An-Najah National University

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Graduation Project

"Assessment of awareness, willingness and attitudes towards residential energy conservation in Palestine"

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Dedication

This thesis is dedicated to:

The sake of Allah, my Creator and my Master … My great teacher and messenger, Mohammed (May Allah bless and grant him), who taught us the purpose of life … My great parents, who never stop giving of themselves in countless ways … To all my family, the symbol of love and giving… My friends who encourage and support me …All the people in my life who touch my heart … I dedicate this research.

Acknowledgment

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Project's Abstract:

Energy in Palestine is considered as one of the main requirements in our life, it's considered a solution to organize the rapid growth in population, increasing living standards and rapid industrial growth has led to big energy demand in the Palestinian Territories in recent years.

The energy sector in the Palestinian territory faces a variety of significant challenges (economic, environmental and political challenges). First, it relies on external sources for the supply of electricity because of the constraints imposed by Israeli policies and actions on the ability of the Palestinian Authority (PA) to operate and develop its energy systems. Second, the costs of importing energy sources are exorbitant. Finally, many environmental risks arise from the use of traditional sources of energy.

We will cover in this project household's behavior of electricity consumption and the awareness and willingness of rationalization of electricity consumptions in residential sector which have the largest percentage of electricity consumption 70.5%.

The objectives of this project are to find out the household's behavior on energy consumption, examine the degree of people's awareness about the need to rationalize their consumption of electricity, then determine the common misuse of electric power ,finally clarification the attitudes toward the energy conservation in Palestine.

Our Project plan is beginning with search for references & pervious theoretical studies which concerned on the energy Consumption and especially electricity consumption , therefore we concerned on the Palestinian references as Palestinian central Bureau of statistics to find the energy data for each sector and especially household's electricity consumption .Then the survey will be designed in the form of parts, Each part contained a set of specific and interrelated questions ,also insure that the survey is valid .we will determined the sample size and their distribution ,Finally after data collection data and analysis it ,we will present the results in detailed report .

In Palestine there is no specialized study to measure the awareness of individuals on the subject of rationalizing electricity in homes, which leads to an increase in electricity bills for all homes, which led us to try to create this awareness of individuals through some guidance and change some habits that may lead to increased consumption of electricity gradually Or in a fixed way.

Chapter One

Introduction

1.1 Background

Energy is the backbone of all our activities in the Earth, it used to make life as good as possible, without the existence of energy we can't accomplish our tasks or continue to live on Earth, because it is the origin of all things around us.

In addition , energy demand is important as it has an impact in the economy, which in turn affects people's lives (i.e. their income, health, happiness), and their ability to meet basic needs such as the need for infrastructure, education and so on. (IEA, 2002)

In general , There are 12 different sources of energy that are used in the world to generate power which are coal , oil , natural gas , uranium and nuclear ,bio energy , hydropower , waste to energy , solar , geothermal , wind , marine and carbon . (World Energy Resources , 2016)

As the demand of various energy sources is increasing and the energy consumption is rising, countries face a risk of depleting their non-renewable energy and thus returning to primitive life free from all forms of energy. This will increase the burden on the government, in addition to the burdens that fall on individuals by increasing the value of the monthly electricity bill that will affect individuals to try to rationalize their energy consumption.

Electricity is a form of energy and is one of the most important blessings offered by science to mankind. Electricity has also become part of modern life and one cannot think of a world without it, because its crucial to human development and it is indispensable for certain basic household activities, such as lighting, refrigeration and the running of household appliances, and cannot easily be replaced by other forms of energy (IEA, 2002)

But with the huge use of electricity through the time, and the lack of sufficient awareness to conserve energy, the risk of energy depletion is increasing. So, governments and individuals try all the ways to conserve energy.

The importance of rationalizing electrical energy that is considered the most important pillars of the optimal exploitation of energy sources such as oil and its derivatives, which helps in preserving these resources for future generations, also avoid the over loading consumption at peak time, and in periods where demand for energy increases to the upper limit ,then reduce the

electricity bill of the subscriber and reduce emissions affecting the environment as a result of fuel savings in generating plants.

According to Palestinian Central Bureau of Statistics, the residential sector accounts for 70.5% of total energy consumption in the Palestine (PENRA, 2016). This highly percentage of consumption was the result of some erroneous behavioral habits of household members that cause increases the value of the bills. So, to reduce the proportion of energy consumption in the residential sector, this study try to create high awareness of family members to rationalize the consumption of electricity in the home by getting off the habits of misconduct , for examples they should take advantage of natural air instead of using the air conditioning system, sunlight instead of electric lighting, and turn off the lights in rooms that doesn't use, all this in order to reduce the proportion of energy consumption, in addition to saving money while maintaining security and safety.

The lack of awareness among individuals all around world about how to conserve energy lead people to use electrical appliances that consume large quantities of electricity, such as air conditioning unit, electric refrigerators, automatic washing machine, dishwashers, electric water heaters, etc.

1.2 Reality of Energy in Palestine:

Within the Palestinian context, with this lack of awareness on conserving consumption of different sources of energy in general and residential electrical energy in particular, results in a set of problems and challenges encountered by energy providers and electrical energy distributors in Palestine. This is true because of many reasons including non-availability of natural resources, unstable political conditions, financial crisis dependence on Israeli energy supplies, not using renewable energy sources, high prices of energy, and the increasing Palestinian population.

Also there is still a challenge to dismantle the forced link between Palestinian and Israeli networks which affect the ability of Palestinians to control the quantity and quality of services in many fields especially energy, Which leads to raising domestic prices of energy .With the fact that 88% of the electricity are imported from Israel. The Figures (1) & (2) shows the electricity sources in the West Bank and Gaza.

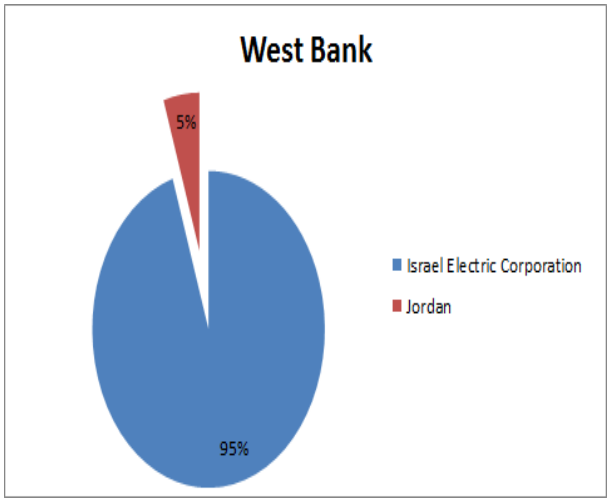


Figure 1: Source of Electricity in West Bank

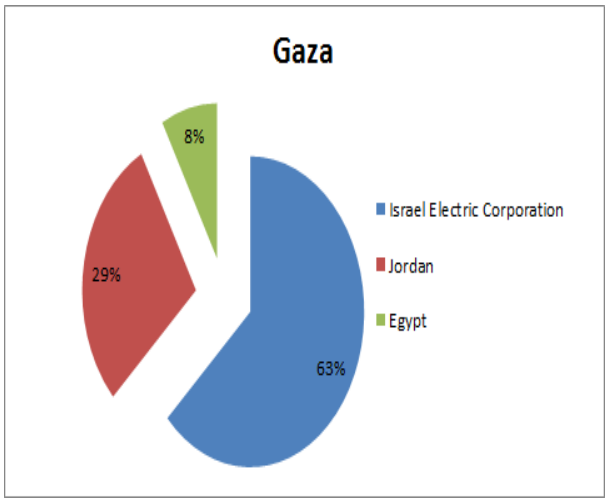


Figure 2: Source of electricity in Gaza

With the annually increasing in the demand of the electricity in Palestine that reach to 7% ,and the significantly dependent on imported electricity from Israel as figures (1&2) shown , a gap between the demand and the available resources appeared , which has a negative impact on the electricity prices,where the price is from 0.465NIS up to 0.69 NIS per KW/h . (PEPRI, 2014)

Due to the increasing in the electricity prices , a high rate of non-payment electricity bills increased, which leads to the inability of municipalities and distribution companies to pay the monthly consumption bill of the Qatar Electricity & Water company, where the Israeli Finance Company pays the financial dues of the Qatar Electricity & Water company from the taxes revenues of the national authority, which burdens the Authority Thus increasing the net lending ratio.

So, Palestinian governments seek to rationalize energy consumption through the activities of the Ministry of Energy, where many projects have been completed, such as rehabilitation of networks, development of the distribution energy sector, construction of major distribution stations, power plants and renewable energy projects.

Moreover, there are few Palestinian companies which provide West Bank with electricity. These are Northern Electricity Company, Tubas Electricity Company, Southern Electricity Distribution Company, Hebron Electricity Company and Jerusalem Distribution Company. Below; we present brief background about these companies. (PERC, 2011)

Northern Electricity Distribution Company (NEDCO): is responsible for 22 local councils whose function is to supervise and supply the rural areas with electricity, in addition to the electricity department in Nablus and Jenin, which started its actual work as a result in 2010.The company is powered by a single supplier, the Qatari company, with 6 points on medium pressure, with a total of 100 MVA. The company is currently trying to join the other 250 local authorities in the northern governorates. The number of subscribers is 80,000 and their percentage is about 16% of the total west Bank population.

Tubas District Electricity Company (TDE CO) : The Company was established in 2006 and in the same year it included 22 local authorities. The company calculates the electricity supply companies through adapters related to the organizations (i.e., providing medium pressure with the loss of transformers).The company incorporated the village councils until the number of local councils reached 38, and in 2010 the company decided to charge the subscribers and account the institutions depending on the transformers except Kabatia .The company is powered by a single supplier, the Qatar Company, through two intermediate pressure points with a total capacity of 25 MVA. The company is currently negotiating a memorandum of understanding with the Yabed

Electricity Authority (13 local authorities). The number of subscribers is 30.000 and their share is about 6% of the total population of the West Bank and the electricity is supplied to Tubas .

Southern Electricity Company(SEL COM): it was officially established in 1998; in fact, in 2004, it formed a partnership with 5 local municipalities with the Ministry of Local Government, represented by the other local authorities: Yatta, Al-Dahariya, Dora, Beit Ummar and Halhul; Dura Municipality The company currently has 3 local authorities. The company is powered by a single supplier, the Qatar Company, through 3 intermediate pressure points, with a total capacity of 13MVA.

Hebron Electric power Company (HEP CO): It was established in 2000 and started its actual operation as a registered company in 2005 to feed the city of Hebron and the city of Halhoul. The company is powered by a single supplier, the Qatari company, through 5 intermediate pressure points with a total capacity of 80 MVA. The number of subscribers is 13,000 and they account for about 3% of the total population of the West Bank and are supplied with electricity for the entire Hebron governorate, except for the area of the Hebron Electricity Company. The number of subscribers is 35,000 and their share is about 7% of the total population of the West Bank and the electricity is supplied to the city of Hebron.

Jerusalem Distribution electricity Company (JDE CO): it was established officially in 1914. The company is powered by two suppliers: the Qatari company, through 37 points of connection to the average pressure, with a capacity of 380 MVA; the second supplier is the Hashemite Kingdom of Jordan, through a single point of 20MVA. The number of subscribers is 215,000, accounting for about 43% of the total population of the West Bank and providing electricity for the four central governorates (Jerusalem, Ramallah, Bethlehem, Jericho).

1.3 Problem statement

Palestine is one of those countries in the Middle East with a unique particularity in this context represented chiefly by the in ability of Palestine to generate and control its own resources of energy due to the existence of Israeli occupation which totally controls the production, generation, pricing and distribution of energy in Palestinian territories. According to recent statistics, in comparison with commercial and industrial sectors, electricity used for residential purposes compromises the major source of electrical energy consumption (about 70%) and billing in Palestine. Recently, Palestinian citizens has suffered from frequent interruptions in the electricity supplies specially in summer hot days in winter cold days due to the increased loading on the network. As the supply of electricity is completely controlled and managed by Israel electrical generation company, the Palestinian distributing companies have nothing to do to solve the interruptions except cutting electrical current for some hours in the day on some regions and cities due to overloading!!Frequent interruptions due to overloading create high levels of un-satisfaction among people due to the inconveniences it might create to them and the stoppage of their lives which are mainly based on electricity. Such inconveniences are doubled for people who are really committed in paying their bills and who has got their electrical devices and equipment failed due to interruptions. Nevertheless, people have their contribution in overloading on the electricity network due to their unplanned usage and operating of some electricity-consuming devices in their houses. More specifically, many people are not aware of the importance of switching off some lights in their houses in the rooms that are not existing in, they operate air conditioning units in summer and heaters in winter while keeping their windows open, they light more than one source of lighting in the same room, they use non energy-saving devices in their houses and unfortunately, some steal electricity from the network illegally. Collectively, all these behaviors adversely contribute to the shortage in electricity supply. To help in resolving this problem, this project aims at assessing the level of awareness, attitudes and willingness of Palestinian citizens to adopt and apply some effective measures in electrical consumption in their houses. Relevant random data will be collected from house owners from different cities via self-report questionnaires. Statistical analyses will be conducted to measure the levels of awareness and willingness towards electrical energy conservation.

1.4 Significance of the project

The energy sector in the Palestinian territory faces a variety of significant challenges (economic, environmental and political challenges). First, it relies on external sources for the supply of electricity because of the constraints imposed by Israeli policies and actions on the ability of the Palestinian Authority (PA) to operate and develop its energy systems (88% of electricity consumed is imported from Israel) .(PEPRI, 2014)

Second, the costs of importing energy sources are exorbitant (electricity import bill is estimated at about 400-500 million dollars a year). Finally, many environmental risks arise from the use of traditional sources of energy. (PEPRI, 2012)

These facts represent genuine challenges to the Palestinian experts to find out the behaviors on energy consumptions that provide consumers the flexibility of monitoring its electricity consumption and making lifestyle changes to save electricity, Table (1) shows the yearly electricity consumption for the last 7 years.

Table 1: The amount of annually electricity consumption in Palestine

Categories (Terajoul)	2009[1]	2010[2]	2011[3]	2012[4]	2013[5]	2014[6]	2015[7]	Total
Households	8374	7508	7842	7884	11260	10632	11785	65285
Agriculture/fishing	41	41	18	23	135	133	142	533
Service and Internal trade	3118	3004	3685	5845	4225	4047	4777	28701
Total	11533	10553	11545	13752	15620	14812	16704	94519
Per. Of residential consumptions (%)	72.61	71.15	67.93	57.33	72.09	71.78	70.55	69.07

1: (PENRA P. E., 2009) 2: (PENRA., 2010) 3: (PENRA , 2011) 4: (PENRA, 2012) 5: (PENRA, 2013) 6: (PENRA 2015) 7: (PENRA, 2016)

Figure (3) shows that the residential sector has the highest proportion of energy consumption, which led to choose the residential sector, to rationalization their electricity consumption.

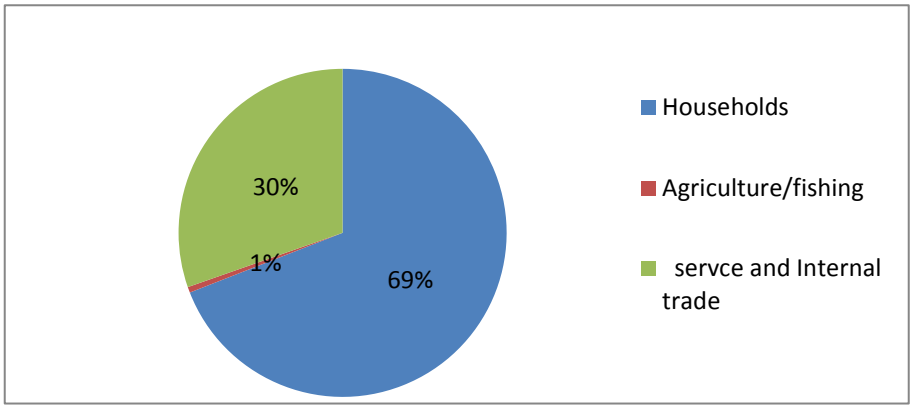


Figure 3: The average consumption for each sector

Figure (4) shows the increase in the amount of electricity consumption in the residential sector over years in the unit of Terajoul.

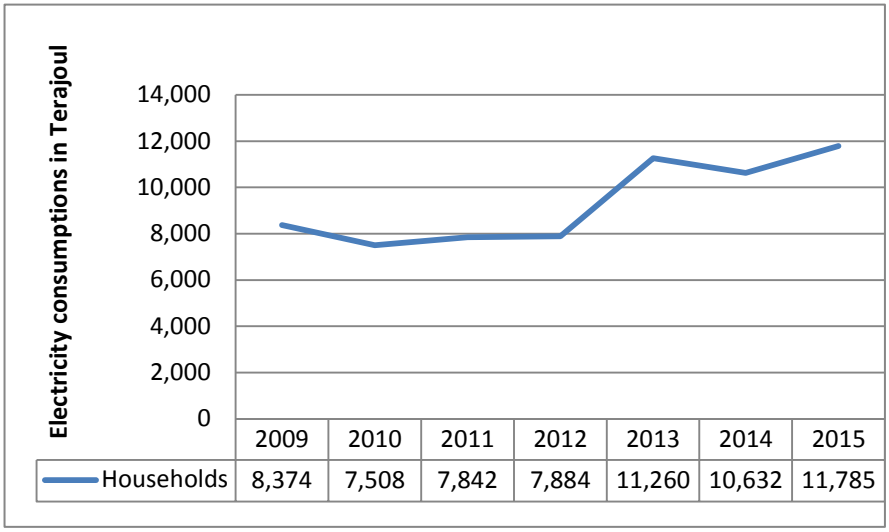


Figure 4: Household's electricity consumption for the last 7 years.

1.5 Objectives

This project aims at achieving the following objectives:

1. Assessing the levels of awareness of Palestinian residential electricity consumers towards conserving electricity in their homes.
2. Assessing the attitudes of Palestinian residential electricity consumers towards conserving electricity in their homes.
3. Assessing the willingness of Palestinian residential electricity consumers towards conserving electricity in their homes.

1.6 Research questions

The study will answer the following questions

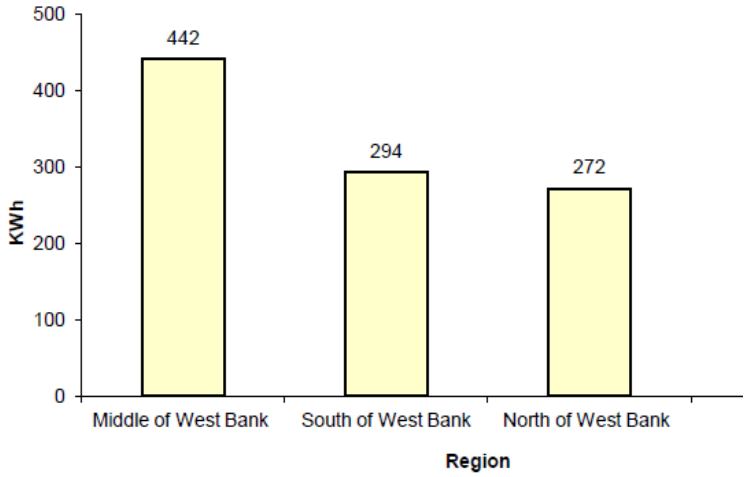
1. What are the awareness levels of Palestinian residential electricity consumers towards conserving electricity in their homes?
2. What are the attitudes of Palestinian residential electricity consumers towards conserving electricity in their homes?
3. What are the levels of willingness of Palestinian residential electricity consumers towards conserving electricity in their homes?

These research questions will be addressed by collecting relevant random data from house owners from different cities via self-report questionnaires. Statistical analyses will be conducted to measure the levels of awareness, attitudes and willingness towards electrical energy conservation.

1.7 Scope of the Study

Due to the difficulty of applying the study to the whole Palestinian areas because of a political reasons, the study population is limited to the Palestinian households in west bank which are connected to the public electricity network ,whether the households used a normal electricity meter , or the households used a prepaid electricity meter.

So, as a result from the figure (5), the regions to be covered in this study are, Middle of West Bank, South of West Bank, and North of West Bank.



, **Figure 5: Average Household Electricity Consumption by Region (PCBS, 2015)**

According to Figure (5), most of the sample will be distributed to the areas of the Middle of West Bank due to the higher amount of electricity consumption there.

1.8 Report structure

This study consists of six chapters. The first chapter is the introduction where the background, problem statement, research objectives, research questions and the scope of the study are introduced.

Chapter two defines the limitations and contains faced the study and how it managed them, also show the courses used in the study.

Chapter Three presented the previous studies about the climate change, the willingness to conservation the energy , household's consumption and polices .In addition to, the hypothesis that undertaken in the study.

The fourth chapter presents the research methodology and identifies the research population, sample, data collection tool as well as the data analysis software package to be used in analyzing the gathered data.

Chapter five was a discussion to show the next steps of work to be undertaken.

Finally, chapter six derives conclusions and presents some recommendations.

Chapter Two

Constrains, Standards/Codes and earlier course work

2.1 Constrains

All studies in different topics are facing many limitations. In this study there are a lot of limitations such as, it constrained in the population of the west bank without covered the whole population in Palestine, because of Israeli occupational. Second, there's a time's limitation because the project has specific time for delivery. Third, the questionnaire will be distributed through two ways, online and self-report questionnaires. However the self-report questionnaires may face some challenges as no adults in the home or no responses, or some respondent won't be accurate in answering the questions, or they mayn't understand the questions, also there are a lot of questions based on estimation that will decrease the accuracy. Finally, lack of statistical information where this study is done before published statically report 2017.

2.2 Earlier Coursework

To help carry out the project successfully, we using some of the courses taken in the previous semesters:

Table2 : The main courses used as reference for the project

Course	**Description**
Quantitative Methods 2 (10631311)	This course gives us background mathematical and statistical skills necessary for solving a wide range of commerce problems. It gives us review of statistics; tests of the location of populations and the sample size; simple and multiple regression for use with time series and cross section data
Computer applications in laboratory (10631310)	This lab provides instructional space to learn how to use software which has many important topics in our practical life, as word , excel, SPSS and Minitab

Energy conservation and auditing (64165521)	Concepts in energy conservation, energy conservation in lighting systems, improvement of power factor. Management of electrical loads. Identification of high-efficiency motors. Selection of alternative fuels to rationalize consumption and reduce heat losses in electrical systems.
Energy and Environment (64164235)	Effects of energy use and energy generation on the environment and climate. Effect of fuel combustion and waste from extraction. Radiation on environmental air. Environmental Management and Economics.
Energy management (64164535)	Application of power management software with exposure to energy accounts and utility bill analysis. Relative tables and preventive maintenance programs.
Heating and Air Conditioning (64167440)	It was an introduction to heating and air conditioning systems. How to choose and install heating and cooling systems, calculations of loads, design of the pipe system

2.3 Survey Standards

The survey standard definition is the minimum accuracies that considered necessary to meet the objectives.

Survey standards tool up quality assurance and consistency in a survey, and also help re-establish missing survey monuments.

Build up survey standards includes stratification and classification processes:

- Stratification of the domain to be envelope by the statistical program will have decisions on:
    1. Administrative categories.
    2. Logical categories.
    3. Sampling locations.

- Classification of the units that will be measured, including:

    1. Boat and gear categories.
    2. Species and species groups.
    3. System units.

Well-defined survey standards help in arranging field operations, facilitating computerization, producing consistent reports. Poorly standards will affect field operations, computer operations and on the meaning of produced estimates.

