (G) and less than E, then the respondent's energy-related knowledge is good.
- Rule 3: If a respondent total score is less than G and greater than small percentage (P), then the respondent's energy-related knowledge is low.
- Rule 4: If a respondent total score is less than P then the respondent's energy related knowledge is poor.
- Rule 5: If a respondent's score is good, low or poor, then he/she is handed an educational material about energy situation and energy conservation in Jordan.

In light of consultation with energy experts, the above fuzzy levels (E, G, P), were developed. Each level represents a domain of knowledge in the previously mentioned six areas. It is evident that scoring the knowledge of an individual is characterized as being a fuzzy matter. The rate of change of knowledge attained is estimated by comparing the pre and post scores for each respondent. The post survey is conducted after a week of the pre-survey. During this period, a structured educational material was disseminated to respondents to raise their level of knowledge concerning energy problem and residential conservation options in Jordan. About 65% of respondents took the post survey.

ANALYSIS AND DISCUSSION

The six knowledge areas A_1 through A_6 can be grouped into two categories. The first category includes A_1, A_2 and A_3 representing the minimum general knowledge base required from responsible citizens. The second category, includes A_4, A_5 and A_6, is more related to practices and more concerned by households' heads. Results obtained from comparing initial and post

computer programmed surveys showed that Jordanians have reasonable general knowledge about energy issues. However, there was a significant improvement in the post survey as compared to the initial one – see Figure 3. Analysis of these results reveals that the change in overall average was about 15%.

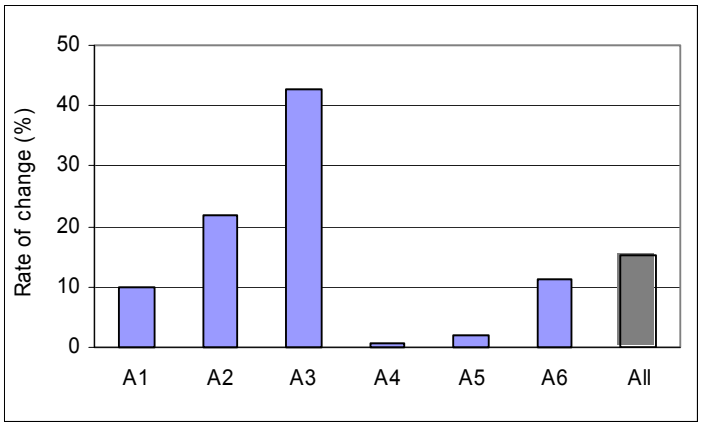

Figure 3. Change in energy-related knowledge by area

This is considered an important and remarkable change about general understanding of energy situation and conservation measures among different categories of the society in Jordan. But residential energy users seem to have limited knowledge about total energy demand and electricity consumption because these two areas, i.e. A_2 & A_3, witnessed a great change after individuals was handed an educational material about energy situation in Jordan. Knowledge about energy sources, A_1, observed moderate change of about 10%. The other three knowledge areas witnessed minor changes. This finding was confirmed by the hypothesis testing, which was conducted to examine any significant difference before and after the awareness program. A t-statistic is used to test if there is any significant difference in the mean score of response for each knowledge area before and after the awareness campaign. Table 1 summarizes the t-statistic results revealing that a significant improvement is detected in the first category, i.e. A_1, A_2 and A_3, while no significant difference detected in the second category, i.e. A_4, A_5 and A_6.

Table 1. Hypothesis testing of the awareness program

Knowledge Area	**t-value (t-critical =1.655)**	**Significant Difference (95% confidence)**
A1	3.60	Yes, $p < 0.001$
A2	6.89	Yes, $p = 0.00$
A3	5.23	Yes, $p = 0.00$
A4	0.33	No
A5	0.86	No
A6	1.65	No
All	7.04	Yes, $p = 0.00$

The most likely reasons behind such a slight change, in the second group, can be attributed to many factors, these are:

- Jordanians believe that energy should be delivered to consumers with low charge, i.e. subsidized by the state, because the country used to import crude oil from Iraq, during the last 15 years under special arrangements. About 300 million US$ of the oil bill were given as grant and the remaining fraction from the oil bill was paid at preferred prices, i.e. less than unit price of crude oil in the international market, as Jordanian commodities and not hard currency to Iraq.
- Energy, i.e. petroleum products, natural gas and electricity, pricing policy is not clear and understandable by the public. It is considered inappropriate and misleading. For example, petroleum products' pricing-methodology is based on setting each product's price at the retail price, i.e. for final users, setting the transfer price for crude oil retroactively, and deriving implicit tax for each product based on the difference between the retail price and the full production and distribution costs. The major disadvantage of such methodology is the confusion caused by mixing the fiscal objectives with policy intentions, including promotion of energy efficiency.
- At present, prevailing retail prices within neighbouring Arab countries are much less than in Jordan, because all these countries are net energy producers and exporters, e.g. Gulf states.
- The government, unexpectedly and without prior notice, raised retail prices of all petroleum products during the study period, i.e. May 2003, of between 10-20%.