Chapter Three

Literature Review

3.1 Overview

Since the energy crises in the 1970s, Social scientists have been researching on household energy consumption. Which provides useful information about how consumers make energy efficiency and conservation choices. This chapter describes and reviews that literature.
The following topics are covered: climate change and its effects on energy consumption, Electricity consumption in residential sector, Willingness and attitudes towards residential energy conversation, and Policies and measures that target the adoption of Energy Efficient appliances among Households.

3.2 Climate change

Globally, climate change is a critical environmental issue. 'Climate Change' as defined by the United Nations Framework Convention on Climate Change (UNFCCC) "it's a change of climate which is caused directly or indirectly to human activity , that alters the composition of the global atmosphere, in addition to natural climate variability observed over comparable time periods". (Glossary, 2007)

Different aspects identified human impact on climate system, that's including changes in ocean heat content, precipitation, atmospheric moisture, and Arctic sea ice. (Peterson et al. , 2009)

Climate change led to raise the greenhouse gases (GHG) emissions, that means these emissions that arising from electricity production are a key contributor to climate change processes. (Pachauri and Meyer, 2014)

Greenhouse gases (GHG's) are chemical compounds that allow sunlight to enter the Earth's atmosphere freely. As infrared radiation bounces back toward space, GHG's trap the heat in the atmosphere, resulting in warming trends on Earth. Without the effect of the greenhouse the average temperature of earth would be about -2°F rather than the 57°F. (Holtberg and Conti, 2011)

Some greenhouse gases, such as carbon dioxide (CO2), emitted out of both human activities and natural processes, besides other GHG's emitted out of human activities only. (Emagazine, 2006)

As we mentioned before the climate change caused by human activities is a phenomenon pointed out to global warming. 'Global warming' refers to average increases over a sustained period of time, in the temperature of the Earth's surface, water and atmosphere, due to GHG emissions in the atmosphere. (Emagazine, 2006)

Also Peterson, et al.(2009) confirmed that the global warming of the past 50 years was because of the human activities which caused increase in greenhouse gases. Figure (6) presented the increasing in temperature over the years, which causes global warming that refers to the human activity.

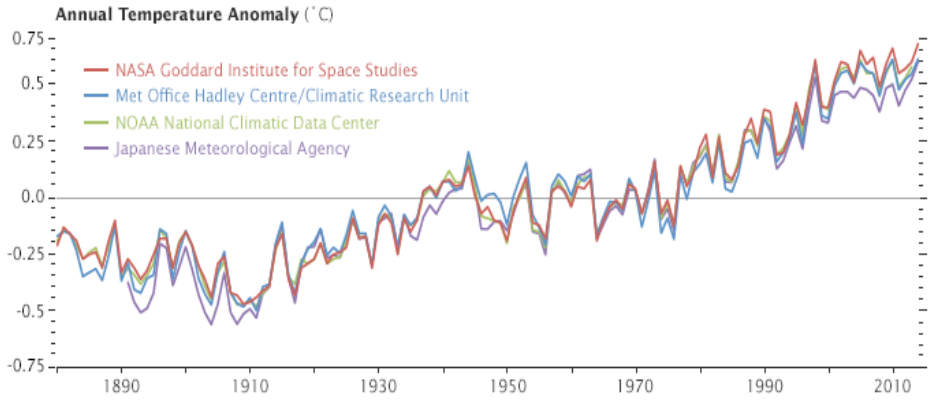


Figure 6 : Increases in mean average surface temperatures on Earth for the last thousand years (sasapos, 2014)

The carbon dioxide CO2 emissions have been accelerating. The growth rate increased from 1.3 percent per year in the 1990s to 3.3 percent per year between 2000 and 2006. (Canadell, et al., 2007)

Moreover carbon dioxide concentration has increased because of the use of fossil fuels in electricity generation, transportation, and industrial and household uses. And it has increased by

nearly 35 % since the start of the industrial revolution. There is evidence that a smaller section of the annual emissions from human is now under taken up, leading to a greater section remaining in the atmosphere and an accelerating rate of increase in the carbon dioxide concentration. Figure (7) below shows the present carbon dioxide CO2 concentration of about 385 ppm is about 30 % above its highest level over at least the last 800,000 years. (Peterson, et al., 2009)

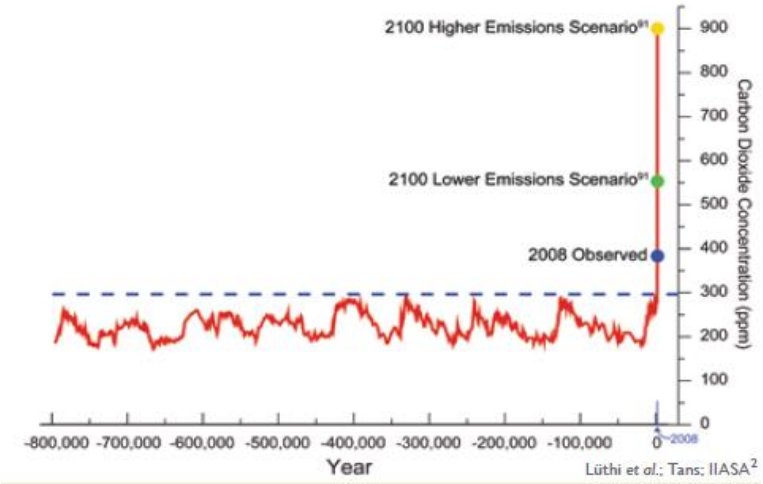


Figure 7 :Records over 800,000 Year of Carbon Dioxide Concentration.

In order to mitigate the global warming which mentioned before, we should reduce CO2 emissions by cutting down on electricity consumption. To prevent negative impacts, energy conservation must be a priority for everyone.

3.3 Electricity consumption in household:

Demand for energy is indirect and driven by the type of service a user desires, such as comfort, cleanliness, or entertainment. This need for various services is associated with consumers' lifestyles – the way people live. (McClaren, 2015)

According to Agarwel et al. (2016) , households try to mitigate the effect of externalities such as noise and pollution by "purchased comfort" activities like closing all doors and windows and switching on air-conditioning, that represent the "self-protection" mechanism from externalities.

Xu and Ang (2013) Say that the environment control, household appliances and personal devices have the highest percentages of the total household's consumption which account for 49%, 45%, and 6% respectively.

Brock,et al. Identify the "power vimpers" which represented by the electrical devices that continuously draw power from electrical outlets, even when not supplying any useful power. Also they mentioned that the "power vimpers" can decrease electrical consumption by 20%.

Air-conditioners, water heaters and refrigerators account for around 76% of total energy consumption in a typical household. (PCBS, 2015)

Brounen et al. (2012) found that homes which constructed pre-1980 consumes energy on average about 50% more than other buildings.

McClaren (2015) Confirmed that weatherization home could decrease a demand for energy in winter and summer months.

Lutzenhiser (1993) Classify consumers into specific lifestyle groups such as "comfort seekers," "budgeters," "high-tech orientation," or "appearance-conscious All of these social classifications are highly relevant when studying patterns of energy consumption.
So, in order to control the consumption of especially electricity, there's global trend to energy conservation by found technologies and saving policies in order to increase the efficiency of energy consumption by households which account of 70.5% of total consumption in west bank as mentions on the Palestinian energy statics. (PCBS, 2016)

3.3.1 Electricity consumption in Palestine:

The PCBS (2015) divided the results related to energy sources in the households during 2015 into sections .First ,covers results related to the forms of energy used for heating house, forms of

water heating; then presents the purposes of different energy use in household activities; and finally, the fourth section presents household Consumption of different energy types.

So, table (3) presented the percentage of using energy for household's activities like heating, water heating, and cooking for different Palestinian regions.

Table 3: Percentage Distribution of Households by Region and Using Energy for Household Activities, January 2015

Region	Using Energy for Household Activities												استخدام الطاقة في الانشطة المنزلية
	Heating		التدفئة	Water Heating		تسخين المياه	Baking		الخبيز	Cooking		الطبخ	
	المجموع Total	لا تستخدم Not Use	تستخدم Use	المجموع Total	لا تستخدم Not Use	تستخدم Use	المجموع Total	لا تستخدم Not Use	تستخدم Use	المجموع Total	لا تستخدم Not Use	تستخدم Use	
Palestine	**100**	**18.0**	**82.0**	**100**	**0.3**	**99.7**	**100**	**50.9**	**49.1**	**100**	**0.5**	**99.5**	**فلسطين**
West Bank	**100**	**6.0**	**94.0**	**100**	**0.4**	**99.6**	**100**	**65.4**	**34.6**	**100**	**0.3**	**99.7**	**الضفة الغربية**
North of West Bank	100	7.4	92.6	100	0.2	99.8	100	78.7	21.3	100	0.2	99.8	شمال الضفة الغربية
Middle of West Bank	100	2.2	97.8	100	0.3	99.7	100	70.6	29.4	100	0.1	99.9	وسط الضفة الغربية
South of West Bank	100	7.8	92.2	100	0.7	99.3	100	44.5	55.5	100	0.5	99.5	جنوب الضفة الغربية
Gaza Strip	**100**	**41.1**	**58.9**	**100**	**0.2**	**99.8**	**100**	**23.1**	**76.9**	**100**	**0.8**	**99.2**	**قطاع غزة**

Moreover, in the tables (4, 5, & 6), show that the electrical energy has a high percentage of using in the most of the household's activities by different regions.

Table 4: Percentage Distribution of Households who are Baking by Region and the Main Fuel

Region	Main Fuel Used for Baking الوقود الرئيسي المستخدم في الخبيز					المنطقة
	المجموع Total	أخرى Others	حطب Wood	غاز البترول المسيل LPG	كهرباء Electricity	
Palestine	**100**	**8.0**	**29.7**	**13.6**	**48.7**	**فلسطين**
West Bank	**100**	**6.7**	**35.2**	**27.7**	**30.4**	**الضفة الغربية**
North of West Bank	**100**	6.8	50.7	29.5	13.0	شمال الضفة الغربية
Middle of West Bank	**100**	1.2	36.3	22.0	40.5	وسط الضفة الغربية
South of West Bank	**100**	9.2	27.5	29.6	33.7	جنوب الضفة الغربية
Gaza Strip	**100**	**9.1**	**25.0**	**1.3**	**64.6**	**قطاع غزة**

Table 5: Percentage Distribution of Households who are Heating by Region and the Main

Region	Main Fuel Used for Heating الوقود الرئيسي المستخدم في التدفئة						المنطقة
	المجموع Total	أخرى Others	كاز Kerosene	حطب Wood	غاز البترول المسيل LPG	كهرباء Electricity	
Palestine	**100**	**4.8**	**1.2**	**29.2**	**25.4**	**39.4**	فلسطين
West Bank	**100**	**2.0**	**1.4**	**24.3**	**32.5**	**39.8**	الضفة الغربية
North of West Bank	**100**	3.1	1.3	22.6	34.7	38.3	شمال الضفة الغربية
Middle of West Bank	**100**	1.9	1.2	14.7	30.2	52.0	وسط الضفة الغربية
South of West Bank	**100**	0.7	1.6	35.4	32.1	30.2	جنوب الضفة الغربية
Gaza Strip	**100**	**13.4**	**0.5**	**44.1**	**3.7**	**38.3**	قطاع غزة

Table 6: Percentage Distribution of Households who are Water Heating by Region and the

Region	Main Energy Source for Water Heating مصدر الطاقة المستخدم في تسخين المياه						المنطقة
	المجموع Total	أخرى Others	الحطب Wood	غاز البترول LPG	طاقة شمسية Solar Energy	كهرباء Electricity	
Palestine	**100**	**1.1**	**8.6**	**27.8**	**3.0**	**59.5**	فلسطين
West Bank	**100**	**0.2**	**8.2**	**32.5**	**2.1**	**57.0**	الضفة الغربية
North of West Bank	**100**	0.2	4.7	32.2	3.1	59.8	شمال الضفة الغربية
Middle of West Bank	**100**	0.6	4.0	19.7	1.5	74.2	وسط الضفة الغربية
South of West Bank	**100**	0.2	16.1	44.1	1.3	38.3	جنوب الضفة الغربية
Gaza Strip	**100**	**2.5**	**9.4**	**18.9**	**4.9**	**64.3**	قطاع غزة

3.4 Essential of conservative electricity in households:

Energy conservation in housing means the efforts made to reduce energy consumption of appliances. Energy conservation can be achieved by increasing energy efficiency, coupling with decreased energy consumption and/or reduced consumption from conventional energy sources.

The result of energy conservation in increased financial capital, environmental quality, national security, personal security, and human comfort. Because of that Individuals and organizations choose to conserve energy. (Carden, 2011)

Electrical energy conservation is essential element of energy policy. Energy conservation reduces the energy consumption and energy demand per capita, and thus makes some of the

growth in energy supply needed to keep up with population growth. This reduces the rise in energy costs, and can reduce the need for new power plants, and energy imports. The reduced energy demand provides more flexibility in choosing the most preferred methods of energy production. . (Carden, 2011)

3.5 Willingness to conservative electricity:

Attitudes are defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly and Chaiken, 2007)

Whitmarsh (2009) Show that the attitudes toward eliminating the effect of climate change greater than the attitudes towards of saving energy.

Bhati et al. (2017) conducted a practice-based study to identify qualitative factors behind energy consumptions; she emphasized the importance of social science in predicting energy consumption as individuals' practices.

As result from Mills and Schleich (2012), there are a lot of factors that have an impact on the energy conservation practice index, such as education which have a positive impact, while the number of adults in the household has a negative impact. Unlike for technology adoption, the knowledge index has a positive impact on the household energy conservation index.

Poortinga (2003) Found out that Environmental behavior is affected by motivational factors, and contextual factors, which including opportunities, individual abilities, status, comfort, and effort.

Ideology and attitude increase awareness of energy consumption, and the propensity of buying green energy, but do not necessarily affect behavior. (Sexton and Sexton, 2011)

Simon (1957) study the need to take the behavioral and psychological aspects, and on the basis of that can be expected consumption of energy or trying to maintain it through the behavior of individuals within the family.

Peters (1989) that concerns for comfort had a stronger influence on conservation behavior than conservation attitudes.

Wilson and Dowlatabadi (2007) the authors of the most recent review on decision making associated with residential energy use, recognized that energy-saving behaviors relate to psychosocial characteristics, such as perceived costs and house amenity losses.

As mentioned in the Theory of Interpersonal Behavior (TIB) "Habits" are responsible in forming a large part of our behaviors, which may be made by result of repetition rather than conscious decision-making. (Triandis, 1977)

Individuals tend to make decisions that offer sufficient satisfaction, but not optimal utility; they also assume a limitation on their knowledge capacity, and thus practice satisfice and "might exhibit cognitive errors as known as 'bounded rationality' (Simon, 1957)

Gardner and Stern (1996) Said that is much easier to change a singular investment decision, such as purchasing a compact florescent lamp (CFL) than to change daily behavior such as switching off lights after leaving a room

The proportion of householders that demonstrate a willingness to adopt measures but have not already done is quite limited. (Gilchrist and Craig, 2014)

3.6 Policies and measures of Energy Efficient appliances among Households

Energy efficiency sources contribute to self-sufficiency and solving peak demand and stand-by capacity problems. (Sinden, 2005)

Energy efficiency needs improving the energy performance of appliances, the importance of energy efficiency, since adequate heating is regarded as a basic need and people are unlikely to

use appliances less in order to conserve energy; improving the thermal performance of a building, on the other hand, has a major potential to reduce carbon, especially if connected with changes in consumer's behavior. (ECN/RIVM, 1998)

Energy efficiency is affected by different types of inertia, the key of the realistic understanding the nature of housing renovation is to designing an effective policy to reduce carbon emissions from the existing housing stock. Fokkema (2006) Current policy measures should be decided with some reference to the specific needs of renovation in the residential sector instead of making accurate estimations and establishing policy measures on requirements and actual costs.

Energy efficiency is the target of efforts to reduce the amount of energy required to provide products and services. For example, insulating a home allows a building to use less heating and cooling energy to maintain the temperature. Installing fluorescent lights or natural skylights reduces the amount of energy required to attain the same level of lighting that compared to using traditional incandescent light bulbs. Compact fluorescent lights use two-thirds less energy and may last from 6 to 10 times longer than incandescent lights. Improvements in energy efficiency are most often achieved by adopting a more efficient technology or production process. (Carden, 2011)

The effect of energy efficiency on peak demand depends on when the appliance is used. For example, an air conditioner uses more energy when it is hot in the afternoon. Therefore, an energy efficient air conditioner will have a big effect on peak demand than off-peak demand. An energy efficient dishwasher, on the other hand, uses more energy when people wash their dishes. This appliance may have little to no effect on peak demand. (Carden, 2011)

Each country has to reduce the household electricity consumption by several ways, for example the European Union has taken actions for increased energy end use efficiency by adoption of energy efficient appliances as energy labeling electrical appliances. (Borg and Kelly, 2016)

In China, it suffered from the huge intensity residential sector, however to reduce it they used the minimum energy efficiency standards, energy efficiency labeling, provide support diffusion of

energy efficient appliances, a buy-back of old appliances, and awareness-raising campaigns among citizens. (Guo Ma, 2013)

Spain promote energy efficiency among households by used regulatory and economic to change the forms of behavior of end consumers, and economic instruments in the form of financial incentives as taxation to encourage investments in efficient equipment ,finally they used the information instruments to raise awareness among householders, and make them change the priorities for appliances which consume energy. (Gireesh Nair, 2013)

In Palestine, it worked to raise the energy economic efficiency through the implementation of the project of electricity meters, which aims to decrease energy consumption and raise the rate of receivables collection. Replace existing street High Pressure Sodium (HPS) lamps with Led lamps which will save 50% of the electricity consumed in streets lighting. (PENRA ,2016)

Energy efficiency policy can be used to raise the energy efficiency in households by improved house keep measures such as switching off lights and use electrical efficient equipment.

Effective policy should be designed confirm the technology adoption, energy conversation are related to household characteristic and social practices. The common and country specific policies are a good combination to develop and adopt the conservation policies. (Bradford, 2012)

Chapter Four

Methodology

4.1 Overview

This chapter aims to describe the data and the methodological approaches for addressing the research questions described in sections 1.5, by the presented of the research approach, sample and population identification, data collection, analysis methods and hypotheses.

This research aims to study, explain and analyze the factors influencing the awareness, willingness and attitudes towards residential energy conversation in Palestine, by using a quantitative approach in order to measure the influence of independent variables on the dependent variable.

❖ **Independent variables in this study are as follows:**

- The average degree of education in family.
- Income rate.
- Type of housing.
- Externalities environment.
- Attitudes and habits.
- Government policies.
- Demographic data (Gender, educational level and age).
- Number of occupants.
- Level of knowledge.
- Household area.
- Year of construction.
- Electrical heating.

❖ **Dependent variable:**

Household's energy consumption

4.2 Nature of study

The successful research needed appropriate methodology to be success; there are two approaches qualitative research and quantitative research (Saunders, et al., 2009). This study concerned on quantitative research by collection information through questionnaire, the results are typically presented using statistics, tables and graphs.

Research design is necessary for each research, which can be described as a general plan about what you will do to answer the research question (Saunders, et al., 2009) .Research design divided into two groups which are: Exploratory research, Conclusive Research.

Table (7) shows Major differences between causal researches, exploratory and descriptive research designs (Zikmund et al., 2012)

Table 7 :Major differences between causal researches, exploratory and descriptive research designs

	Causal research	Exploratory research	Descriptive research
Amount of uncertainty characterizing	Clearly defined	Highly ambiguous	Partially defined
Key research statement	Research hypotheses	Research question	Research question
When conducted	Later stages of decision making	Early stage of decision making	Later stages of decision making
Usual research approach	Highly structured	Unstructured	Structured

This study used the causal research (explanatory research) design to study cause-and-effect relationships between the variables and test the research hypothesis.

4.3 Study Population

According to the results of the PCBS (2015) which indicated that about 99.9% of households were connected to the public electricity network, also it shows that 58.3% of households used *a* normal electricity meter, and 41.7% of households used a prepaid electricity meter.

So, the target population of this research consist all the Palestinian's households with electricity meters with the both type of electricity meter connection.

The population size:

According to the PCBS (2016), the average of the family size was 4.9 at the end of 2015, and a population about 2,972,069 person at the end of 2016.

So, to calculate the approximate number of families in west bank, we applied equation (1):

$$\textbf{number of families} = \frac{\textbf{population}}{\textbf{family size}} \quad \textbf{……. (1)}$$

So, the number of families in west bank almost equal 606,545 families.

The population size could calculate by multiplying the previously number of families in west bank by the percentage of households were connected to the public electricity network (99.9%), that is:

99.9% * 606,544.6939 = 605,938.14 families

4.4 Study Sample Calculations

Therefore, the study sample will be selected randomly from the total number of households in west bank. In order to determine the required sample size four elements should be identified first: (Daniel and Cross , 2013)

- Population size: the size of the whole population.

- Confidence level: the level of certainty that the gathered sample characteristics represent the population characteristics.
- Confidence interval (precision level): the margin of error that can be tolerated. In the current study, a confidence level of 95% is chosen, and a confidence interval of 5 (error margin is 0.05) is selected.
- Standard deviation: It describes the variance expected in the responses, since we haven't actually administered our survey yet, the safe decision is to use 0.5 this is the most forgiving number and ensures that the sample will be large enough.

Since, the values were defined; the calculation of the sample size can be made, by applied equation (2): (Daniel and Cross , 2013)

$$\mathbf{n} = \frac{N * z^2 * p * q}{\left(d^2 * (N-1)\right) + (z^2 * p * q)} \quad \ldots\ldots\ldots\ldots (2)$$

Where:

n: sample size

N: Population size

z: 1.96 according to 95% level of confidence

p: the percentage picking a choice from the population. Then, p equal 0.5 in order to have the largest possible n.

q: 1-p = 0.5

d : the acceptable error margin (5%)

By substituting all the previous values in the equation (2), the sample size will equal 384 family.

4.5 Data collection method

Questionnaire survey was used (see appendix 1 for Arabic version), in order to collect the necessary data.

The questionnaire helps to collecting a large amount of data from a large size population, simplicity and speed and on a standardized method. (Oates, 2006)

The designed questionnaire used closed and opened questions, closed questions including Likert scale, and nominal in which the respondents can choose from a given set of alternatives. The researcher used a five point Likert scale with anchors strongly agree.

The survey was also designed in the form of parts. Each part contained a set of specific and interrelated information, consisted of two main divisions: demographic characteristics and the study factors. Demographic characteristics included gender, age, and educational level. On the other hand, the second division takes the independent variables.

The questionnaire distributed in two forms: online questionnaire which designed by using Google Forms service by Google website. Also the self-report questionnaires used and distributed in different cities in the west bank.

4.6 Data analysis:

Minitab 17 software product was used in order to analyze the gathered data; it can be used to perform data entry and analysis and to create tables and graphs. Minitab is capable of handling large amounts of data and can perform all of the analyses covered in the text, also it have a huge capabilities in statistical analyses, and its ability to do data transformation as well as building regression models for the quantitative research.

Data analysis was conducted according to the following procedure:

1. Hypotheses testing
2. Normality check for the variables.
3. Building regression models.
4. Comparisons between different demographic factors.

4.7 Study Hypotheses

This study aims to test ten hypotheses. These hypotheses test the effect of main independent variables on the electricity consumption of the residential sector which are Income rate, Type of housing , Externalities environment , Attitudes and habits, Government policies, Demographic data (gender , educational level , age) , Number of house members , and Level of knowledge.

First Hypothesis

Issue: is the individual's income rate affecting the electricity consumption?

Some research has shown that household energy use has traditionally been explained by income levels. (Räty, 2010)

Thus, in order to test the effect of the income rate on electricity consumption, first hypothesis reads:

Hypothesis (H1): high-income families do not care about working to reduce energy consumption compared to low-income earners.

Second Hypothesis

Issue: Is there a relationship of the type of building with the amount of electricity consumed?

More recent research has shown that the substantial effect of old houses on energy consumption — homes constructed pre-1980 consume, on average, about fifty percent more energy.

(Brounen, et al. 2012)

Modern houses that used smart technologies will have a full impact to reduce the amount of energy consumption when we integrated the Smart Devices, Smart homes, and Smart Grids, which is illustrated by the study by (Collotta, et al. 2015)

Smart lighting in common areas will be capable of detecting human traffic and operate only when necessary, reducing energy usage by up to 40%. (Bhati, et al. 2017)

The use of the Energy Management System (HEMS) in houses reduced the energy consumption by about 20%.Thus, the second hypothesis is:

Hypothesis (H2): The type of building (old or modern) is associated with an inverse relationship with the amount of electricity consumed, when the house is modern and equipped with energy conservation systems. The energy consumed was less than that of the old houses.

Third hypothesis

Issue: Is the average degree on education in family influence on the electricity consumption?

Prior studies also have shown that more recent research has shown that there is a positive correlation between education level and energy-saving activities including the econometric analyses by ((Brechling and Smith, 1994)So the third hypothesis is:

Hypothesis (H3): The level of education in the Palestinian families is positively associated with the awareness of individuals and their willingness towards energy consumption.

Fourth Hypothesis

Issue: Is the gender affect the amount of the electricity consumption?

Ding et al. (2017) confirm that gender is a factor influencing the energy consumption of households.

A lot of research shows the relationship between gender and the consumption of energy, the figure (6) explains that males have the highest percent of energy consumption towards female.

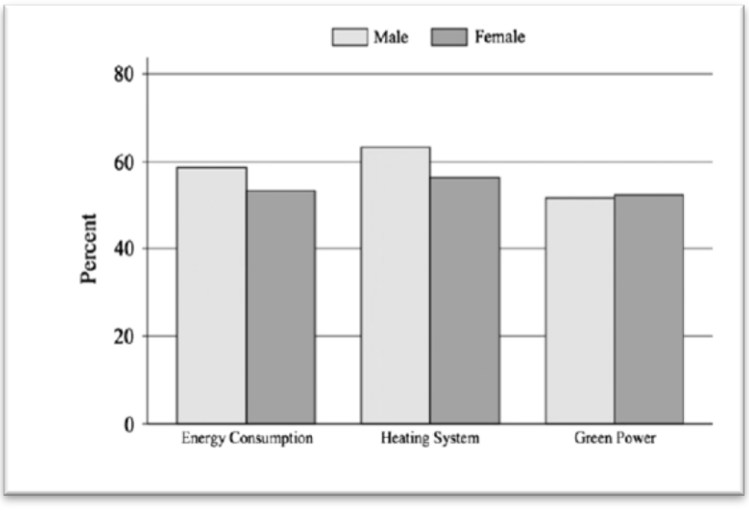


Figure 8 :The effect of gender on electricity consumption

Hence, the fourth hypothesis is:

Hypothesis (H4): energy consumption in households is increasing in males more than in females.

Fifth Hypothesis

Issue: Is the age has a relationship with the electricity consumption?

The majority of studies are based on information taken from the head of household, but other studies take into account other age groups we can explain it in 3 point:

Older household heads may be less likely to adopt energy efficient technologies because the expected rate of return is lower than for households with younger heads. This line of reasoning is supported by the findings of (Curtis, et al. 1984), (Walsh, 1989), (Poortinga, 2003), and (Mahapatra, 2008)

Younger households may be more likely to move and hence be less inclined to invest in energy efficiency improvements. Middle aged households should be most likely to adopt capital-intensive energy efficiency measures (Mills, et al. 2010)

Lutzenhiser (1992) Finds that older households are less likely to adapt behavior ,while in Mills and Schleicher (2010) adoption intensity of energy efficient light bulbs increases at a declining rate with age.

Hence, the fifth hypothesis is:

Hypothesis (H5): middle aged of individuals in household (19 to 65 years of age) is the most age group that Take care to reduce energy consumed in homes.

Sixth Hypothesis

Issue: Is the external environment influence on the electricity consumption?

Xu et al. (2013) Identified environment control which account of 49% of total consumption of energy.

There is some external factors effect on consumption energy in household. Family members prefer to use electric lighting instead of lighting the sun and use of air conditioners instead of natural air due to noise or pollution. (Agarwal, et al. 2016)

Hypothesis (H6): The external environment increases the electricity consumption at homes.

Seventh Hypothesis

Issue: Is the government policies affecting the electricity consumption?

Abhishek Bhati (2017) Show that general information about government policies and awareness about energy savings could be given with detailed information and better results for building energy-saving behaviors.

Hypothesis (H7): Government policies that imposed on households with high energy consumption are a disincentive to increasing energy consumption and thus reduce the amount of energy consumed in households.

Eighth Hypothesis

Issue: Is there a relationship of the habits and attitudes of individuals in household with the amount of electricity consumed?

The attitudes towards energy conservation in general may at best explain a small share of the variation in residential energy consumption or adoption of energy savings measures.

Hypothesis (H8): The habits and attitudes of individuals in household increase the amount of energy consumption.

Ninth Hypothesis

Issue: Is the number of house members' influence on the electricity consumption?

Common perception is that, as the number of family member's increases, a family would consume more electricity.

Hypothesis (H9): The increase numbers of occupants will increase the amount of energy consumption.

Tenth Hypothesis

Issue: Is level knowledge of energy saving influence on the electricity consumption?

Knowledge about potential energy savings is related with higher raise the energy efficient technologies and that will lead to decrease the consumption. (Viklund, 2004)

Hypothesis (H10): the good knowledge of energy savings will decrease the electricity consumption.

Figure 7 presents the framework of the hypotheses in the study :

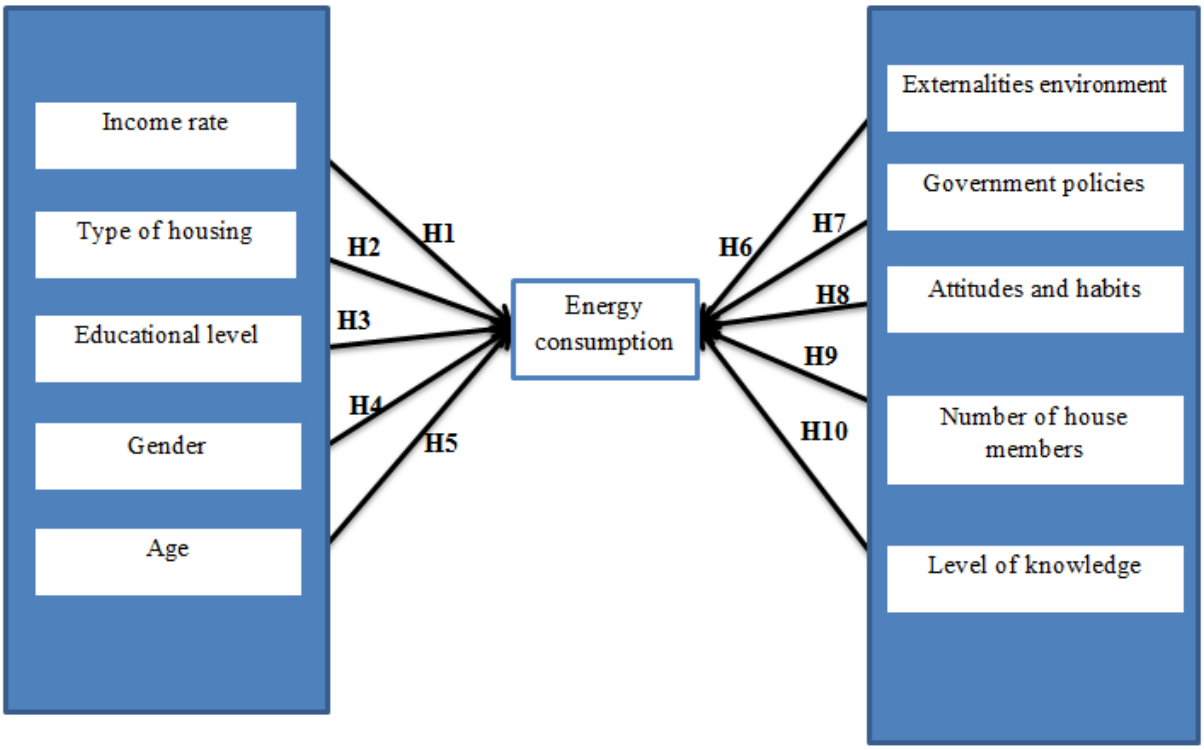


Figure 9 : Hypotheses Structure

Chapter Five

Data Analysis and Discussion

5.1 Overview

This chapter aims to analysis the gathered data in addition to discussing these results. The analysis stars with sample characteristics that classified in two sections of demographic items and survey items. Follow with the hypotheses tests by using Pearson correlation coefficients. Then use the significant factors for dependent factor in building main regression models. Finally, the chapter shows the statistical analysis of the correlation between dependent factors and demographic items by using Kruskal-Wallis and Mann-Whitney tests.

5.2 presented sample

Cronbach's alpha is a measure used to assess the reliability, or internal consistency, of a set of scale or test items. In other words, the reliability of any given measurement refers to the extent to which it is a consistent measure of a concept, and Cronbach's alpha is one way of measuring the strength of that consistency. However Standardized Item Alpha used when the individual scale items are not scaled the same. (Goforth, 2015)

Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is actually no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale.

George and Mallery (2003) provide the following rules of thumb:

Excellent ($\alpha > 0.9$) , Good($\alpha > 0.8$) , Acceptable ($\alpha > 0.7$) , Questionable ($\alpha > 0.6$) , Poor ($\alpha > 0.5$) , and Unacceptable ($\alpha < 0.5$) .

At the beginning of analysis, Cronbach alpha was checked, for a sample of 484 responses, it was 0.38 which is very low, so it's not acceptable were Cronbach's alpha should be at least 0.6.

So, in order to have a higher Cronbach alpha a better presented sample population must find.

The questionnaires were divided by regions to: north, middle and south of West bank. Then Cronbach alpha were computed for each of regions. The highest Cronbach alpha was for north with 0.68.

So, the represented sample to be analyses comes from North and Middle of the West bank with 199 respondents. The selected region included each of the following cities: Jenin, Nablus, Tubas, Tulkarm and Qalqileh.

5.2 Sample Characteristics

5.3.1 Demographic characteristics

Eight demographic characteristics were considered in the study, which are: gender, age, and marital status, and educational level, place of residence, income rate, financial support and electrical consumption rate. Age was classified as (18-25 Y, 26-35 Y, 36-45 Y, and more than 45 years).The educational level was then classified into (less than high school, high school, diploma, bachelor, and higher education).On the other hand, the place of residence included three level which are (City , Village , and refugee camp).Also according to the income rate and electrical consumption rate, they were divided in level of (less than 2000₪ , 2000-5999₪ , 6000-8999₪ , more than 9000₪) and (100-199₪ , 200-399₪ , 400-599₪ , and more than 600 ₪) respectively. Then regarding to the respondent's financial support it classified as (Entirely, Partially, and never).

Finally, the both remaining demographic characteristic gender and marital status was classified in just two population of (Male, Female) and (Unmarried, Married) respectively.

Figure (10) show that out of the one hundred and ninety nine valid surveys, there were 77 (38.7%) males and 122 (61.3%) females.

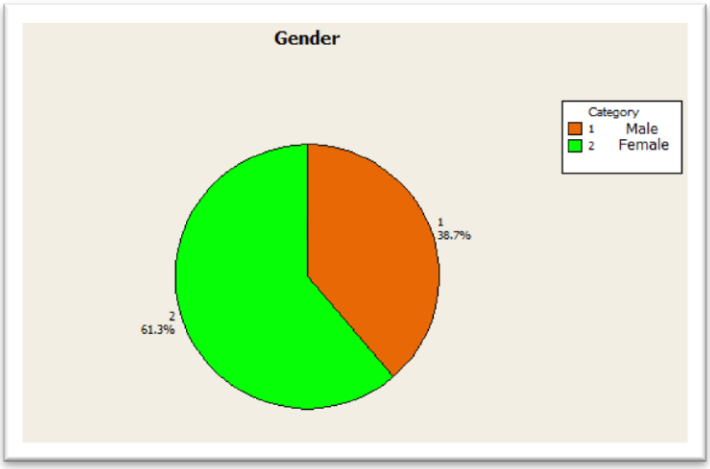


Figure 10 : Respondents distribution according to gender

Regarding age, the distribution of participants was as illustrated in Figure (11) .The largest number of participants according to age was in the age category of 18-25 years with 90 participants (45.2%), followed by 26-35 years category with 54 participants (27.1%).On the other hand, the smallest age category was for the participants aged of 36-45 years with only 25 participants (15.1%). Finally the number of participants in the aged more than 45 years was 30 participants (12.6%).

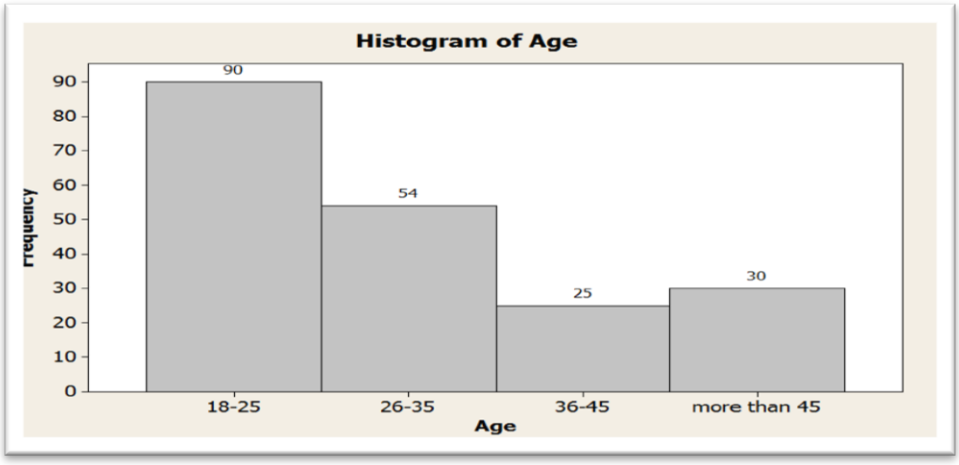


Figure 11: Respondents distribution according to age

On the other hand, relating to the education level, represented in Figure (12) showed the frequency of each population (sector).The findings showed that the highest sector was for the bachelor degree holder with 129 participants (64.8%), then secondary degree holders which has equal participants number with higher education degree holders with 26 participants (13.1%), then the holders of diploma degree with 14 participants (7%) , and finally the primary degree with 4 participants (2%).

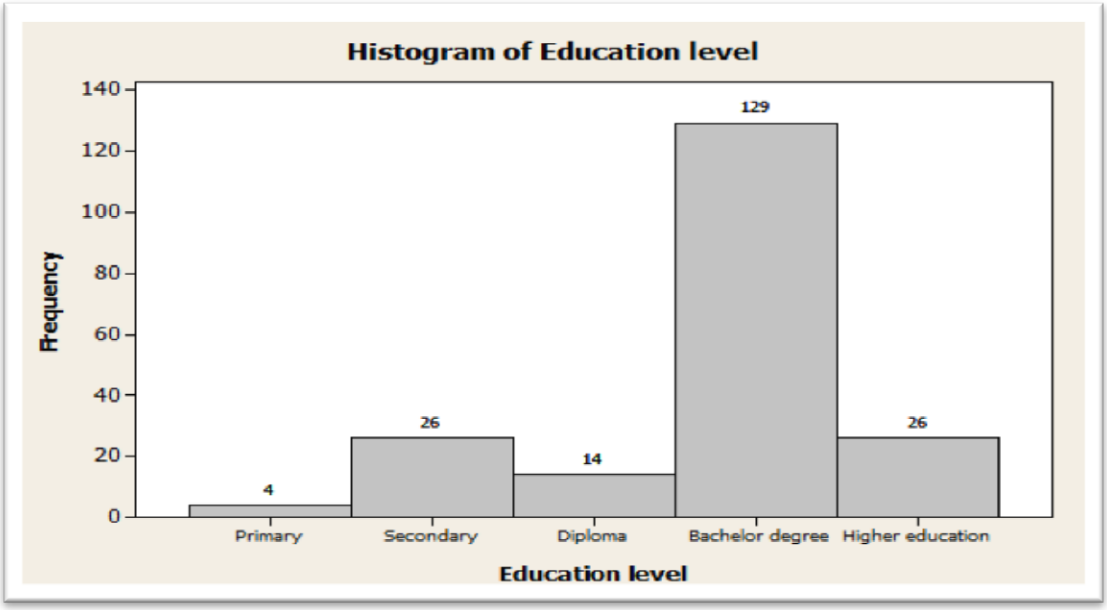


Figure 12 : Respondents distribution according to educational level

Relating to the place of residence characteristic, the findings showed that the Proportion of citizens was 55.3%, followed by Village residents with 42.7%, and the remaining proportion for refugee camp residents with 2%. Figure (13) show the frequency of each sectors.

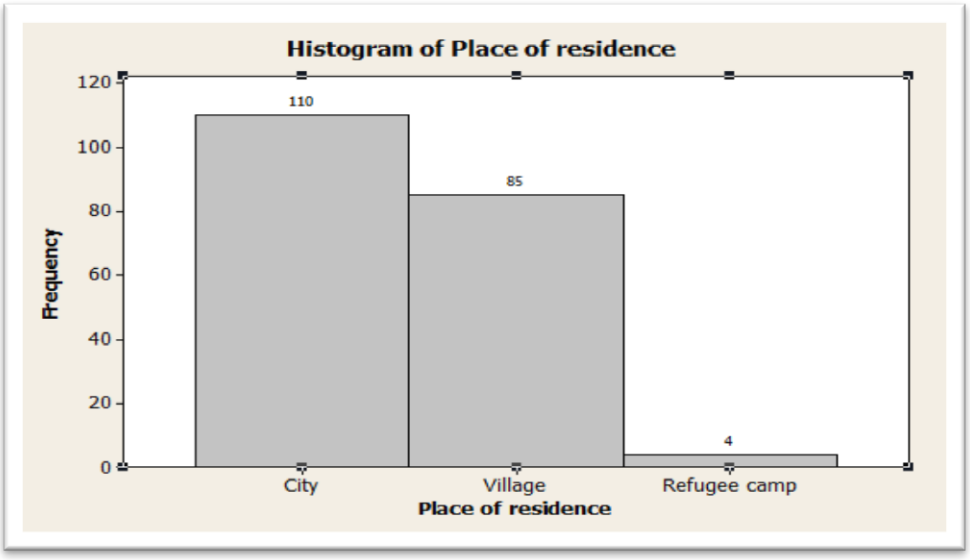


Figure 13 : Respondents distribution according to place of residence

In figures (14 & 15) you will see the results of the frequency of each sector of the both income rate and financial support rate characteristics respectively.

With regards to income rate in figure (14) , the chart shown that most participants fall in the category of (2000-5999₪) with 122 participants , following by (6000-8999₪) with 42 participants , then category of (Less than 2000₪) with19 participants , finally the less participants number fall in category of (More than 9000₪) with just 16 participants.

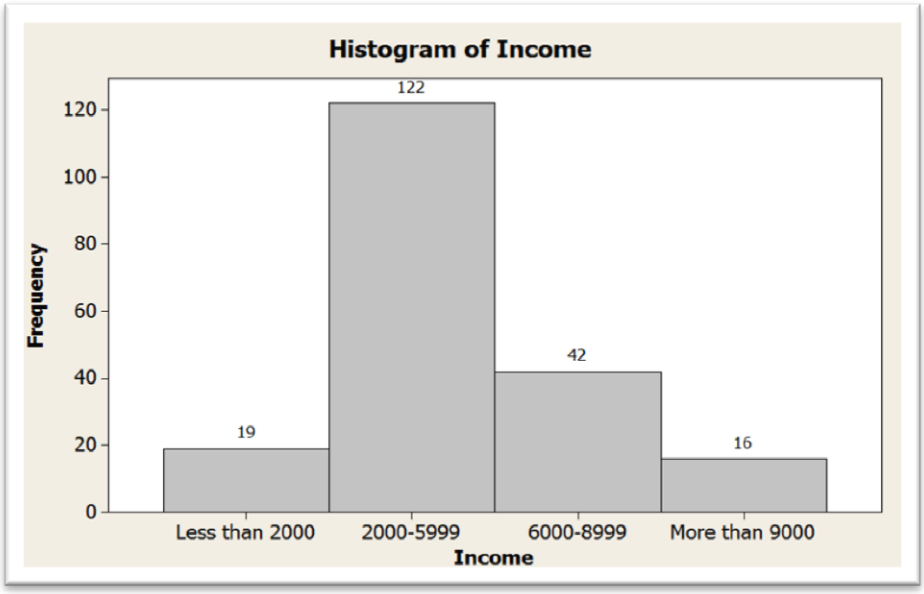


Figure 14 :Respondents distribution according to income rate

Then we have Figure (15) which relates to the financial support, the results in chart show the participants distributes on different categories with their frequency.

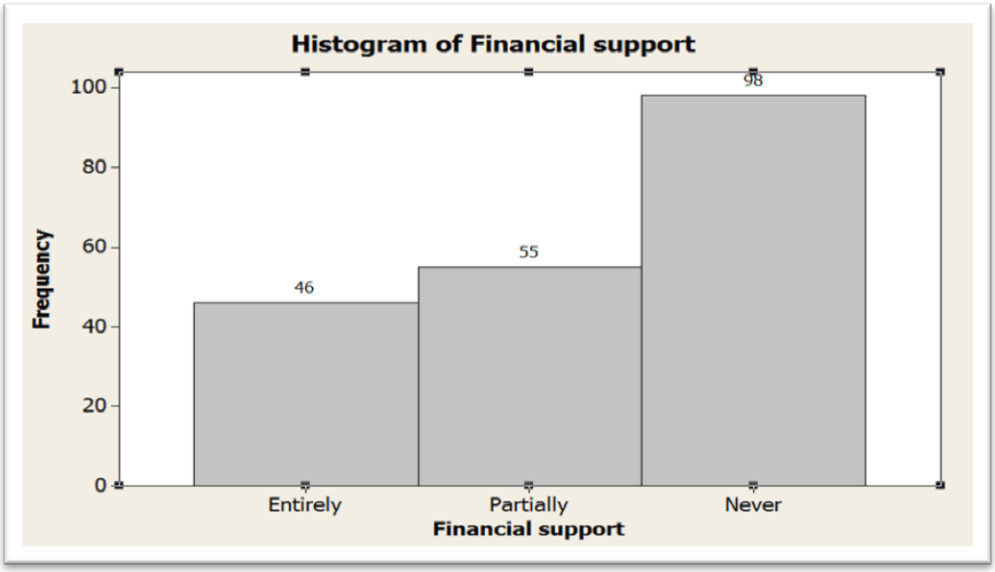


Figure 15 : Respondents distribution according to financial support

The last demographic characteristic of the electrical consumption rate finds that the rate of (200-399) were the largest sector with 212 participants, next was the category of participants with (100-199) of 143 participants , followed by (400-599) consumption rate with 90 participants , and finally participants with (equal or more than 600) were the smallest sector with 40 participants . Figure (16) shows these results.