Knowledge about energy conservation practices among ordinary people, A_4, and pollution resulting from using different energy forms, A_5, observed insignificant change. This is due to the fact that the scored level, in the initial survey, is already high, which indicates clearly that Jordanians are aware of the risks associated with pollution. But this does not mean that such areas should not be addressed in the future since the implementation of most of the energy conservation measures and mitigation options, that are financially attractive, requires both the intention and support from the government as well as understanding and participation of energy suppliers and consumers (Vine et al., 1988; Jaber and Probert, 2001). But the desired involvement is dependent on the consumers and suppliers awareness of the existence of these options, technologies required and understanding the related costs and benefits. In general, it can be said that the lack of awareness of these technologies and their potentials, due to the absence of concerned governmental agencies, is an extremely important factor (Jaber, 2002a,b&c; Jaber et al, 2003b). The only way to overcome this situation is the provision of information on energy conservation and free access of public to such information. Thus, governmental agencies such as the Ministry of Energy and Mineral Resources and/or Ministry of Environment as well as NGOs should organize seminars and workshops for different categories of the society to adopt energy conservation options through a national energy plan. Also promotional campaigns and demonstration shows and/or projects would create a general awareness about the existence of various housekeeping and energy conservation measures for different sectors and alternative solutions as well as involved costs for implementing them.

CONCLUSIONS

Significant improvement was detected for the first category representing the minimum general knowledge base required from responsible citizens. While no significant improvement could be detected for the second category that related to practices. But the overall average knowledge is appreciably improved after the awareness program. The level of general energy knowledge, relationship between energy and the environment and energy conservation practices in the residential sector among the public was reasonable. However, there is still a

room for improvement through enhancing their knowledge by dissemination of related energy information and transparent pricing policy. This has been done in the post survey, when individuals was handed a simple, but concentrated educational material about energy situation and conservation possibilities in Jordan. With regard to energy conservation practices, it is apparent that Jordanians are not following sound energy practices. In terms of energy policy and pricing little positive impact has been achieved in the post survey.

These findings may be attributed to the general belief that energy is abundant and almost half of the imported crude oil from Iraq was free and the other half was paid at special discounted prices. Equally important, is the non-existence of a clear and comprehensive national energy plan and the limited budget allocated for advocating wise energy-management programs. Thus, at present there may be little incentives for individuals, or even industrial and commercial enterprises, to conserve energy. Because the purchase price of efficient appliances or equipment is much higher, than that of conventional ones. Therefore, many consumers, who are sensitive to the initial cost, will not be interested in using energy efficient systems. But through proper awareness and demonstration programs as well as incentives, such as financial assistance by providing soft loans or grants, and technical aid to encourage energy end-users, in all sectors, to employ the latest technologies and more energy-efficient equipment, final energy demand can be reduced or controlled. But energy conservation programs do not offer much now, since changes in energy users' practices would take a long time. More effort should be directed to address such issues at the national level, in the near future, and specific targeted investigations about energy management in all sectors of the economy as part of a national energy plan.

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Appendix A: Energy knowledge computer-programmed survey

Information about the person who filled the questionnaire

Sex (enter **M** for male and **F** for Female):

Status (enter **S** for single and **M** for married):

Education: Enter,

L for lower than high school

C for College

H for high school graduate

S for university student

B for BSc degree

M for MSc degree

D for PhD degree

Age (enter your age in numbers):

Location of your home (enter **C** for city, **T** for town & **V** for village):

Type of your home (enter **V** for villa, **H** for independent house, **A** for apartment & **O** for others):

Ownership of your home (enter **W** for owned, **R** for rented & **O** for others):

Each of the following questions, in all groups, is answered using:
H for highly significant
S for significant
N for non-significant

1- Knowledge about energy sources in Jordan (A_1)

Q_1. Jordan is poor in terms of energy sources:

Q_2. Jordan is totally dependent on imported energy to satisfy local demand:

Q_3. Cost of imported energy is high and poses a burden on the national economy:

Q_4. Indigenous energy sources represent small percentage of the national demand:

Q_5. Solar energy and oil shale represent Jordan's future energy sources:

Q_6. Most of the population has access to the electricity service:

Q_7. Energy demand is growing rapidly in Jordan:

Q_8. Some of consumed electricity is imported from Egypt:

2- Knowledge about energy consumption in Jordan (A_2)

Q_1. Transport sector is the major energy consumer:

Q_2. Household sector consumes about 25% of final energy demand, and it is the 2nd largest consumer after transportation sector:

Q_3. Industrial sector is ranked 3rd, but it consumes same as household sector:

Q_4. Average energy consumption per capita is much less than those prevailing in neighbouring countries:

Q_5. Total energy bill (electricity, LPG & heating fuels) is considered high and represents a significant portion of the family income:

3- Knowledge about electricity consumption in households (A_3)

Q_1. Refrigerator is major consumer of electricity:

Q_2. Freezer (standard or deep) is the 2nd largest consumer of electricity:

Q_3. Lighting is ranked as 3rd consumer of electricity:

Q_4. Air-conditioning is ranked as 4th consumer of electricity:

Q_5. Washing machine is ranked as 5th consumer of electricity:

Q_6. Domestic water electrical heater is ranked as 6th consumer of electricity:

Q_7. Electrical heating stoves are ranked as 7th consumer of electricity:

4- Knowledge about energy conservation practices in households (A_4)

Q_1. Using solar water heater helps in saving energy:

Q_2. Thermally insulated houses consume less energy during winter and summer:

Q_3. In a centrally heated house, controlling temperature inside the house will provide desired comfort and save energy:

Q_4. Turning off lights, when not needed, will reduce the monthly electricity bill:

Q_5. Using energy saving lights is an important way to reduce electricity consumption:

Q_6. Using natural ways of ventilation and/or heating instead of artificial means will cut energy consumption in the house:

Q_7. Maintain and operate electrical appliances according to manufacturers' instruction:

Q_8. Using energy when only required will reduce waste and enhance the utilization efficiency:

Q_9. It is important for Jordanians to employ most effective and efficient ways in order to save energy in different sectors:

5- Knowledge about pollution resulting from using various energy forms (A_5)

Q_1. Power stations and the oil refinery pollute the local environment:

Q_2. Air quality in suburbs and rural regions are much better than in urban areas:

Q_3. Fuels and/or spent oil leakage pollute soil and water resources:

Q_4. Air quality inside the house depends on type of heating system (central, kerosene or LPG heater, electrical stove) being employed and air change rate (ventilation):

Q_5. Operating portable LPG or kerosene stoves in closed spaces will increase concentration of gaseous pollutants and results in suffocation or death:

Q_6. Careless and ignorance when using various forms of energy are the most important reasons behind accidents in households:

Q_7. Energy conservation reduces energy bill, on national and personal levels, as well as emissions to the environment:

Q_8. Fuel quality and specification have direct influence on types and concentration of air emissions:

6- Knowledge about energy policy and pricing in Jordan (A_6)

Q_1. The retail price of diesel is less than actual cost:

Q_2. The government is subsidizing kerosene in order to help low income families:

Q_3. The retail price of LPG cylinder is less than the actual cost:

Q_4. Current electricity tariff is acceptable and does not cause any inconvenience for households:

Q_5. The government should work on improving specifications of locally produced fuels:

Q_6. The government should work on developing extensive public awareness programs about best practices leading to energy conservation:

Q_7. The government should work on encouraging different categories of public to save energy by providing financial incentives and targeted programs:

Q_8. The government should work on enacting existing rules and regulations that would help in improving efficiency and reduce energy consumption:

Q_9. The government should work on developing legal frame works and standards to include issues related to energy conservation in different sectors and applications:

Q_{10}. Modifying the monthly electricity bill to be more informative, i.e. contain new information, instructions and best practices to save energy:

Q_{11}. Purchase price of highly efficient appliances is more than traditional ones:

The results of the survey:

Area	Score
(A_1) Knowledge about energy sources in Jordan	n_1 out of W_1
(A_2) Knowledge about energy consumption in Jordan	n_2 out of W_2
(A_3) Knowledge about electricity consumption in households	n_3 out of W_3
(A_4) Knowledge about energy conservation practices in households	n_4 out of W_4
(A_5) Knowledge about pollution resulting from using various energy forms	n_5 out of W_5
(A_6) Knowledge about energy policy and pricing in Jordan	n_6 out of W_6

Your total score is = $s_1 + s_2 + s_3 + s_4 + s_5 + s_6$ out of 1.0

Your Knowledge is:

Where:

E < Excellent knowledge < 100

G < Good knowledge < E

P < Low knowledge < G

0 < Poor knowledge < P

and experts in the field of energy management specify E=about 0.8, G=about 0.65 & P=about 0.45.