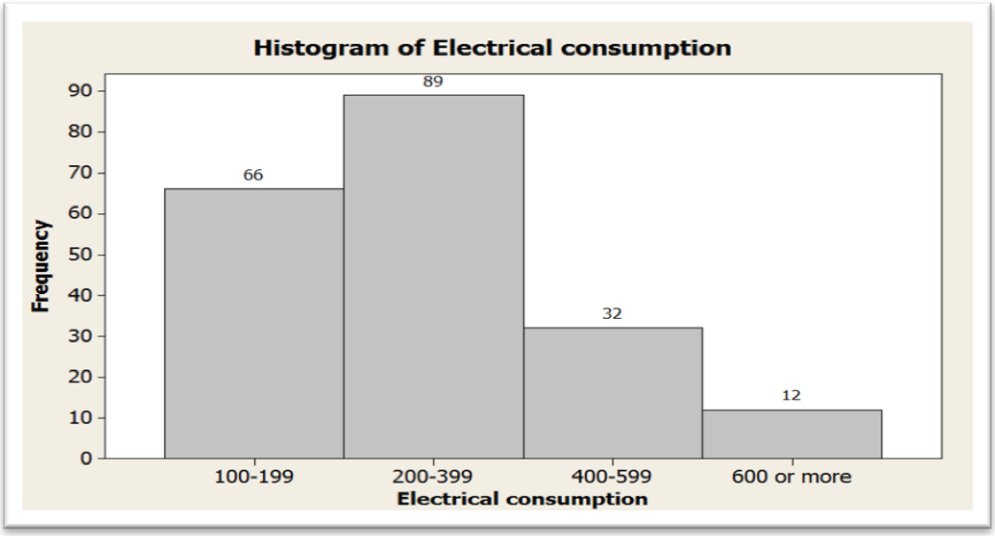


Figure 16 : Respondents distribution according to electrical consumption rate

5.4 Survey items:

This section contained the actual measures used to measure the effect of each variable. For a smoother display of results, this section has been divided in to four subsections, the first three subsections for the questions that related to each of knowledge, awareness and willingness and the mean and standard deviation of each question.

5.4.1 Awareness questions:

The questions in table (8) below were used to measure the average of the awareness about rationalizing their electricity consumption, and compute the mean and standard deviation for each of the questions.

- The choices to answer questions classified in scale of:

For all questions expect questions number of 4 &7: (3: Always, 2: Sometimes, 1: Never).

For questions 4 & 7: (3: Never, 2: Sometimes, 1: Always)

Table8 : mean and standard deviation of awareness questions

	Questions to measure Awareness	Mean	St.Dev.
1	When you buy a new device, do you take in your consideration if the device saves electricity? (Energy star)	2.2714	0.6565
2	I turn off the lights in the different rooms and facilities of the house if no one there?	2.5829	0.5702
3	I open the curtains in the morning in order to take advantage of the sunlight?	2.5930	0.6197
4	I turn on all lamps when entering the room?	1.9799	0.7104

5	Make sure to close the electric heaters when leaving unused rooms in the winter (for more than 10 minutes)?	2.7789	0.4510
6	Make sure to close the electric fans when leaving unused rooms in the summer (for more than 10 minutes)?	2.5930	0.6437
7	Leave the TV on, while there is no one to watch?	1.5025	0.5013
8	Do you put the clothes under the sun?	2.8040	0.4679
The average of mean and st.dev		2.404886	0.577588

5.4.2 Willingness questions:

Questions in table (9) below are used to measure the average of the people willingness to rationalize their electricity consumption, and then the mean and standard deviation for each of the questions are computed and shown.

- The choices to answer questions are classified in scale of:

For questions 2&3: (2: Always, 1: Sometimes, 0: Never)

For questions 1&4: (3: Always, 2: Sometimes, 1: Never)

Table9 : mean and standard deviation of willingness questions

	Qquestions to measure willingness	**Mean**	**St.Dev.**
1	If we add some feature to a device like (power saving) and we increase the price of this device, are you ready to buy it?	2.5427	0.5477
2	Are you willing to change your behaviour inside the home to better economize electricity if it works to lower the cost of the electricity bill?	2.7437	0.4710

3	Do you think it is necessary to add the issue of awareness to rationalize the consumption of electricity in school curricula in order to promote the culture of rationalization in society since childhood?	2.8291	0.3905
4	Read bulletins that help save energy	1.1457	0.3677
The average of mean and st.dev		2.3153	0.444225

5.4.3 Knowledge questions:

The survey used the questions shown in table (10) in order to measure the knowledge level of individuals about the need to rationalize the consumption of electricity، and about various environmental problems.

Moreover, the table showed the mean and standard deviation for the answers for each of the questions.

- . The choices to answer questions are classified in scale of:

For all questions: (2: Always, 1: Sometimes, 0: Never)

Table10 :mean and standard deviation of knowledge questions

	Questions to measure knowledge	Mean	St.Dev.
1	I have already heard about the concept of rationalizing electricity consumption	1.1106	0.6178
2	How much do you know about global warming?	0.9397	0.6328
3	How much do you know about the ozone hole?	1.0955	0.5467
4	How much do you know about acid rain?	1.0302	0.5588

5	How far do you know about the noxious emissions from combustion processes?	1.1457	0.4860
	The average of mean and st.dev	1.06434	0.56842

5.4.4 "Specifications of the house "questions:

In this section of the survey, the respondents were asked to give us some data about their houses. Table (11) below shows the questions related to this section and the mean and standard deviation for each question.

- . The choices to answer each questions are classified in scale of:
  Question #1: (2: separate house, 1: apartment)
  Question #2: (2: house rental, 1: house owning)
  Question #3: (1:1979 or more, 1980-1989, 1990-1999, 2000-2009, 2010 and more)
  Questions #4, 5&6: (3: Entirely, 2: Partially, 1: Never)
  Question # 7: (3: Single layer, 2: Double layer, 1: don't know)
  Question # 8: (3: Aluminum, 2: iron, 1: wood)
  Question # 9: open answer

Table11 : mean and standard deviation of specification of the house questions

	Questions about specification of the house	Mean	St.Dev.
1	Type of housing	1.6935	0.4622
2	Ownership of the house	1.8945	0.3080
3	home construction	3.3568	1.1184
4	Is there a source of pollution in the surrounding environment?	1.7739	0.6773

5	Do you think the sources of pollution around the house affect the consumption of electricity?	1.98621	0.781613
6	Does the house contain insulation materials for heat and cold?	1.4372	0.6070
7	Number of window layers in the house?	2.0955	0.7289
8	Type of window frames	2.9347	0.2856
9	Total House Area	194.06	91.35

5.4.5 Question about "Consumption reasons":

The respondents were asked to give their opinions about the possible reasons of high electricity consumption in Palestine by a multiple choice question.

- . The choices to answer the questions are:

  1: The appliances are always connected to electricity.

  2: Lack of awareness about the need to rationalize electricity consumption.

  3: Behavior that increases the consumption of electricity.

  Table (12) shows the frequency of answers for each previously choices.

Table 12 : Tally for consumption possible reasons

Choices	Count	Percent (%)
1	88	26%
2	134	39%
3	121	35%

5.4.6 Future solutions

Eight future solutions that can rationalize the consumption of electricity have been put in the survey to be selected by respondents, according to their opinion while they can choose more than one solution. From the results of the survey, we get that the solar cells solution has the highest percentage (21%) and the vital gas solution gets the lowest percentage (6%). The figure 1 below shows the future solutions with the percentages of the applicability for each solution in Palestine according to the respondent opinion.

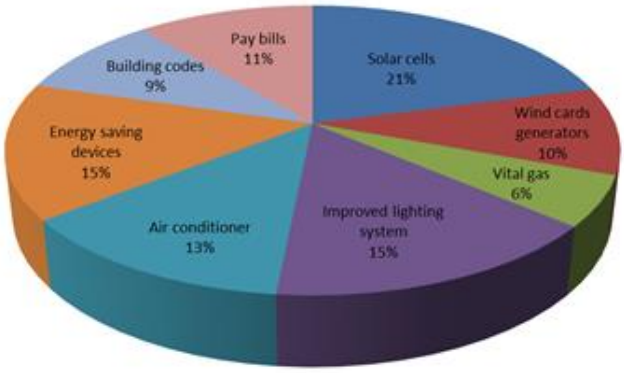


Figure 17 : The future solutions with their percentages

5.4.7 Lighting construct:

One of the solutions to achieve energy conservation is to use more energy efficient bulbs.
The National Optical Astronomy Observatory (NOAO) showed in their document the different between each type of lights bulbs (Incandescent Bulbs, CFL, and LED).
It said that the LED bulb are the most efficient bulbs up to date , while the CFL bulb are less efficient which work by running electricity through gas inside the coils, exciting that gas, and producing light. Then the incandescent light bulb considered as the least efficient bulbs.
So , because of the importance to choose the most economical type of lighting bulbs , the survey ask to choose the using types by a multiple choice question.

- The choices to answer the questions are:
  1: LED
  2: Fluorescent
  3: Tungsten
  12: LED & Fluorescent

23: Fluorescent & Tungsten

13: LED & Tungsten

123: LED, Fluorescent & Tungsten

Finally the results showed that the use of LED bulbs in household sector has a low percentage of using with 20.6%.

Table 13: Respondents' distribution to the use of light bulbs

Type of lighting	Count	Percent
1	41	20.6
2	72	36.18
3	6	3.02
12	30	15.08
13	0	0
23	14	7.04
123	36	18.09

5.4.8 The role of the media in rationalizing the consumption of electricity

In this section of the survey, the respondents were asked to give their opinion about the role of the media in raising the awareness about the rationalization of electricity consumption. Table (14) below shown the questions related to this section and their choices.

Table 14 : Role of the media in rationalizing the consumption of electricity

Question	Choices	Mean
I think that media have an active role in spreading the culture of energy conservation	1: Always 2:Sometimes 3: Never	2.37186
In your opinion, what is the best media used?	1: TV 2: Internet 3:Printed publications 4 : Radio 5: Advertising	2.14054
What is the source of your knowledge about the concept of rationalization of electricity consumption?	1: Media 2: Internet 3: Education sector 4:Books 5:Surrounding people 6: Other	2.56281

5.4.9 Electrical appliances

The survey ask respondents about all the electrical appliances that are likely to be inside the house with their number, the detailed Minitab results of this model are shown in appendix (2). Also the respondent was asked if there is old equipment using in the house) for more than 5 years).

Then, there are in detailed questions about air-conditioning and solar if they are present، the questions are shown in the table (15) below.

Table 15 : Questions about air conditioning and solar heaters

• **Air conditioning**			
Questions	Choices	Mean	Standard deviation
Make sure to close the air conditioners when leaving the unused rooms	1: Always 2: Sometimes 3: Never	2.67586	0.538552
What is the average temperature of the air conditioning system in summer?	Open Answer	19.7310	2.68291
What is the average temperature of the air conditioning system in winter?	Open Answer	27.2143	2.42091
Do you make a regular maintain to the air conditioner filters?	1: Always 2: Sometimes 3: Never	1.92143	0.710333
• **Solar system**			
Questions	Choices	Mean	Standard deviation
Do you make a regular maintain to the solar heater filters?	1: Always 2: Sometimes 3: Never	2.05143	0.729262
Do you use the solar heater on sunny days in the winter?	1: Always 2: Sometimes 3: Never	2.36782	0.681972

5.5 Statistical Differences Based on Demographic Factors

In this study eight demographic factors are considered. These include Age, Gender, marital state, educational level, Place of residence, Income, Financial support and Electrical consumption. Based on the previous normality check results and since the data was not normally distributed, non-parametric tests were used.

Kruskal-Wallis Test in particular was used for comparing participants' Willingness, knowledge and awareness according to demographic factors. The output of the Kruskal-Wallis test includes (Minitab support):

- The number of items in each group N.
- The median of each group.
- Ave rank which is the average rank of the ranks for all observations within each sample. When a group's average rank is higher than the overall average rank, the observation values in that group tend to be higher than those of the other groups.
- The Z-value which indicates how the average rank for each group compares to the average rank of all observations. A negative z-value indicates that a group's average rank is less than the overall average rank, whereas a positive z-value indicates that a group's average rank is greater than overall. The higher the absolute value, the further a group's average rank is from the overall average rank.
- P-value.

5.5.1 Statistical difference according to Age

i. Statistical difference according to Age with Awareness

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_o: the medians of all age categories are equal in awareness.

H_1 : the medians of all age categories are not equal in awareness.

The significance level of 5% the following results shown in table (16) were obtained:

Table 16: Kruskal-Wallis Test for Awareness versus Age

Age	N	Median	Ave rank	Z-value
18-25	90	2.286	90.9	-2.02
26-35	54	2.286	93.2	-1.01
36-45	25	2.429	118.5	1.72
>45	30	2.429	124	2.48
This test is significant at p value of 0.011 , level of significance α=0.05				

Examining the level of significance (0.011<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different ages in the awareness. By looking at the median column, it realized that the median for small ages is higher the oldest one.

ii. Statistical difference according to age with willingness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_o: the medians of all age categories are equal in willingness.

H_1: the medians of all age categories are not equal in willingness.

At a significant level of 5% the following results shown in table (17) were obtained:

Table 17: Kruskal-Wallis Test: willingness versus Age

Age	N	Median	Ave rank	Z-value
18-25	90	2.25	88.5	-2.56
26-35	54	2.25	97.1	-0.43
36-45	25	2.5	121.5	1.99
>45	30	2.5	121.7	2.24
This test is significant at p value of 0.005 , level of significance α=0.05				

Examining the level of significance (0.005<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different ages in the willingness. By looking at the median column, it realized that the median for oldest people is higher the youngest one.

iii. Statistical difference according to Age with Knowledge.

H_o: the medians of all age categories are equal in Knowledge.

H_1: the medians of all age categories are not equal in Knowledge.

At a significant level of 5% the following results shown in table (18) were obtained:

Table 18 Kruskal-Wallis Test: knowledge versus Age

Age	N	Median	Ave rank	Z-value
18-25	90	1	108.7	1.94
26-35	54	1	94.9	-0.76
36-45	25	1	101	0.09
>45	30	0.8	82.2	-1.84
This test is significant at p value of 0.132 , level of significance α=0.05				

The p-value of this test was 0.132 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

5.5.2 Statistical difference according to Gender

i. Statistical difference according to Gender with Awareness

In order to test for the availability of statistical differences in awareness between males and females, the following null and alternative hypothesis were formulated:

H0: There is no statistical difference between males and females in awareness.

H1: there is a statistical difference between males and females in awareness

At a significant level of 5% the following results shown in table (19) were obtained

Table 19 Kruskal-Wallis Test for Awareness versus Gender

Gender	N	Median	Avg Rank	Z
Male	77	2.286	93.1	-1.33
Female	122	2.429	104.3	1.33
The test is insignificant at 0.175 (adjusted for ties), level of significance α= 0.05				

The p-value of this test was 0.175 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

ii. Statistical difference according to Gender with Willingness

H0: there is no statistical difference between males and females in willingness.

H1: there is a statistical difference between males and females in willingness.

At a significant level of 5% the following results shown in table (20) were obtained:

Table 20: Kruskal-Wallis Test for Willingness versus Gender

Gender	N	Median	Avg Rank	Z
Male	77	2.5	98.7	-0.25
Female	122	2.25	100.8	0.25
The test is insignificant at 0.79 (adjusted for ties), level of significance α= 0.05				

The p-value of this test was 0.79 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

iii. Statistical difference according to Gender with Knowledge

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: there is no statistical difference between males and females in n Knowledge.

H1 : there is a statistical difference between males and females in Knowledge.

The significance level of 5% the following results shown in table (21) were obtained:

Table 21 Kruskal-Wallis Test for Knowledge versus Gender

Gender	N	Median	Avg Rank	Z
Male	77	1	91.7	-1.62
Female	122	1	105.3	1.62
The test is insignificant at p=0.097 (adjusted for ties), level of significance α= 0.05				

The p-value of this test was 0.097 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

5.5.3 Statistical difference according to Marital State

i. Statistical difference according to Marital with Awareness

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: there is no statistical difference between unmarried and married persons in awareness.

H1: there is a statistical difference between unmarried and married persons in awareness.

The significance level of 5% the following results shown in table (22) were obtained:

Table 22: Kruskal-Wallis Test: Awareness vs martial state

Marital state	N	Median	Avg Rank	Z
Un married	98	2.286	88	-2.91
Married	101	2.429	111.7	2.91
The test is significant at 0.003 (adjusted for ties), level of significance α= 0.05				

Examining the level of significance (0.003<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different marital state in the awareness. By looking at the median column, it realized that the median for married is higher than un-married Persons.

ii. Statistical difference according to Marital with Willingness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: there is no statistical difference between unmarried and married persons in willingness.

H1: there is a statistical difference between unmarried and married persons in willingness.

The significance level of 5% the following results shown in table (23) were obtained:

Table 23: Kruskal-Wallis Test willingness versus Marital state

Marital state	N	Median	Avg Rank	Z
Un married	98	2.25	90.7	-2.25
Married	101	2.5	109	2.25
The test is significant at 0.017 (adjusted for ties), level of significance α= 0.05				

Examining the level of significance (0.017<0.05) led to rejecting the null hypothesis; in other words, there is a statistical difference between married and unmarried persons in willingness towards conserving electricity in residential sector. By looking at median column, it is realized that the median for married is higher than unmarried persons.

iii. Statistical difference according to Marital with Knowledge.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: there is no statistical difference between unmarried and married persons in knowledge.

H1: there is a statistical difference between unmarried and married persons in knowledge.

The significance level of 5% the following results shown in table (24) were obtained:

Table 24: Kruskal Wallis Test: knowledge versus Marital state

Marital state	N	Median	Avg Rank	Z
Un-married	98	1	107.8	1.89
Married	101	1	92.4	-1.89
The test is significant at 0.053 (adjusted for ties), level of significance α= 0.05				

The p-value of this test was 0.053 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal for marital state.

5.5.4 Statistical difference according to Education level

i. Statistical difference according to Education Level with Awareness

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of all educational level categories are equal in awareness

H1: The medians of all educational level categories are not equal in awareness

The significance level of 5% the following results shown in table (25) were obtained:

Table 25: Kruskal-Wallis test for awareness versus educational level

Educational level	N	Median	Ave rank	z-value
1	4	2.571	142.6	1.5
2	26	2.429	101.4	0.13
3	14	2.429	104	0.27
4	129	2.429	95	-1.57
5	26	2.429	113.3	1.27
This test is significant at p value of 0.32, level of significance α=0.05				

The p-value of this test was 0. 32 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

ii. Statistical difference according to Education Level with Willingness

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of all educational level categories are equal in Willingness

H1: The medians of all educational level categories are not equal in Willingness

The significance level of 5% the following results shown in table (26) were obtained:

Table 26: Kruskal-Wallis Test: willingness versus Education level

Educational level	N	Median	Ave rank	z-value
1	4	2.5	144.5	1.56
2	26	2.25	95.2	-0.45
3	14	2.5	125.9	1.75
4	129	2.25	94.6	-1.8
5	26	2.5	110.9	1.03
This test is significant at p value of 0.079, level of significance α=0.05				

The p-value of this test was 0.079 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

iii. Statistical difference according to Education Level with Knowledge

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of all educational level categories are equal in Knowledge.

H1: The medians of all educational level categories are not equal in Knowledge.

The significance level of 5% the following results shown in table (27) were obtained:

Table 27:Kruskal-Wallis Test: knowledge versus Education level

Educational level	N	Median	Ave rank	z-value
1	4	0.8	52.1	-1.68
2	26	0.9	80.5	-1.85
3	14	1	88.2	-0.8
4	129	1	100.7	0.23
5	26	1.2	129.8	2.83
This test is significant at p value of 0.007, level of significance α=0.05				

Examining the level of significance (0.007<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different ages in the awareness. By looking at the median column, it realized that the median for small ages is higher the oldest one.

5.5.5 Statistical difference according to Place of residence

i. Statistical difference according to Place of residence with awareness

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of place of residence are equal in awareness

H1: The medians of place of residence categories are not equal in awareness

The significance level of 5% the following results shown in table (28) were obtained:

Table 28: Kruskal-Wallis test awareness versus Place of residence

Place of residence	N	Median	Ave rank	z-value
City	110	2.429	96	-1.09
Village	85	2.429	104.4	0.92
Camp	4	2.429	117.3	0.61
This test is insignificant at p value of 0.489, level of significance α=0.05				

The p-value of this test was 0.489 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

ii. Statistical difference according to Place of residence with willingness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: the medians of all place of residence categories are equal in willingness.

H1: the medians of all place of residence categories are not equal in willingness.

The significance level of 5% the following results shown in table (29) were obtained:

Table 29: Kruskal-Wallis Test: willingness versus Place of residence

Place of residence	N	Median	Ave rank	z-value
City	110	2.25	96.6	-0.93
Village	85	2.25	103.5	0.74
Camp	4	2.375	119.8	0.69
This test is insignificant at p value of 0.52, level of significance α=0.05				

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The p value of this test was 0.52 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

iii. Statistical difference according to Place of residence with Knowledge.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of place of residence are equal in Knowledge.

H1: The medians of place of residence categories are not equal in Knowledge.

The significance level of 5% the following results shown in table (29) were obtained:

Table 30: Kruskal-Wallis Test: Knowledge versus Place of residence

Place of residence	N	Median	Ave rank	z-value
City	110	1	98.3	-0.45
Village	85	1	100.8	0.16
Camp	4	1.2	129.3	1.03
This test is insignificant at p value of 0.551, level of significance α=0.05				

The p-value of this test was 0.551 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

5.5.6 Statistical difference according to Income

i. Statistical difference according to Income with awareness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of income are equal in awareness.

H1: The medians of income categories are not equal in awareness.

The significance level of 5% the following results shown in table (31) were obtained:

Table 31: Kruskal-Wallis Test awareness versus Income

Income	N	Median	Ave rank	z-value
Less than 2000	19	2.429	113.1	1.04
2000-5999	122	2.429	97.7	-0.72
6000-8999	42	2.357	96.5	-0.45
More than 9000	16	2.429	111.6	0.84
This test is insignificant at p value of 0.560, level of significance α=0.05				

The p-value of this test was 0.56 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

ii. Statistical difference according to Income with willingness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: the medians of all income categories are equal in willingness.

H1: the medians of all income categories are not equal in willingness.

The significance level of 5% the following results shown in table (32) were obtained:

Table 32: Kruskal-Wallis Test: willingness versus Income

Income	N	Median	Ave rank	z-value
Less than 2000	19	2.5	115.5	1.24
2000-5999	122	2.25	98.3	-0.52
6000-8999	42	2.25	104.2	0.54
More than 9000	16	2.25	83.3	-1.21
This test is insignificant at p value of 0.330, level of significance α=0.05				

The p value of this test was 0.33 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

iii. Statistical difference according to Income with Knowledge.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: the medians of all income categories are equal in willingness.

H1: the medians of all income categories are not equal in willingness.

The significance level of 5% the following results shown in table (33) were obtained:

Table 33: Kruskal-Wallis Test Knowledge vs Income

Income	N	Median	Ave rank	z-value
Less than 2000	19	0.8	72.7	-2.17
2000-5999	122	1	99.5	-0.15
6000-8999	42	1	112.7	1.61
More than 9000	16	1	102.9	0.21
This test is insignificant at p value of 0.084, level of significance α=0.05				

The p-value of this test was 0.084 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

5.5.7 Statistical difference according to financial support

i. Statistical difference according to financial with awareness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of financial support are equal in awareness.

H1: The medians of financial support categories are not equal in awareness.

The significance level of 5% the following results shown in table (34) were obtained:

Table 34: Kruskal-Wallis Test awareness vs financial support

Financial support	N	Median	Ave rank	z-value
never	46	2.429	118.1	2.43
partially	55	2.429	104.6	0.69
Entirely	98	2.286	88.9	-2.67
This test is significant at p value of 0.012, level of significance α=0.05				

Examining the level of significance (0.012<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the finical support in the awareness.

ii. Statistical difference according to financial support with willingness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of financial support are equal in willingness.

H1: The medians of financial support are not equal in willingness.

The significance level of 5% the following results shown in table (35) were obtained:

Table 35: Kruskal-Wallis Test: willingness versus financial support

Financial support	N	Median	Ave rank	z-value
never	46	2.5	111.4	1.54
partially	55	2.5	114.1	2.14
Entirely	98	2.25	86.7	-3.21
This test is significant at p value of 0.003, level of significance α=0.05				

Examining the level of significance (0.003<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different ages in the awareness.

iii. Statistical difference according to financial support with Knowledge.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: The medians of financial support are equal in Knowledge.

H1: The medians of financial support are not equal in Knowledge.

The significance level of 5% the following results shown in table (36) were obtained:

Table 36: Kruskal-Wallis Test: knowledge versus financial support

Financial support	N	Median	Ave rank	z-value
never	46	1	83.4	-2.24
partially	55	1	101	0.15
Entirely	98	1	107.3	1.75
This test is significant at p value of 0.059, level of significance α=0.05				

The p-value of this test was 0.059 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

5.5.8 Statistical difference according to Electrical consumption

i. Statistical difference according to electrical consumption with awareness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: the medians of all electrical consumption categories are equal in awareness.

H1: the medians of all electrical consumption categories are not equal in awareness.

The significance level of 5% the following results shown in table (37) were obtained:

Table 37: Kruskal-Wallis test awareness versus electrical consumption

Electrical consumption	N	Median	Ave rank	z-value
100-199	66	2.429	116.4	2.83
200-399	89	2.286	91.7	-1.83
400-599	32	2.429	96.4	-0.38
More than 600	12	2.286	81	-1.18
This test is insignificant at p value of 0.03, level of significance α=0.05				

Examining the level of significance (0.03<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different ages in the awareness. By looking at the median column, it realized that the median for small ages is higher the oldest one.

ii. Statistical difference for electrical consumption according to willingness.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: the medians of all electrical consumption categories are equal in willingness.

H1: the medians of all electrical consumption categories are not equal in willingness.

The significance level of 5% the following results shown in table (38) were obtained:

Table 38: Kruskal-Wallis Test: willingness versus electrical consumption

Electrical consumption	N	Median	Ave rank	z-value
100-199	66	2.5	112.2	2.11
200-399	89	2.25	95.5	-1
400-599	32	2.25	96.7	-0.36
More than 600	12	2.25	75.1	-1.54
This test is insignificant at p value of 0.087, level of significance α=0.05				

The p value of this test was 0.087 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

iii. Statistical difference according to electrical consumption with Knowledge.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H0: the medians of all electrical consumption categories are equal in Knowledge.

H1: the medians of all electrical consumption categories are not equal in Knowledge.

The significance level of 5% the following results shown in table (38) were obtained:

Table 39: Kruskal-Wallis test knowledge versus consumption

Electrical consumption	N	Median	Ave rank	z-value
100-199	66	1	103.3	0.57
200-399	89	1	102.8	0.61
400-599	32	1	99.8	-0.02
More than 600	12	0.8	61.8	-2.37
This test is insignificant at p value of 0.113, level of significance α=0.05				

The p-value of this test was 0.113 which is higher than 5%, thus no enough evidence is available to reject the null hypothesis that all medians are equal.

The results of the demographic factors comparison with awareness, willingness and knowledge indicated that, first there were significant statistical differences between awareness with each of age, marital state, financial support and educational level. Secondly there were statistical differences between willingness with age, marital state and financial support. Finally the knowledge has a statistical difference with only educational level.

5.6 Statistical differences according to electrical appliances.

After the section that talked about the statistical analysis (awareness, knowledge and willingness) with demographic, There were questions related to awareness, but did not add to the average of the awareness because not all responders have air conditioning and solar heater that will give us wrong average, so this led to analysis each question alone.

1. Air conditioning

- The first question was did you turn off the air conditioning when you leave the room?

After do the Kruskal test for all demographic with the question, the result was that there's a statistical difference between turn off the air conditioning and the gender which specified below.

i. Statistical difference based on Gender for turn off the air conditioning.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_o: there is no statistical difference between males and females for turn off the air conditioning.

H_1: there is a statistical difference between males and females for turn off the air conditioning.

The significance level of 5% the following results shown in table (40) were obtained:

Table 40:Kruskal-Wallis test turn off air conditioning vs gender.

Gender	N	Median	Avg Rank	Z
Male	55	3	66.1	-1.65
Female	91	3	78	1.65
The test is insignificant at 0.036 (adjusted for ties), level of significance α= 0.05				

Examining the level of significance (0.036<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the males and females in the awareness of turn off air conditioning.

- The second question was do you make a period maintenance for your air conditioning?

After do the Kruskal test for all demographic with the question, the result was that there's a statistical difference between make period maintenance for air conditioning and the age which specified below.

ii. Statistical difference based on age for maintenance the air conditioning.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_o: there is no statistical difference between ages maintenance the air conditioning.

H_1: there is a statistical difference between ages for maintenance the air conditioning.

The significance level of 5% the following results shown in table (41) were obtained:

Table 41:Kruskal-Wallis test maintenance the air conditioning versus Age

Age	N	Median	Avg Rank	Z
18-25	60	2	72.2	0.44
26-35	40	2	57.4	-2.41
36-45	20	2	84.8	1.7
>45	20	2	77.1	0.79
The test is insignificant at 0.035 (adjusted for ties), level of significance α= 0.05				

Examining the level of significance (0.035<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different ages in the awareness of maintenance the air conditioning.

2. Solar heater

For the solar heater there was also two questions, the first one was do you make a period maintenance for your solar heater, after do the kruskal walles for all the demographic ,the result shows that there was a statistical differences with each of gender, income and financial support as specified below.

i. Statistical difference based on gender for maintenance of solar heater

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_o: there is no statistical difference between males and female for maintenance of solar heater.

H_1: there is a statistical difference between male and female for maintenance of solar heater.

The significance level of 5% the following results shown in table (42) were obtained:

Table 42: Kruskal-Wallis test maintenance the solar heater versus gender

Gender	N	Median	Avg Rank	Z
Male	69	2	96.9	1.87
Female	106	2	82.2	-1.87
The test is insignificant at 0.044 (adjusted for ties), level of significance α= 0.05				

Examining the level of significance (0.044<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the male and females.

ii. Statistical difference based on income for maintenance the air conditioning.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H $_0$: there is no statistical difference between different incomes for maintenance the air conditioning.

H $_1$: there is a statistical difference between different incomes for maintenance the air conditioning.

The significance level of 5% the following results shown in table (43) were obtained:

Table 43:Kruskal-Wallis test maintenance the solar heater versus income

Income	N	Median	Ave rank	z-value
Less than 2000	17	1	58.8	-2.5
2000-5999	104	2	91.4	1.09
6000-8999	39	2	87.8	-0.02
More than 9000	15	2	97.7	0.78
This test is insignificant at p value of 0.05, level of significance α=0.05				

Examining the level of significance 0.05 is equal to the significance level which led to rejecting the null hypothesis; in other words, there's a statistical difference between the different incomes in the awareness.

iii. Statistical difference based on financial support for the maintenance solar heater.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_0: there is no statistical difference between in different financial support for the maintenance solar heater.

H_1: there is a statistical difference between in different financial support for the maintenance the solar heater.

The significance level of 5% the following results shown in table (44) were obtained:

Table 44:Kruskal-Wallis test maintenance the solar system versus financial support

Financial support	N	Median	Ave rank	z-value
never	43	2	105.8	2.65
partially	51	2	83.3	-0.78
Entirely	81	2	81.5	-1.58
This test is significant at p value of 0.016, level of significance α=0.05				

Examining the level of significance (0.016<0.05) led to rejecting the null hypothesis; in other words, there's a statistical difference between the different financial support in the awareness.

- The second question was do you use the solar heater? The result shows that there was a statistical difference between the using of solar heater with educational level only as shown below.

iv. Statistical difference based on educational level for using solar heater.

Kruskal-Wallis test was conducting for testing the following null hypothesis:

H_0: there is no statistical difference between educational levels for using solar heater

H_1: there is a statistical difference between educational levels for using solar heater

The significance level of 5% the following results shown in table (45) were obtained:

Table 45:Kruskal-Wallis test using solar heater the solar system vs educational level

Educational level	N	Median	Ave rank	z-value
Primary	4	3	132.5	1.81
Secondary	24	3	103.1	1.63
Diploma	13	2	68.8	-1.39
Bachelor’s degree	109	2	83.9	-1.21
Higher education	24	2	90.8	0.34
This test is significant at p value of 0.047, level of significance α=0.05				

Examining the level of significance (0.047<0.05) led to rejecting the null hypothesis; in other words, there’s a statistical difference between the different educational level in the awareness.

5.7 Hypotheses testing

This study aims to test ten hypotheses relating each of the independent variables with electricity consumption. The correlation coefficients of these hypotheses are illustrated table (46):

Table 46 :Correlation between the independent variables with the electrical consumption

	Electrical consumption	
	r	P-value
Income	0.299	0.000
Type of housing	-0.002	0.975
Educational level	0.041	0.565
Gender	0.062	0.385
Age	-0.028	0.690
Surrounding environment	0.050	0.484
Attitudes	0.003	0.971
Family number	0.377	0.000
Level of knowledge	-0.072	0.314

In correlation test, if one variable tends to increase as the other decreases, the correlation coefficient is negative. Conversely, if the two variables tend to increase together the correlation coefficient is positive. We discuss each hypothesis hereunder:

Hypothesis (H1): high-income families do not care about working to reduce energy consumption compared to low-income earners.

The current study found that the correlation coefficient of the income factor was positive. And the P-value was 0.000 which is lower than 5%. Thus, high income families care about working to reduce electricity consumption. So, we will reject the first hypothesis.

Hypothesis (H2): The type of building (old or modern) is associated with an inverse relationship with the amount of electricity consumed, when the house is modern and equipped with energy conservation systems. The energy consumed was less than that of the old houses.

The current study found that the correlation coefficient of the type of building factor was negative. So, the electrical consumption will increase if the building is old. And the P-value was 0.975 which is higher than 5%. Thus, the modern house will consume the energy less than the old one. So, we will accept the second hypothesis.

Hypothesis (H3): The level of education in the Palestinian families is positively associated with the awareness of individuals and their willingness towards energy consumption.

We found that the correlation coefficient (r) of the education level variable was positive. So, if the educational level is high, this will affect the electrical consumption to decrease it and conserve it and the individuals have high willingness awareness towards conserving electricity. And the P-value was 0.565 which is higher than 5%. Then in this case we will accept the third hypothesis.

Hypothesis (H4): energy consumption in households is increasing in males more than in females.

We found that the correlation coefficient (r) of the gender variable was positive. And the P-value was 0385 which is higher than 5%. So, we get that males consume the electricity more than females. Then in this case we will accept the third hypothesis.

Hypothesis (H5): middle aged of individuals in household (19 to 65 years of age) is the most age group that Take care to reduce energy consumed in homes.

We found that the correlation coefficient (r) of the age variable was negative. So, if individuals with age less than 19 year old that will increase the electricity consumption, and will not care about the electricity conserving. And the P-value was 0.690 that is higher than 5%. Then in this case we will accept the fifth hypothesis.

Hypothesis (H6): The external environment increases the electricity consumption at homes.

This hypothesis was accepted in this research as the analysis of the data found that the correlation coefficient (r) has a positive value, and the P-value was 0.484 that is higher than 5%. That mean homes that surrounded by pollution and noise resources, individuals have to close windows, doors (they buy their comfort) and this will increase the electricity consumption.

Hypothesis (H7): Government policies that imposed on households with high energy consumption are a disincentive to increasing energy consumption and thus reduce the amount of energy consumed in households.

When government impose financial penalties for who consume the electricity more than the limit especially at peak times that will oblige individuals to conserve the electricity.

Hypothesis (H8): The habits and attitudes of individuals in household increase the amount of energy consumption.

This hypothesis was accepted in this research as the analysis of the data found that the correlation coefficient (r) has a positive value, and the P-value was 0.971 that is higher than 5%.

Hypothesis (H9): The increase numbers of occupants will increase the amount of energy consumption.

This hypothesis was rejected in this research as the analysis of the data found that the P-value was 0.000 which is lower than 5%, and the correlation coefficient (r) has a positive value. This means that increase or decrease in the number of home members do not affect the electricity consumption.

Hypothesis (H10): the good knowledge of energy savings will decrease the electricity consumption.

This hypothesis was accepted in this research because the analysis of the data found that the correlation coefficient (r) has a negative value, and the P-value was 0.314 which is more than 5%. When the individuals have a good knowledge about high electricity consumption future risks, they will propel to decrease the consumption.

The result of hypotheses testing showed that the ten main variables; type of housing, educational level, gender, age, surrounding environment, attitudes, and level of knowledge factors were insignificant and affect the electricity consumption. On the other hand; income, and total family number factors were significant and do not affect the electricity consumption.

5.8 Normality checks of the variables

Since normality is a prerequisite for many statistical tests including
regression, ANOVA and other tests, the normality test for dependent variable was conducted using Anderson-Darling test.

The result for the normality test showed that the data of the represent sample was not normal.

The statistics have shown that if a variable fails a normality test there are three options, first it is critical to look at the histogram and the normal probability plot to see if an outlier or a small subset of outliers has caused the non-normality. If there are no outliers, you might try a transformation (such as, Box-Cox) to make the data normal. If a transformation is not a viable alternative, you can use nonparametric methods that do not require normality may be used. (NCSS Statistical software, 2018).

Based on the option of using data transformation techniques in order to transform the data into normal distribution we applied Box-Cox transformation with optimal lambda.

Box & Cox (1964) proposed a parametric power transformation technique in order to reduce non-normality that necessary assumption for a linear model, by using a mathematical functions. With represented in the below equation (1):

$$y_i^{(\lambda)} = \begin{cases} y_i^{\lambda}; & \lambda \neq 0 \\ \log y_i; & \lambda = 0 \end{cases}$$

Equation 1 : Mathematical function for Box-Cox transformation

After applied the Box-Cox transformation, the data transferred into normal distribution with (P-value >0.05)).

5.9 Regression Models

5.9.1 Residuals check

This study aims to build a multiple regression between dependent variable (willingness) as a response, and the two independent variables (awareness and knowledge) as predictors.

- **Analyzed residuals' distribution:**

  The residuals are analyzed by using a normality test of residuals, and examining the resulting p-value.

  The null hypothesis for residuals' distribution is

  H_0 : Distribution is normal

  While the alternative hypothesis is

  H_1 : Distribution is not normal

  Therefore, the resulted p-value is equal 0.06, which higher than the level of significance of 5%, then the null hypothesis is accept and the distribution is normal, and the regression model is a good fit for the data.

- **Residuals independence:**

  In this test a hypothesis used to examining the autocorrelation, which could be done by using Durbin Waston test, the value of Durbin Waston appear in the output of the regression model in Minitab. The statistics ranges of the value from 0 to 4.

  A value closer to 0 indicates a positive autocorrelation, while the value closer to 4 indicates a negative autocorrelation, and a value near to 2 indicates that's there is autocorrelation.

  The resulted value of Durbin-Watson statistic equal 1.77167, which closer to 2.

  So there is no autocorrelation.

- **Multicollinearity (correlation between predictors) :**

  Multicollinearity could be measured by examining the values of Variance Inflation Factor (VIF) column in the output of a regression models.

  In this regression model the correlation between the two predictors equal

8.04451, which acceptable according to researches that considered a value of 10 to be a maximum acceptable value. (Kennedy, 1992)

So, the residual check above approve that the model represents a good fit for the data.

5.9.2 Main Regression Model

In order to achieve the best analysis for the data and have the optimal regression model which fit the data most, different type of regression were examined. First, examine a simple regression between the response (willingness) and each of predictors (knowledge and awareness).

Then a multiple regression model of first degree polynomial and multiple regression model of second degree polynomial were tested.

- **Testing the significance of each predictors :**

  Two simple regression models were test between the two significant predictors.

  Table (47) summarizes the results of these two models:

Table 47 : Simple regression model between independent variables and willingness

Predictor	Regression Equation	P-value	R^2	Adj-R^2	Decision
Awareness	willingness = 0.816 + 0.644 Awareness	0	44.1%	43.8%	Significant
Knowledge	willingness = 2.11 + 0.193 knowledge	0	8.1%	7.6%	Significant
Level of significance α = 5%					

The P-value of each predictor are lower than the significance level of 0.05 , indicating that each independent variable is significant, which means that any change in the predictors will lead to change in response variable.

Therefore, the next multiple regression model uses all of these predictors together.

- **Multiple regression model of first degree polynomial between willingness and significant independent variables:**

The resulted regression equation was:

Willingness^2 = 2.14706 Awareness + 0.423546 knowledge

- **Testing model significance (F-test of overall significance of the model)**

  In general, an F-test in regression compares the fits of different linear models; the F-test can assess multiple coefficients simultaneously.

The hypotheses for the F-test of the overall significance are as follows:

- **Null hypothesis**: $\beta_0=\beta_1 = \ldots\ldots \beta_k=0$

- **Alternative hypothesis**: $\beta_j \neq 0$ for at least one j

From the table of (Analysis the variance), we notice that the significance of the regression model is 0.0, indicating that at least one coefficient is not equal to zero, which means that a linear relationship exists.

- **Testing individual regression model coefficient :**

- **Null hypothesis**: $\beta_j=0$; j=1,2,…..,k

- **Alternative hypothesis**: $\beta_j \neq 0$; j=1,2,…..,k

*** k: number of repressors (Here k=2)**

The values of the slope coefficient β's are illustrated in Table (48):

Table 48 : Coefficient values for regression model

Predictor	coefficient	Value	Standard Error of the coefficient	P-value
Awareness	β_1	0.110456	0.051507	0.000
Knowledge	β_2	0.613329	0.035985	0.002
Level of significance α = 0.05				

The slope coefficients (β's) find on the Table (48) for the two factors are positive, which mean that the two factors have a positive influence on willingness. The highest influence was for Knowledge factor with 0.613329, then Awareness factor with 0.110456.

Notice that the value of R^2 of this model was 46.67%, R^2 adjusted was 46.13%

This means the amount of variability in willingness in conserve electrical consumption explained by the model is around 46%.

- **Residuals Check**

The checking of the residuals values stored in the model, indicated that the residuals have a non-normal distributed with p-value less than 0.005, which lower than the level of significance of 5%, then the null hypothesis is reject and the distribution is not normal, and the regression model can't analysis the data.

The probability plot for residuals are seem to be as illustrated in figure (18) .

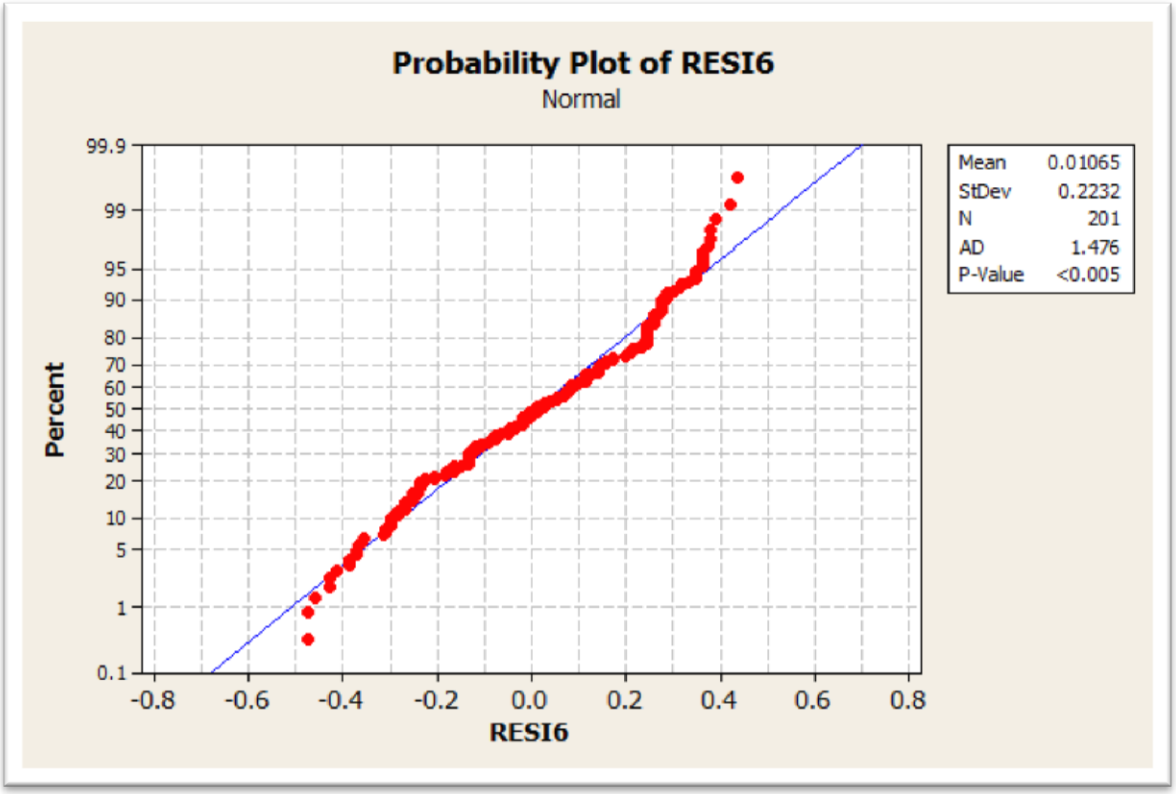


Figure 18 : Normality plot of residuals before transformation

Also the independency of residuals which tested by Durbin-Watson statistic value, which showed that the residuals are independent since DW statistics is 1.82767 which is close to 2,

Moreover, about multicollinearity, in this regression model the correlation between the two predictors equal 1.03818, which acceptable according to researches that considered a value of 10 to be a maximum acceptable value. So there is no multicollinearity.

i. **First degree polynomial between independent constructs and willingness modification.**

In order to achieve the regression model that fit the data, the residuals must follow the normal distribution. So, a Box-Cox transformation will perform on the response data then analyze the transformed response in the general regression analysis.

Also, in order to improve the R^2 and R^2 adjusted values, by uncheck the intercept to fit the model without a constant term (β_0).

The resulted regression equation was:

Willingness^2 = 2.14706 Awareness + 0.423546 knowledge

- **Testing model significance (F-test of overall significance of the model)**

In general, an F-test in regression compares the fits of different linear models; the F-test can assess multiple coefficients simultaneously.

The hypotheses for the F-test of the overall significance are as follows:

- **Null hypothesis**: $\beta_1 = \ldots\ldots \beta_k = 0$
- **Alternative hypothesis**: $\beta_j \neq 0$ for at least one j
-

From the table of (Analysis the variance), we notice that the significance of the regression model is 0.0, indicating that at least one coefficient is not equal to zero, which means that a linear relationship exists.

- **Testing individual regression model coefficient :**
- **Null hypothesis**: $\beta_j = 0$; j=1,2,…..,k
- **Alternative hypothesis**: $\beta_j \neq 0$; j=1,2,…..,k

*** k: number of repressors (Here k=2)**

The values of the slope coefficient β's are illustrated in Table (49) :

Table 49 : Coefficients values for modification regression model

Predictor	coefficient	Value	Standard Error of the coefficient	P-value
Awareness	β_1	2.14706	0.077911	0.000
Knowledge	β_2	0.423546	0.160463	0.009
Level of significance α = 0.05				

The slope coefficients (β's) find on the Table (49) for the two factors are positive, which mean that the two factors have a positive influence on willingness. The highest influence was for awareness factor with 2.14706, then knowledge factor with 0.423546.

Notice that the value of R^2 of this model was 97.36%, R^2 adjusted was 97.33%.
This means the amount of variability in willingness in conserve electrical consumption explained by the model is around 97%.

- **Residuals Check**

The checking of the residuals values stored in the model illustrated in the figure (19), indicated that the residuals were distributed normally with p-value 0.06, which higher than the level of significance of 5%, then the null hypothesis is accept and the distribution is normal. So, now the regression model is a good fit for the data.

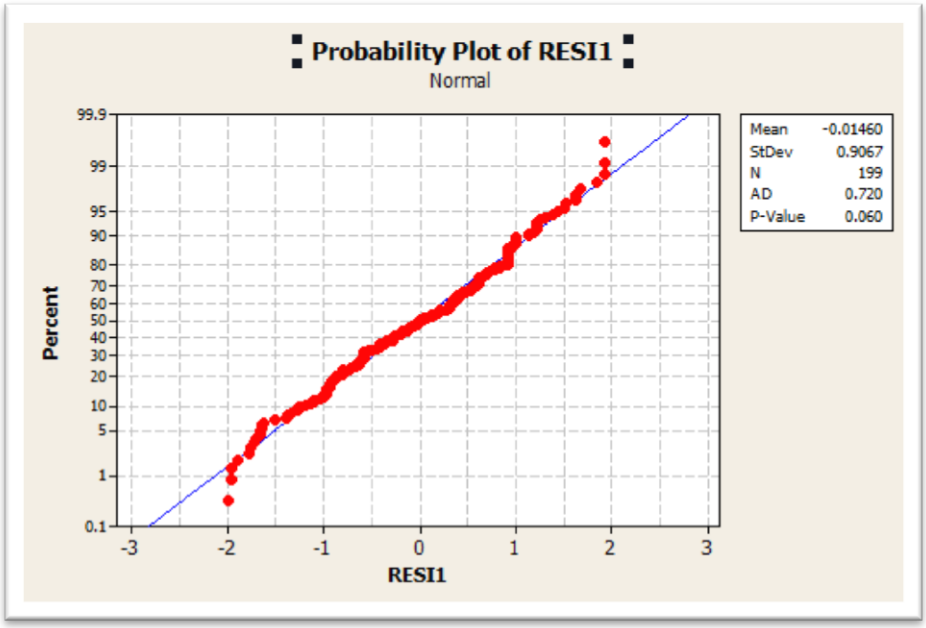


Figure 19 :Normality plot for residuals

Moreover, the independency of residuals which tested by Durbin-Watson statistic value, are showed that the residuals are independent since DW statistics is 1.77167 which is close to 2.

Also about multicollinearity, in this regression model the correlation between the two predictors equal 8.04451, which acceptable according to researches that considered a value of 10 to be a maximum acceptable value. So there is no multicollinearity.

The detailed Minitab results of this model are shown in appendix (3).

Chapter Six

Conclusion and Recommendations

6.1 Overview

This chapter presents the summarize results of the research and drives conclusion .beside that it aims to suggest some recommendations regarding enhancing people to rationalize their electrical consumption.

6.2 Conclusion

Due to large consumption of electricity in residential sector in west bank, the study was made to covering and analyzing the factors which had a negative effect on their electricity consumption.

So, the reason behind under taking this research was to meet three main objectives:

1. What are the awareness levels of Palestinian residential electricity consumers towards conserving electricity in their homes?
2. What are the attitudes of Palestinian residential electricity consumers towards conserving electricity in their homes?
3. What are the levels of willingness of Palestinian residential electricity consumers towards conserving electricity in their homes?

In order to archive these objectives, the current research followed the quantitative approach in which a questionnaire was used to gather the required data for analysis.

The data was analyzed using Minitab software package. This study examined ten main hypotheses which related the ten independent factors with the main dependent variable.

The findings have shown the strongest correlations between the studied factors and the consumption.

The results showed that eight out of ten main independent variables had a significant influence on electricity residential consumption in West bank. These were educational level, age, gender, surrounding environment, type of house, level of knowledge and attitudes.

According to the research questions, the variables of knowledge, willingness and awareness were examined by building a regression model for the data, different attempts were under taken to build the model for the data most, the best model suggested that was the first polynomial degree of multiple regression for the two independent variables which are knowledge and awareness, and the dependent variable willingness.

These factors explain about 97% of the variability in willingness about the consumption in west bank, the highest impact was for the knowledge factor, followed by the awareness.

Statistical difference based on demographic factors show that there was statistical significant regarding age, marital state, financial support and educational level to awareness. Then for willingness there were statistical significant between it and each of age, marital state and financial support. Finally the knowledge has a statistical significant just with educational level.

6.3 Contribution of the study

While reading the available literature related to factors affecting household's electricity consumption, it was noted that the number of studies in the Arab world was limited, and none of these studies Palestinian context. Therefore, the current research is the first to analyze and determine the factors affecting house hold's electricity consumption in Palestine and the relative significance of each factor.

6.4 Recommendation

- Unplug your appliances when they're not in use
- Buy appliances with a good energy rating
- Pick the right washing machine
- Choose an energy-efficient devices
- Insulate your roof or ceiling
- Avoid installing downlights
- Close all external windows and doors
- Shade your windows
- Install ceiling fans
- For a governmental recommended polices, add a penalty percentage when people consume the electricity more than limit at peak hours.
- Use a LED pulps in lighting system to decrease the electricity consumption in homes.

References:

- Abhishek Bhati, M. H. (2017). Energy conservation through smart homes in a smart city: A lesson for Singapore households. *Energy Policy*, 230-239.
- Agarwel, satyanarain, sing, & vollmer. (2016). Effects of construction activities on residential consumption. *Effects of construction*.
- Bradford, M. J. (2012). Residential energy-efficient technology adoption, energy conservation, knowledge, and attitudes: An analysis of European countries. 616-628.
- Brock, C., Collier, J., & Wilfong, K. (n.d.). *Assessing and Reducing the Electricity Consumption of Residential Students.*
- Brounen, Kok, & J.M. (2012). *Residential Energy Use and Conservation: Economics.* European Economic Review.
- Canadell, J. G., Quéré, C. L., & Raupach, M. R. (2007). Contributions to accelerating atmospheric CO2 growth from economic activity, carbon intensity, and efficiency of natural sinks. *Proceedings of the National Acadmic of Sciences of the United States of America* , 18866–18870.
- Carden, p. (2011). *advances in energy conversation.* The English Press.
- Curtis, F. S.-H. (1984). Household energy conservation. *Energy Policy*, 452–456.
- Daniel, W. W., & Cross , C. L. (2013). *Biostatistics: A Foundation for Analysis in the Health Sciences, 10th Edition.* Wiley.
- Dirk Brounen, N. K. (2012). Residential energy use and conservation: Economics. *European Economic Review*, 931–945.
- ECN/RIVM. (1998). *Nationale Energie Verkenningen 1995-2020.* Energieonderzoek Centrum Nederland.
- Emagazine. (2006). *Clear Air Cool Planet Energy Use.*
- Fokkema, p. d. (2006). *Policies for improving energy.* Minna Marjaana SUNIKKA.

- Gardner, G. T., & Stern, P. C. (1996). *Environmental problems and human behavior* . Boston: Allyn and Bacon.
- Gireesh Nair, L. G. (2013). Factors influencing energy efficiency investments in existing Swedish residential buildings. 591-602.
- Glossary. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Intergovernmental Panel on Climate Change.
- Guerin, D., Yust, B., & Coopet, J. (2000). Occupant Predictors of Household Energy Behavior and Consumption Change as Found in Energy Studies Since 1975. *Family and Consumer Sciences Research Journal*, 48-80.
- George, D. &. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.).* Boston: Allyn & Bacon.
- Goforth, C. (2015, Nov. 16). *Research Data services + sciences*. Retrieved from Using and Interpreting Cronbach's Alpha: http://data.library.virginia.edu/using-and-interpreting-cronbachs-alpha/
- Guo Ma, P.-S. J. (2013). *Energy Policy.*
- Holtberg, P., & Conti, J. (2011). *Emissions of Greenhouse Gases in the United States 2009.* Washington, DC: U.S Energy Information Administration.
- IEA, (. t. (2002). *World Energy Outlook.*
- Institute, P. E. (2012). *Renewable Energy in the Palestinian Territory:Opportunities and Challenges.* Palestine: MAS.
- Institute, P. E. (2014). *Country paper for the State of Palestine: Energy sector.* Palestine.
- Institute, P. E. (2014). *The Electricity Sector: Current Status and The Need Reform* . Palestine: MAS.
- Kennedy , Peter ; A Guide to Econometrics (1992)
- Lutzenhiser, L. (1992). A cultural model of the household energy consumption. *energy*, 47–60.
- Lutzenhiser, L. (1993). Social and Behavioral Aspects of Energy Use. *Annual Review of Energy and the Environment 18*, pp. 247-289.
- M.Macey, M. A. (1985). Evaluating the impact of two energy conservation programmes in a midwestern city. *Applied Geography*, 39-53.

- Mahapatra, K. G. (2008). An adopter-centric approach to analyze the diffusion patterns of innovative residential heating systems in Sweden. *Energy Policy*, 577–590.
- Mario Collotta, G. P. (2015). A novel energy management approach for smart homes using bluetooth low energy. 2988-2996.
- Mills, B. a. (2010). What's Driving Energy Efficient Appliance Label Awareness and Purchase Propensity? *Energy Policy*, 814-825.
- Mills, B., & Schleich, J. (2012). Residential Energy-Efficient Technology Adoption,. *An Analysis of European Countries*, 616-628.
- Oates, B. J. (2006). *Researching Information Systems.* London: SAGE Publications Ltd.
- Pachauri, & Meyer. (2014). *Climate Change 2014:Synthesis Report.* Geneva, Switzerland: IPCC.
- PCBS. (2015). *Household Energy Survey:Main Results.* Ramallah - Palestine: Palestinian Central Bureau of Statistical.
- PCBS. (2016). *Palestine stastical Yearbook.* Palestinian Central Bureau of Stastics.
- PCBS. (2016). *Palestinian statistical yearbook 2016.* Palestinian Central Bureau of Statistics.
- PENRA, P. (2011). *Energy Tables.* Ramallah-Palestine.
- PENRA, P. E. (2009). *Energy Tables.* Ramallah-Palestine.
- PENRA, P. E. (2010). *Energy Tables.* Ramallah-Palestine.
- PENRA, P. E. (2012). *Energy Tables.* Ramallah-Palestine.
- PENRA, P. E. (2013). *Energy Policy.* Ramallah-Palestine.
- PENRA, P. E. (2015). *Energy Tables.* Ramallah-Palestine.
- PENRA, P. E. (2016). *Energy Tables.* Ramallah-Palestine.
- PERC. (2011). *palestinian electricity regulatory council*. Retrieved from http://www.perc.ps/ar/index.php?p=ser37
- Peterson, T. C., Karl, T. R., & Melilo, J. M. (2009). *global climate change impacts in US.* United States of America: Cambridge University Press.

- Poortinga, W. L. (2003). Household preferences forenergy-saving measures: a conjoint analysis. *Economic Psychology*, 49-64.
- Räty, R.-K. A. (2010). Energy consumption by gender in some European countries. *Energy Policy*, 646-649.
- S P Borg N. J. (September 2011). *The effect of appliance energy efficiency improvements on domestic electric loads in european HouseholdS.* Glasgow, UK : Energy Systems Research Unit, Mechanical Engineering, University of Strathclyde.
- S. Agarwal, R. S. (2016). Effects of construction activities on residential electricity consumption: evidence from Singapore's public housing estates. *Energy consumption*.
- Sexton , S. E., & Sexton, A. L. (2011). Conspicuous Conservation: The Prius Effect.
- Sinden, G. (2005). *The Guardian.*
- Triandis. (1977). *Theory of Interpersonal Behaviour.*
- VANESSA BRECHLING, S. S. (1994). Household Energy Efficiency in the UK. 44–56.
- Viklund, M. (2004). Energy policy options—from the perspective of public attitudes and. *Energy Policy*, 1169-1171.
- Walsh, M. (1989). Energy tax credits and housing improvement. *Energy Economics*, 275–284.
- Whitmarsh, L. (2009). Behavioural responses to climate change: Asymmetry of intentions and impacts. *Journal of Environmental Psychology*, 13-23.
- *World Energy Resources* . (2016). Retrieved from word energy council: https://www.worldenergy.org/publications/2016/world-energy-resources-2016/
- *World Energy Resources 2016*. (2016, October). Retrieved from https://www.worldenergy.org/publications/2016/world-energy-resources-2016/
- X.Y. Xu, B. A. (2013). Analysis residential energy consumption using index decomposition analysis. *Appl. Energy, 113* , 342-351.
- Xu, & Ang. (2013). Analysis residential energy consumption using index decomposition analysis. pp. 342-351.
- Zhihua Ding, G. W. (2017). Research on differences in the factors influencing the energy-saving behavior of urban and rural residents in China–A case study of Jiangsu Province. *Energy Policy*, 252-259.

- Zikmund, W.G., Babin, J., Carr, J. & Griffin, M. (2012) “Business Research Methods: with Qualtrics Printed Access Card” Cengage Learning

- Retrieved septemper 21, 2014, from sasapos: https://www.sasapost.com/10-ulternative-energy-sources/

Appendix (1)

استبيان قياس مدى وعي المواطن لترشيد استهلاك الطاقة الكهربائية

عزيزي المواطن، نحن طالبات مشروع تخرج من كلية الهندسة وتكنولوجيا المعلومات في جامعة النجاح الوطنية نضع بين أيديك استبياناً خاصاً لقياس مدى الوعي والسلوك لترشيد استهلاك **الكهرباء** في المنازل ،وشاكرين تعاونك معنا للإجابة على فقرات الاستبيان، حيث أن الدقة والموضوعية في إجاباتكم وأرائكم تعكس وعيكم وحرصكم على وصولنا إلى النتائج الدقيقة والصحيحة المرجوة علماً بأن المعلومات الواردة سوف تستخدم لأغراض البحث العلمي فقط وستعامل بسرية تامة مع خالص شكرنا وتقديرنا لتعاونكم معنا...

يرجى من حضرتكم تعبئة البيانات التالية و اختيار ما ترونه مناسبا ومنطبقا عليكم في كل من الأسئلة التالية :

1	**المعلومات الشخصية**				
1.1	العمر	○18-25	○26-35	○36-45	○45 فأعلى
1.2	الجنس	○ذكر	○أنثى		
1.3	الحالة الاجتماعية	○أعزب	○متزوج		
1.4	المستوى التعليمي	○ابتدائي	○ثانوي	○دبلوم	○بكالوريوس ○دراسات عليا
1.5	المحافظة				
	مكان المنزل	○مدينة	○قرية	○مخيم	

2	**العوامل الاقتصادية**				
2.1	معدل الدخل الشهري للعائلة (بالشيكل)	○أقل من 2000	○ 2000-5999	○6000-8999	○9000 فأكثر
2.2	أعيل عائلتي ماديا	○بشكل كامل	○بشكل جزئي	○أبدا	
2.3	معدل استهلاك الكهرباء شهريا(تقريباً) (بالشيكل)	○100-199	○ 200-399	○400-599	○600 فأكثر
2.4	نوع عداد الكهرباء	○ عادي	○عداد دفع المسبق		
2.5	هل يترتب عليك أي ديون سابقة لشركة الكهرباء	○نعم	○لا		
2.6	هل يوجد لديك أجهزة كهربائية قديمة (أكثر من 5 سنوات):	○ نعم بشكل كلي	○نعم بشكل جزئي	○لا يوجد	
	← إذا كانت إجابة 2.5 ما مدى استخدامك لها	○دائما	○أحيانا	○نادرا	

3	**الأجهزة الكهربائية المستخدمة في المنزل : يرجى تعبئة البيانات التالية**

الأجهزة	العدد	الأجهزة	العدد
جهاز تكييف		مضخة ماء	
مروحة		جهاز حاسوب	
مدفأة كهربائية		مايكروويف	
مدفأة غاز		غسالة	
مدفأة كاز		نشافة	
سخان ماء(بويلر)		سشوار	
سخان ماء(اتمور)		فريزر مستقل	
سخان ماء (كتل)		شفاط كهربائي	
تلفاز		ثلاجة	
مكنسة كهربائية		مبرد مياه (كولر)	
مكواة		غاز كهربائي	
توستر		الخلاط الكهربائية	

الجلاية				
← **إذا كان لديك أجهزة أخرى ما هي، وما عددها** ..... ، .... ، .... ،				
3.2	**عند شراء جهاز جديد هل تأخذ بعين الاعتبار مدى توفيره في استهلاك الكهرباء (Energy star)؟**	○دائما	○أحيانا	○أبدا
3.3	**في حال تم اضافة خاصية توفير الطاقة لجهازك مقابل مبلغ معقول من المال هل انت على استعاداد لشراءه ؟**	○دائما	○أحيانا	○أبدا

4	**مواصفات المنزل**					
4.1	طبيعة السكن	○بيت مستقل	○شقة في عمارة			
4.2	المكان الذي اسكن فيه	○ ملك	○أجار			
4.3	عدد أفراد العائلة التي اسكن معها					
4.4	عدد الأفراد الذين تتراوح أعمارهم من سنة إلى 18 سنة					
4.5	عدد كبار السن في المنزل ممن تتراوح أعمارهم فوق ال65 سنة					
4.6	مساحة الكلية للمنزل (م^2)					
4.7	تاريخ بناء المنزل	○1979 فما قبل	○1989-1980	○1999-1990	○2009-2000	○2010 فما بعد
4.8	هل يوجد في البيئة المحيطة لمنزلك أي مصدر للضجيج او تلوث بيئي(شارع رئيسي ، روائح كهربائية ،مصنع ...) ؟	○نعم بشكل كلي	○نعم بشكل جزئي	○أبدا		
4.9	اذا كان جواب 4.8 هل تعتقد انه يؤثر بشكل سلبي على استهلاك الكهرباء(مثلا زيادة في تشغيل مكيفات)؟	○نعم بشكل كلي	○نعم بشكل جزئي	○أبدا		
4.10	هل بناء المنزل يتضمن مواد عازلة لانتقال الحرارة والبرودة ؟	○نعم بشكل كلي	○نعم بشكل جزئي	○أبدا		
4.11	عدد طبقات الشبابيك في المنزل	○طبقة	○طبقتين	○لا أعرف		
4.12	نوع إطار الشبابيك	○ألمنيوم	○حديد	○خشب		
4.13	نوع الإضاءة المستخدمة في المنزل(يمكن اختيار أكثر من إجابة)؟	○مصابيحLED	○ فلوريسنت (نيون ابيض)	○ لمبة تنجيستون 		
5	**هذا القسم يتعلق بسلوك أهل المنزل بما يخص موضوع ترشيد استخدام الطاقة الكهربائية في المنزل :**					
5.1	أقوم بإطفاء الإضاءة في غرف و مرافق المنزل المختلفة في حال عدم تواجد احد فيها	○دائما	○أحيانا	○أبدا		

5.2	أقوم بفتح ستائر الغرف للاستفادة من اضاءة أشعه الشمس	○دائما	○أحيانا	○أبدا
5.3	أقوم بإضاءة جميع المصابيح عند الدخول للغرفة	○دائما	○أحيانا	○أبدا
5.4	اتاكد من إغلاق المدافئ الكهربائية عند الخروج من الغرف غير المستخدمة في الشتاء. (لأكثر من عشر دقائق)	○دائما	○أحيانا	○أبدا
5.5	أتأكد من إغلاق المراوح عند الخروج من الغرف غير المستخدمة صيفاً (لأكثر من عشر دقائق)	○دائما	○أحيانا	○أبدا
5.6	ابقي التلفازمضاءً في حين لا يوجد احد أمام التلفاز للمشاهدة	○دائما	○أحيانا	○أبدا

← إذا كنت تمتلك أجهزة تكييف داخل المنزل قم بالإجابة على الاربعة أسئلة التالية ، أما إذا كنت لا تمتلك انتقل لسؤال 5.11

5.7	اتاكد من إغلاق المكيفات عند الخروج من الغرف غير المستخدمة	○دائما		○أحيانا		○أبدا
5.8	ما معدل درجة الحرارة التي تقوم بمعايرة جهاز التكييف عليها صيفا؟					
5.9	ما معدل درجة الحرارة التي تقوم بمعايرة جهاز التكييف عليها شتاءا؟					
5.10	أقوم بصيانة و تنظيف فلاتر المكيفات صيفا وشتاءً	○دائما		○أحيانا		○أبدا
5.11	ما هي وسيلة التدفئة المستخدمة شتاءً (يمكنك اختيار أكثر من إجابة)	○كهرباء	○غاز	○كاز	○ديزيل	○غير ذلك
5.12	هل تمتلك سخان شمسي لتسخين المياه (إذا كانت الإجابة نعم قم بالإجابة على السؤاليين التاليين (5.13 ،5.14) ، و في حال كانت الإجابة لا انتقل لسؤال 5.15)	○نعم		○لا		
5.13	هل تقوم بعمل صيانة دورية لسخان الشمسي؟	○دائما		○أحيانا		○أبدا
5.14	هل تقوم باستخدام هذا السخان الشمسي بالأيام المشمسة شتاءً	○دائما		○أحيانا		○أبدا
5.15	هل تنشر الغسيل تحت أشعة الشمس بدلا من استخدام النشافة الكهربائية	○دائما		○أحيانا		○أبدا
5.16	أنا على استعداد لتغيير سلوكي المنزلي لترشيد أفضل لاستهلاك الكهرباء في حال كانت تعمل على تخفيض تكاليف فاتورة الكهرباء	○دائما		○أحيانا		○أبدا
5.17	هل تعتقد أن وسائل الإعلام لها دور فاعل في نشر ثقافة ترشيد استهلاك الطاقة الكهربائية	○دائما		○أحيانا		○أبدا
5.18	إذا كان جواب 5.17 نعم ، برأيك ما هي أفضل وسيلة لنشر ثقافة الترشيد.	1. التلفاز 2. الانترنت ووسائل التواصل الاجتماعي 3. النشرات المطبوعة				

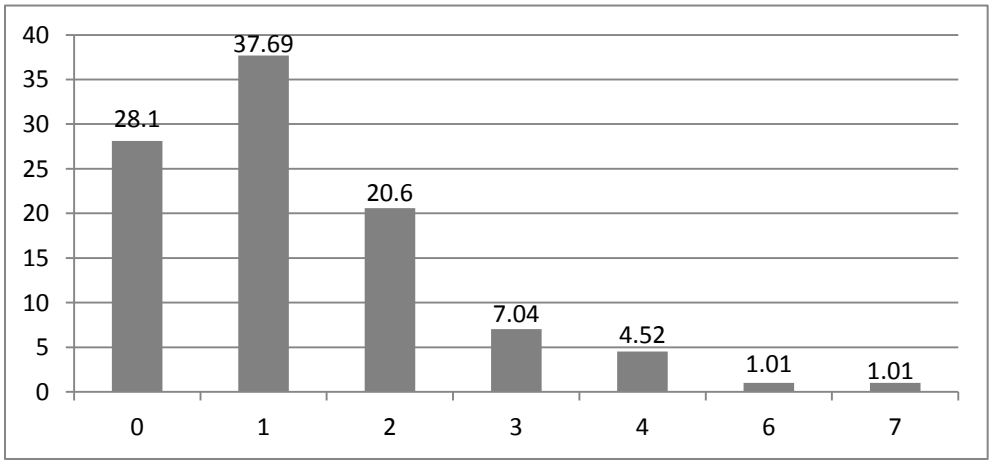
		4. الراديو 5. الإعلانات في الأماكن العامة و وبين المدن		
5.19	هل تعتقد انه من الضروري إضافة موضوع التوعية لترشيد استهلاك الكهرباء في المناهج المدرسية وذلك لتعزيز ثقافة الترشيد لدى المجتمع من ذو الصغر؟	○دائما	○أحيانا	○أبدا
5.20	من أسباب الاستهلاك الزائد للطاقة الكهربائية؟ (يمكنك اختيار أكثر من إجابة)	○شبك الأجهزة دون فصلها من الكهرباء ○قلة وعي الأفراد لضرورة ترشيد الكهرباء ○السلوكيات داخل المنزل التي تزيد من الاستهلاك للكهرباء		
5.21	هل تعتقد أن أسعار الكهرباء مرتفعة في فلسطين؟	○نعم بشكل كبير	○نعم بشكل جزئي	○لا أعلم
5.22	هل تعتقد أن معدل استهلاكك الشهري للكهرباء مرتفعة نسبيا؟	○نعم بشكل كبير	○نعم بشكل جزئي	○لا أعلم
5.23	برأيك من الأكثر استهلاكا للكهرباء ؟	○الذكور	○الاناث	○لا يوجد فرق

6	الوعي بترشيد استهلاك الكهرباء في المنزل			
6.1	هل سبق و سمعت بمفهوم ترشيد استهلاك الكهرباء ؟	○بشكل تفصيلي	○بشكل عام	○لا أعلم
6.2	اذا كانت اجابة 6.1 نعم ، فما هو مصدر معرفتك بترشيد استهلاك الكهرباء؟	○وسائل الاعلام ○الانترنت ○المدارس والجامعات ○ الكتب ○الاشخاص المحيطين ○غير ذلك		
6.3	ما مدى معرفتك بموضوع الاحتباس الحراري	○بشكل تفصيلي	○بشكل عام	○لا أعلم
6.4	سمعت عن ثقب الأوزون	○بشكل تفصيلي	○بشكل عام	○لا أعلم
6.5	سمعت عن الأمطار الحمضية	○بشكل تفصيلي	○بشكل عام	○لا أعلم
6.6	سمعت عن الانبعاثات الضارة الناتجة عن عمليات الاحتراق	○بشكل تفصيلي	○بشكل عام	c
6.5	الحلول المستقبلية التي يمكن أن تساهم بترشيد استهلاك الطاقة الكهربائية هي برأيك كما يلي : (يمكن إختيار أكثر من إجابة)	○طاقة متجددة (خلايا شمسية كهربائية) ○طاقة متجددة (مولدات بطاقة الرياح) ○طاقة متجددة (غاز حيوي) ○خفض الاستهلاك المنزلي (تحسين نظام الإنارة) ○توعية الناس بعمل المكيفات وطريقة خفض الاستهلاك ○دعم الأجهزة المنزلية الموفرة للطاقة ○تعديل كود البناء بفلسطين بحيث يصبح إجباري (عوازل، زجاج مزدوج) ○وضع حل جذري لمشكلة سرقة الكهرباء وفاقد الشبكة وعدم الالتزام بدفع الفواتير		
6.6	أقوم بالاطلاع على النشرات التي تساعد على ترشيد الطاقة	○ دائما	○أحيانا	○أبدا

Appendix (2)

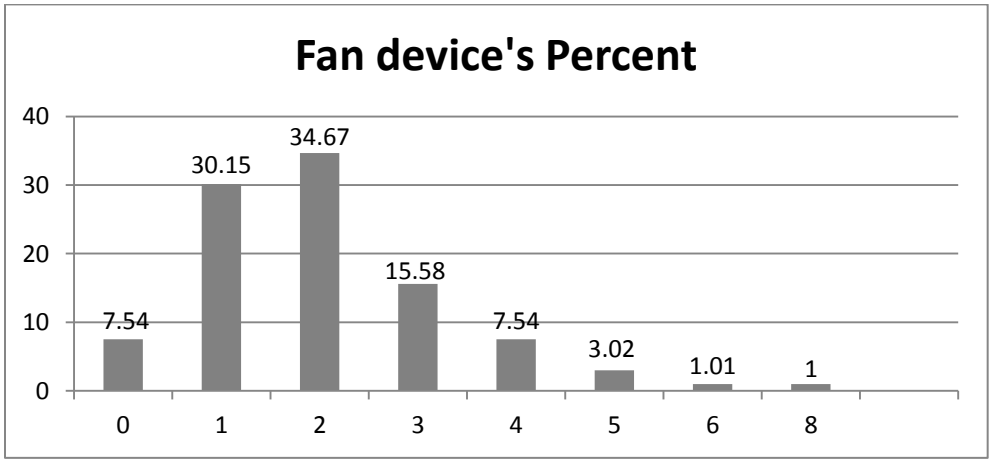
1. Air conditioners

Conditioner	0	1	2	3	4	6	7	Total
Count	56	75	41	14	9	2	2	199
Percent	28.1	37.69	20.6	7.04	4.52	1.01	1.01	100



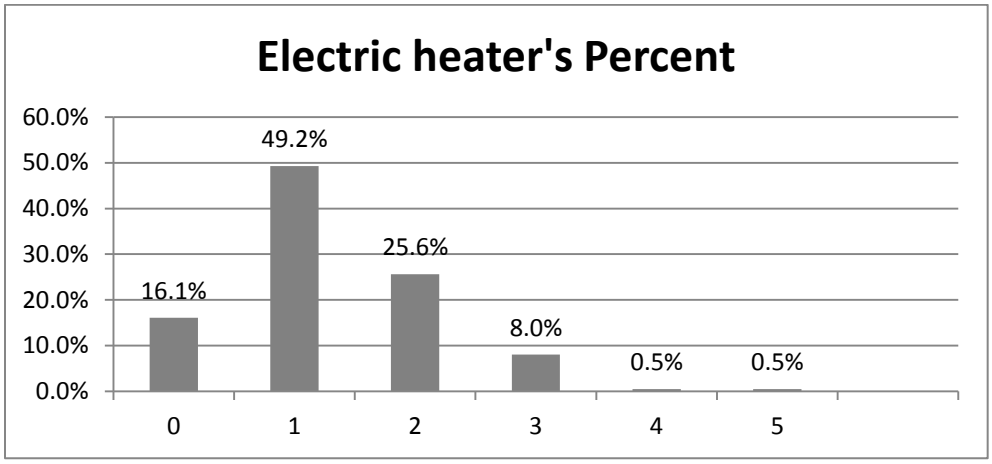
2. Fan

FAN	0	1	2	3	4	5	6	8	Total
Count	15	60	69	31	15	6	2	1	199
Percent	7.54	30.15	34.67	15.58	7.54	3.02	1.01	1	100



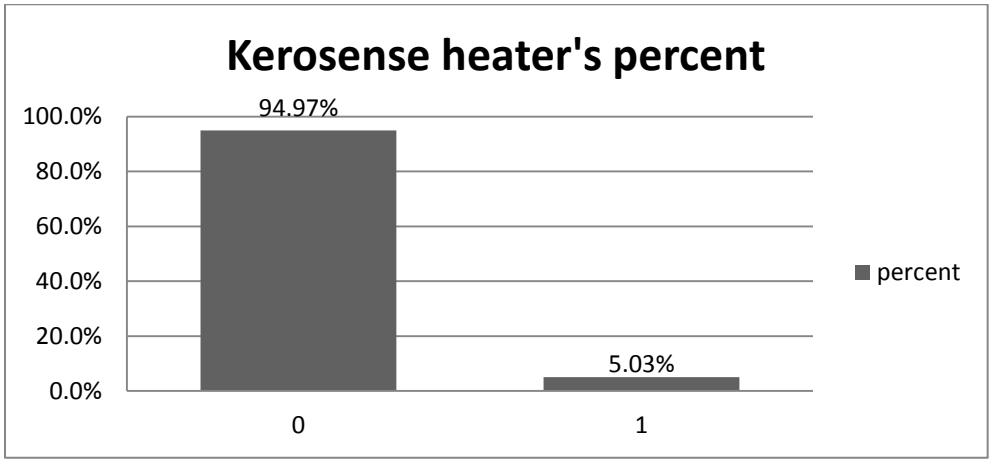
3. Electric heater

Electric Heater	0	1	2	3	4	5	Total
Count	32	98	51	16	1	1	199
Percent	16.10%	49.20%	25.60%	8.00%	0.50%	0.50%	100%



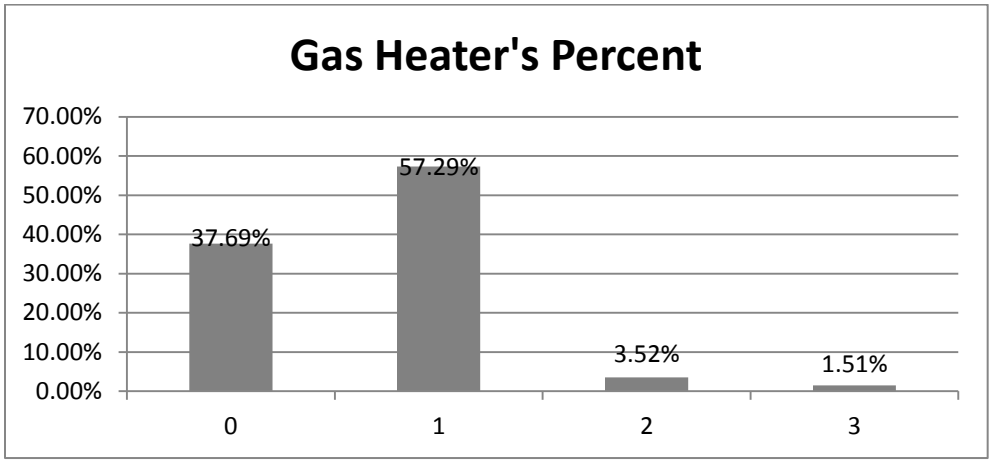
4. Kerosene Heater

Kerosene Heater	0	1	Total
Count	189	10	199
Percent	94.97%	5.03%	100%



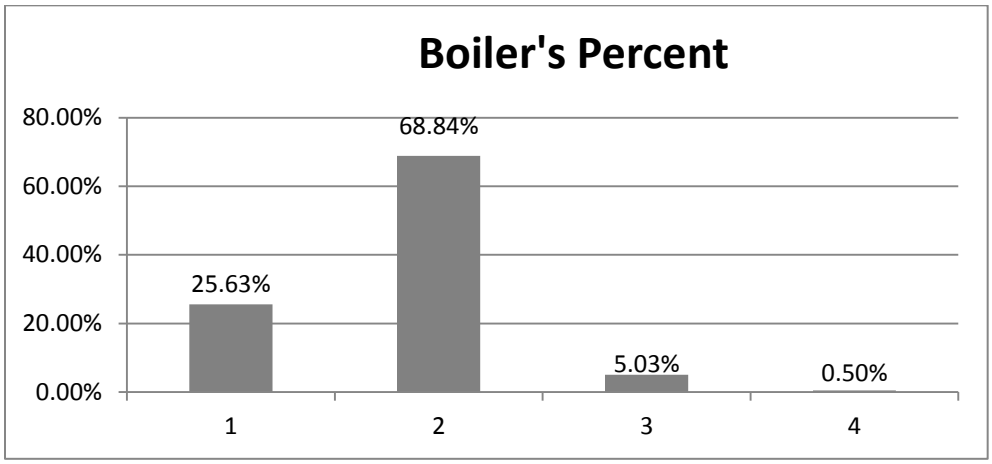
5. Gas Heater

Gas Heater	0	1	2	3	Total
Count	75	114	7	3	199
Percent	37.69%	57.29%	3.52%	1.51%	100%



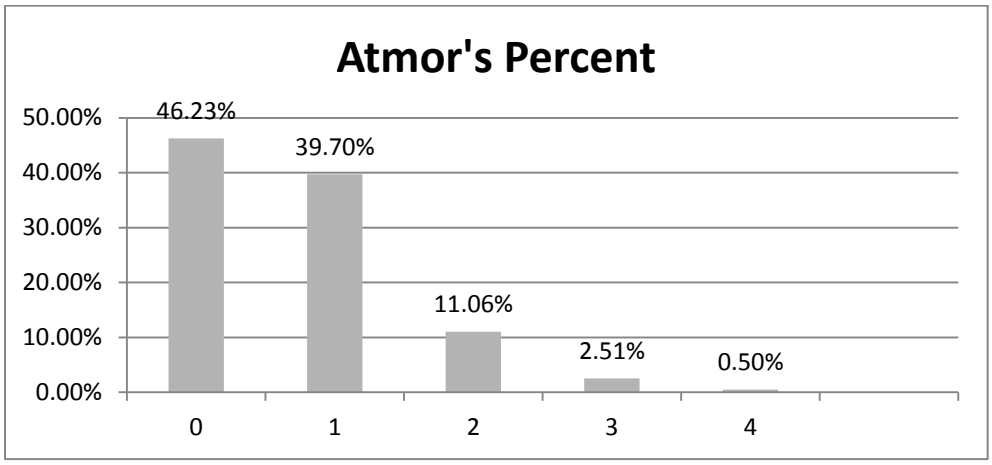
6. Boiler

Boiler	0	1	2	3	Total
Count	51	137	10	1	199
Percent	25.63%	68.84%	5.03%	0.50%	100%



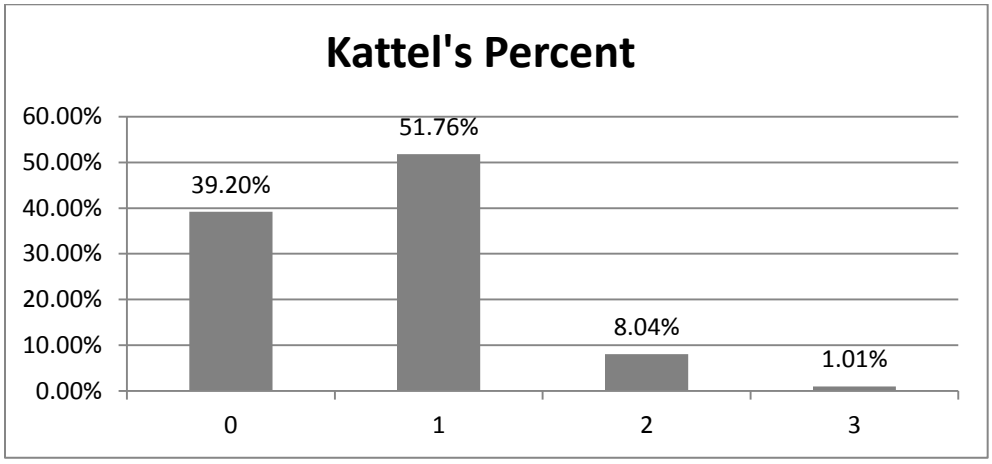
7. Atmore's

Atmore	0	1	2	3	4	Total
Count	92	79	22	5	1	199
Percent	46.23%	39.70%	11.06%	2.51%	0.50%	



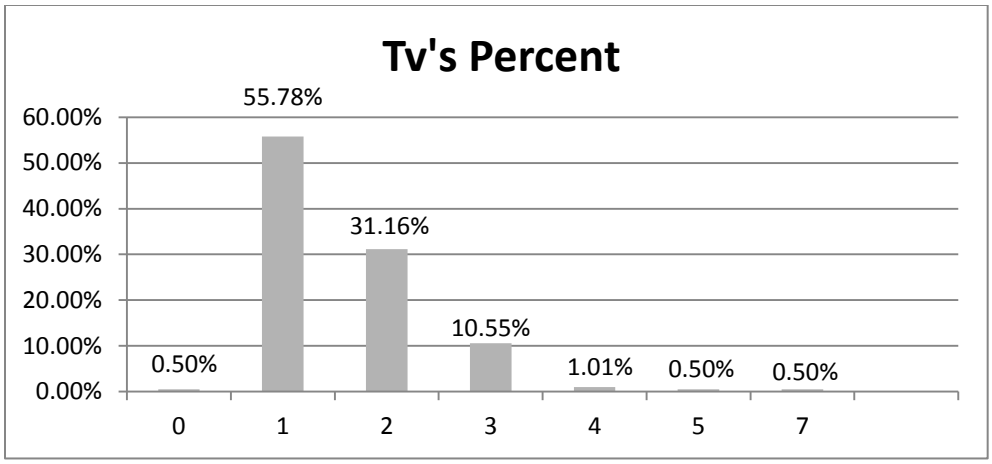
8. Kettle

Kettel	0	1	2	3	Total
Count	78	103	16	2	199
Percent	39.20%	51.76%	8.04%	1.01%	100%



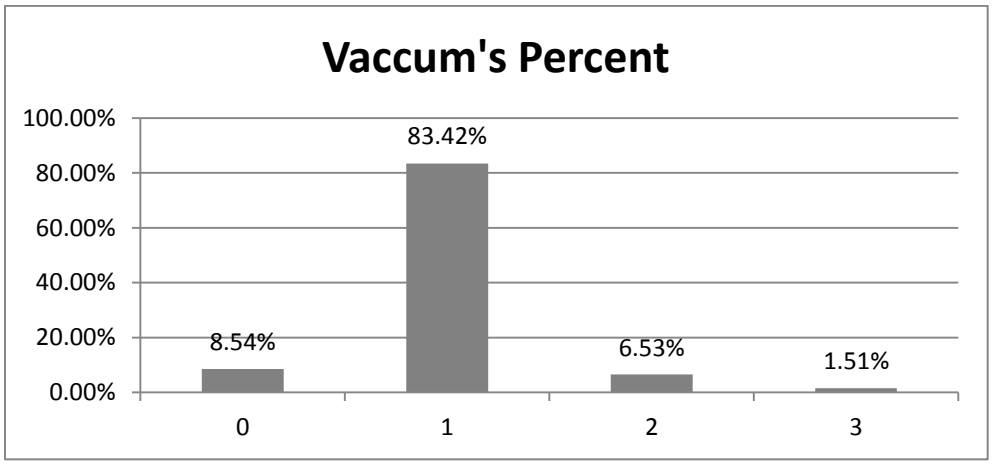
9. Tv

TV	0	1	2	3	4	5	7	Total
Count	1	111	62	21	2	1	1	199
Percent	0.50%	55.78%	31.16%	10.55%	1.01%	0.50%	0.50%	100%



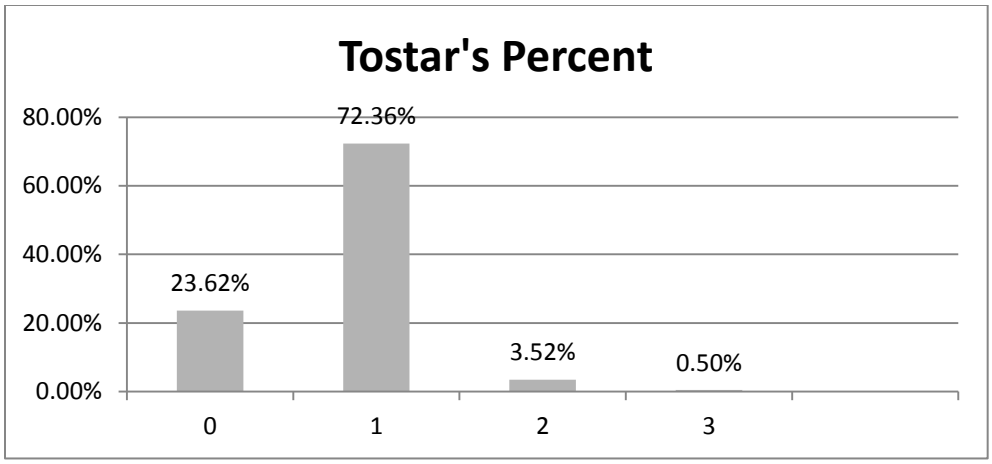
10. Vaccum

Vaccum	0	1	2	3	Total
Count	17	166	13	3	199
Percent	8.54%	83.42%	6.53%	1.51%	100%



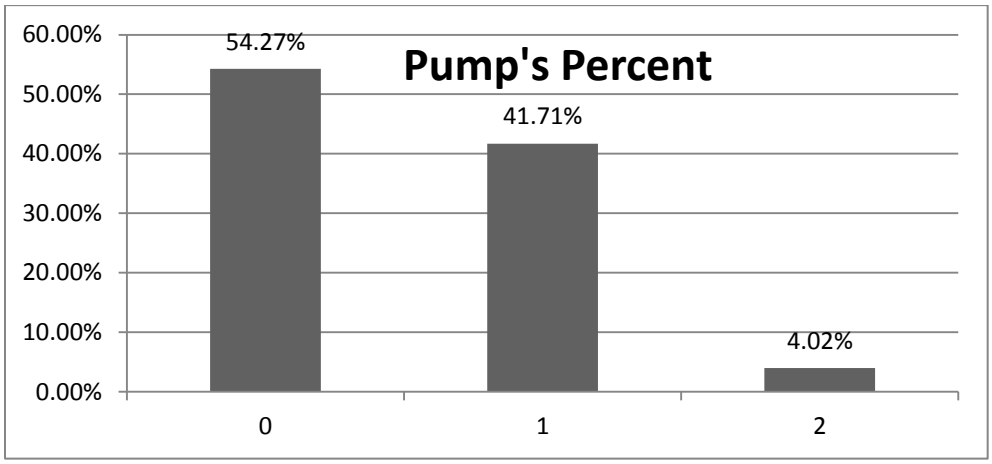
11. Tostar

Tostar	0	1	2	3	Total
Count	47	144	7	1	199
Percent	23.62%	72.36%	3.52%	0.50%	



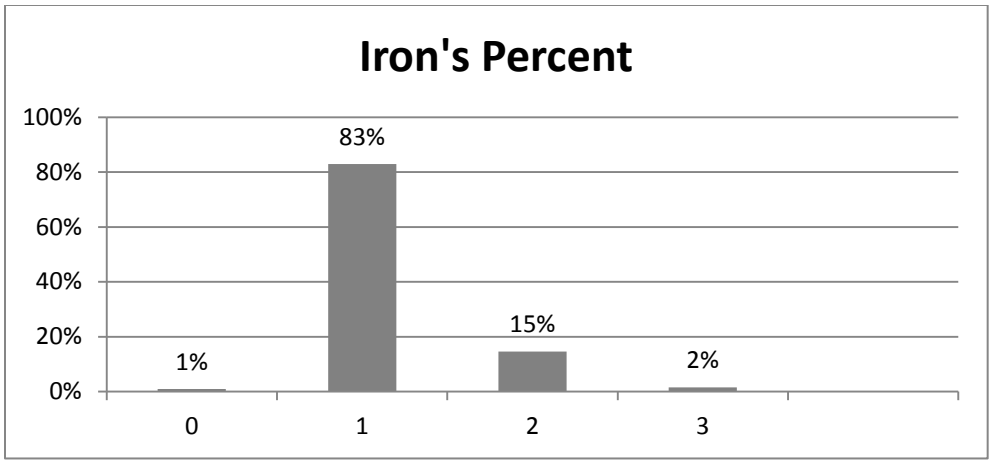
12. Pump

Pump	0	1	2	Total
Count	108	83	8	199
Percent	54.27%	41.71%	4.02%	100%



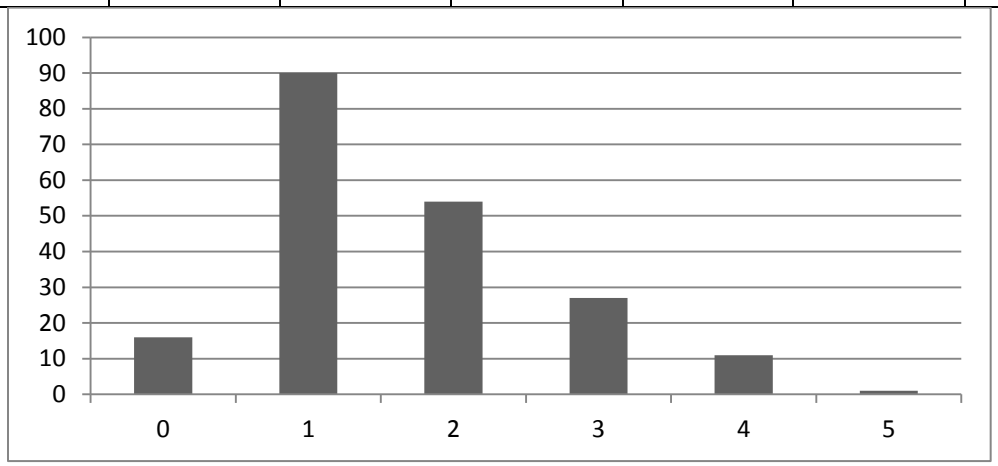
13. Iron

Iron	0	1	2	3	Total
Count	2	165	29	3	199
Percent	1%	83%	15%	2%	



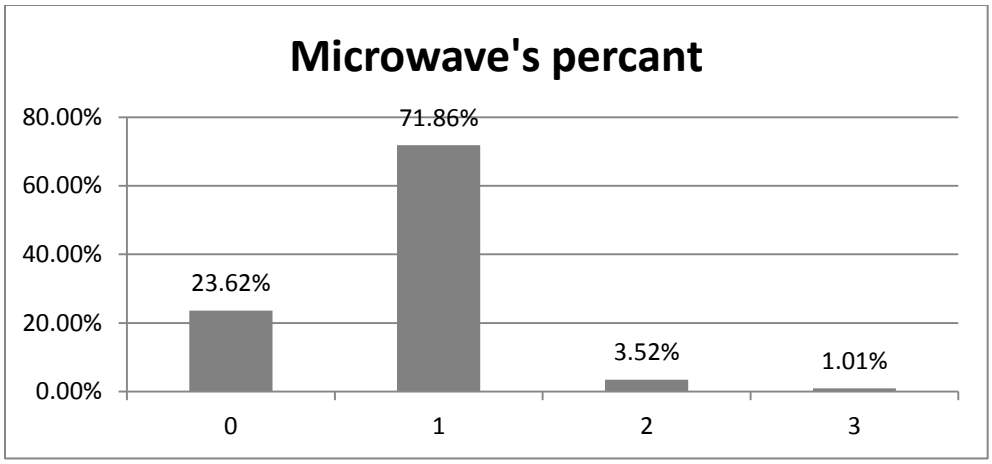
14. Computer

Computer	0	1	2	3	4	5
count	16	90	54	27	11	1
percent	8.04%	45.23%	27.14%	13.57%	5.53%	0.50%



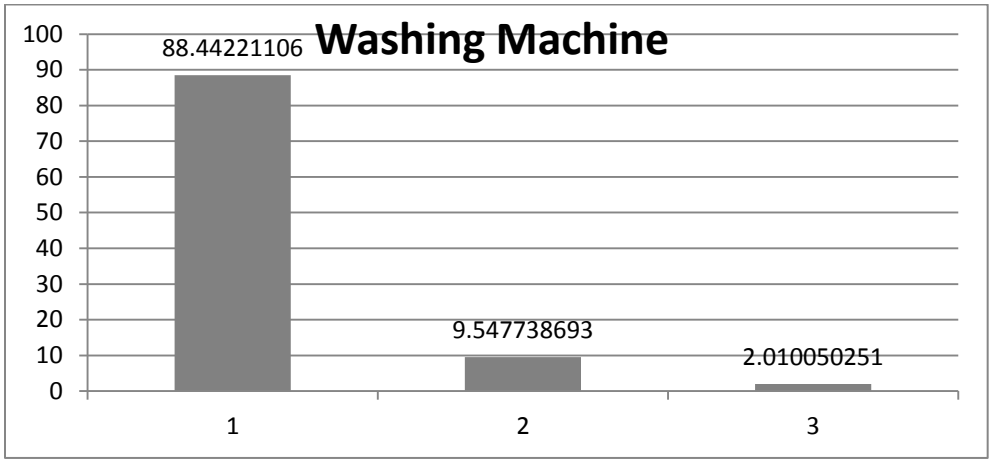
15. Microwave

Microwave	0	1	2	3
count	47	143	7	2
Percent	23.62%	71.86%	3.52%	1.01%



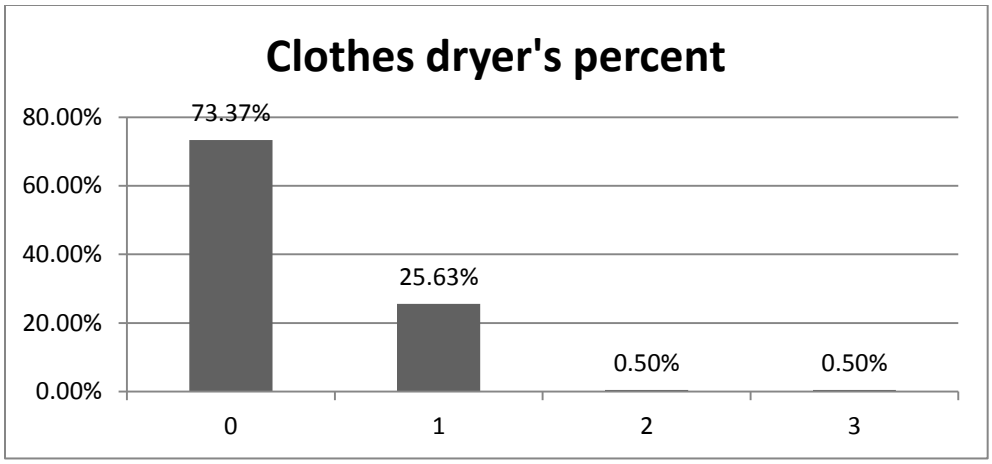
16. Washing Machine

Washing Machine	1	2	3
count	176	19	4
Percent	88.44221	9.547739	2.01005



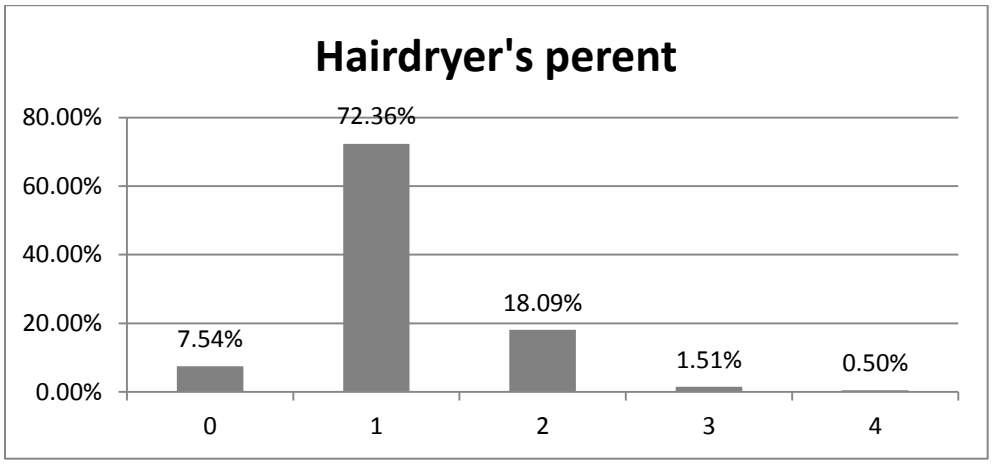
17. Clothe dryer

Clothes dryer	0	1	2	3
count	146	51	1	1
percent	73.37%	25.63%	0.50%	0.50%



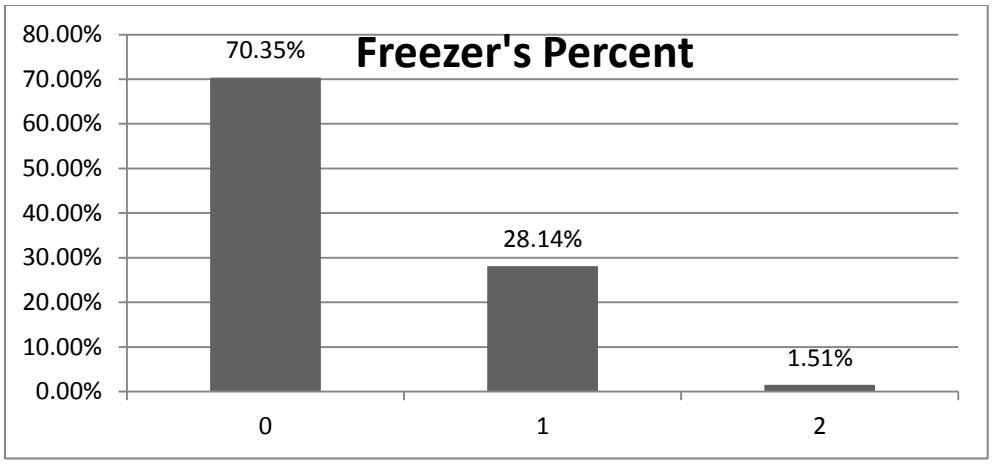
18. Hairdryer

Hairdryer	0	1	2	3	4
Count	15	144	36	3	1
Percent	7.54%	72.36%	18.09%	1.51%	0.50%



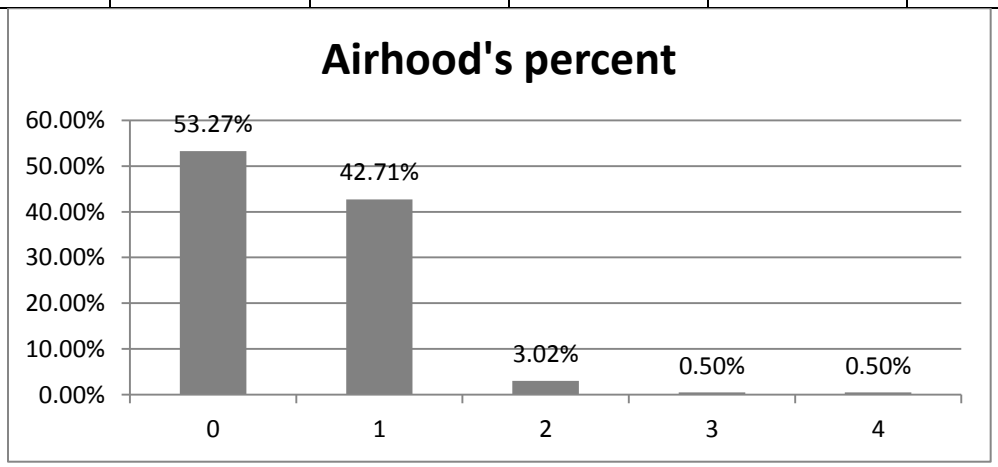
19. Freezer

Freezer	0	1	2
count	140	56	3
Percent	70.35%	28.14%	1.51%

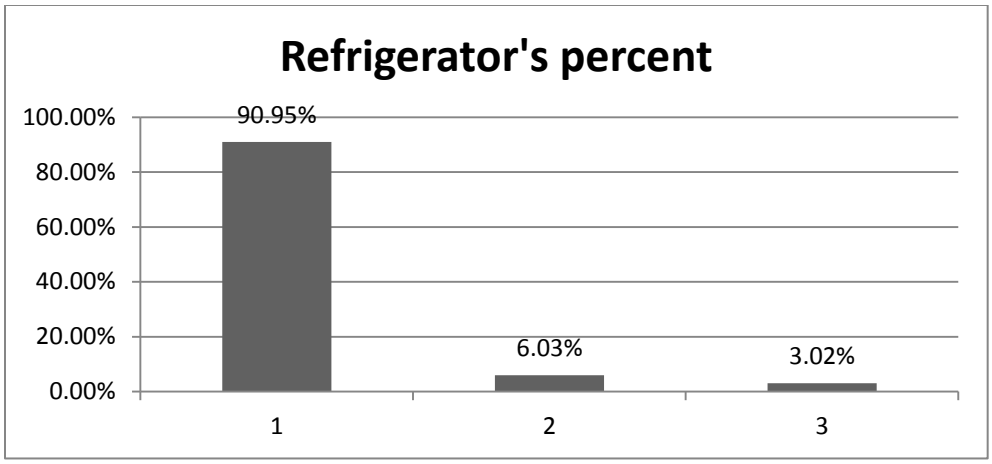


20. Air Hood

Air hood	0	1	2	3	4
count	106	85	6	1	1
percent	53.27%	42.71%	3.02%	0.50%	0.50%

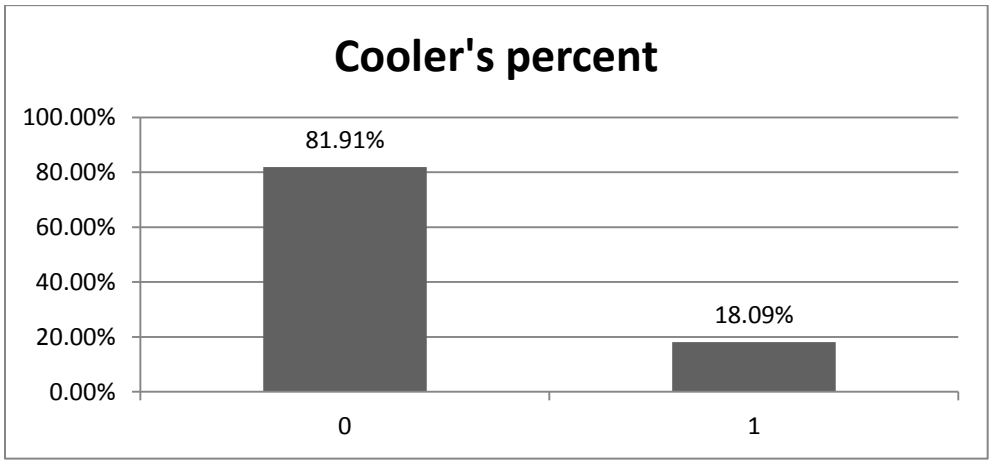


21. Refrigerator



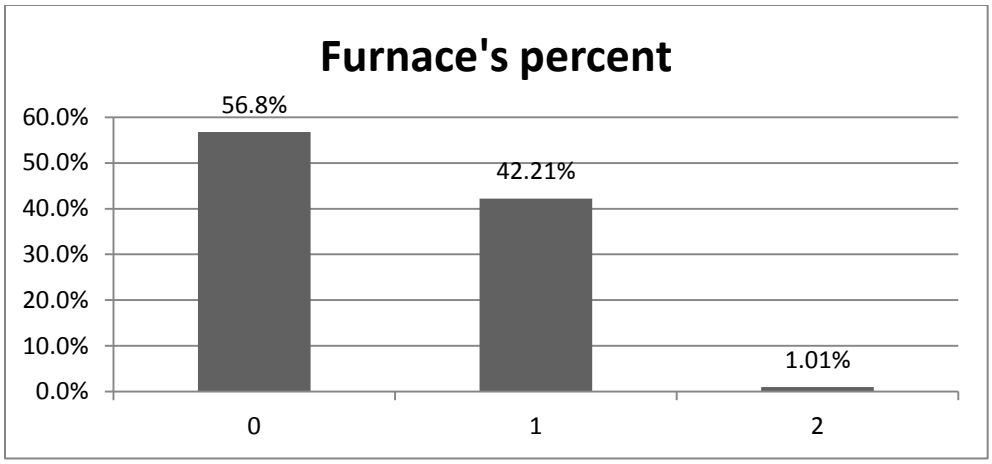
22. Cooler

Cooler	0	1
count	163	36
percent	81.91%	18.09%



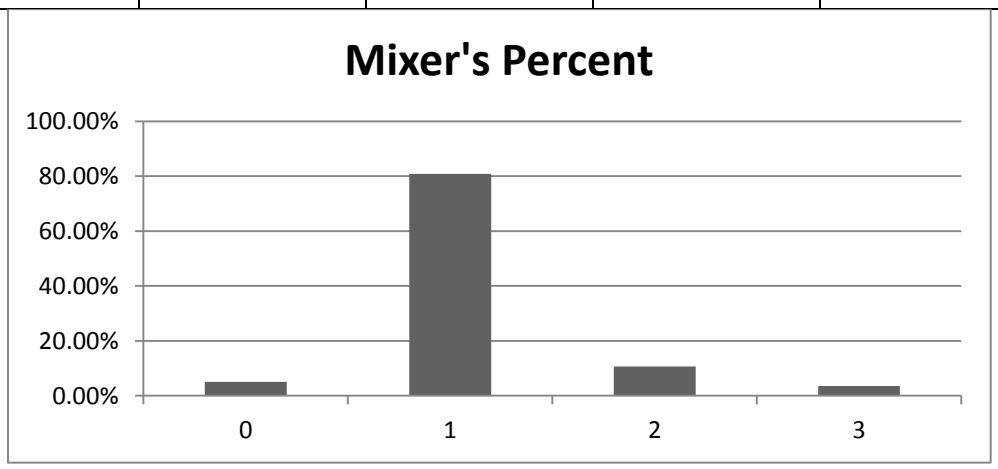
23. Furnace

Furnace	0	1	2
count	113	84	2
percent	56.8%	42.21%	1.01%



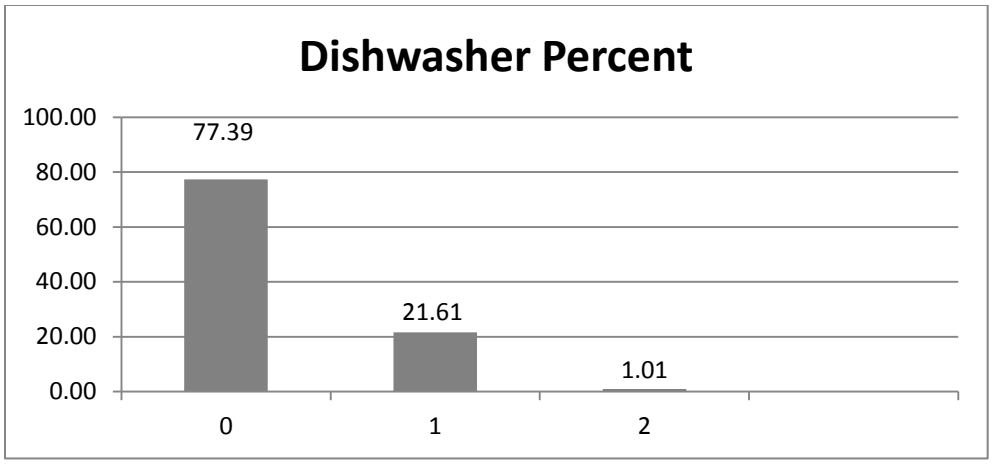
24. Mixer

Mixer	0	1	2	3
count	10	160	21	7
percent	5.05%	80.81%	10.61%	3.54%



25. Dishwasher

Dishwasher	0	1	2
count	154	43	2
Percent	77.39	21.61	1.01



- Summary of the devices

Devices	Mean	StDev	Minimum	Maximum
Air Conditioner	1.311558	1.304002	0	7
Fan	2.015075	1.296761	0	8
Electric heater	1.291457	0.885048	0	5
Kerosene Heater	0.050251	0.219014	0	1
Gas Heater	0.688442	0.614157	0	3
Boiler	0.80402	0.53822	0	3
Atmore	0.713568	0.799853	0	4
Kattel	0.708543	0.655572	0	3
TV	1.59799	0.858232	0	7
Vaccum	1.01005	0.460456	0	3
Iron	1.165829	0.435354	0	3
Toaster	0.809045	0.506242	0	3
Pump	0.497487	0.57625	0	2
Computer	1.648241	1.028328	0	5
Microwave	0.819095	0.529377	0	3
Washing machine	1.135678	0.397827	1	3
Clothes Dryer	0.281407	0.493602	0	3
Hair dryer	1.150754	0.583776	0	4

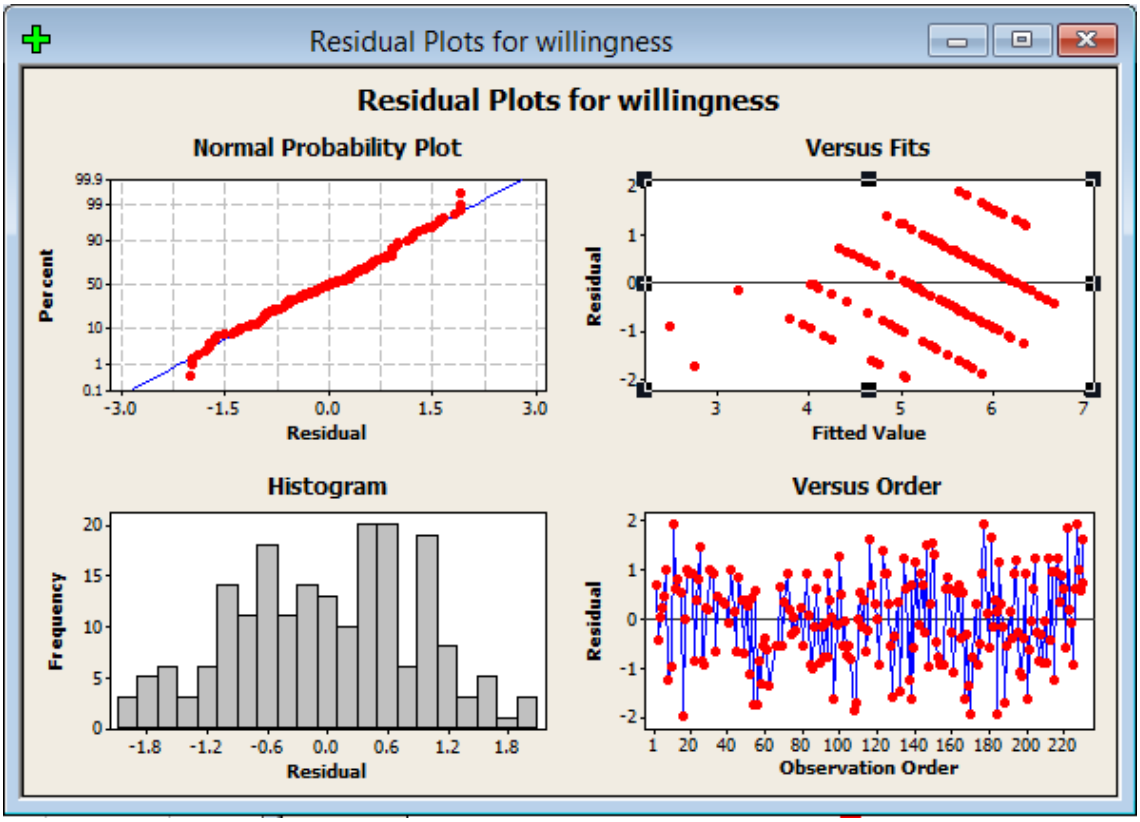
Appendix (3)

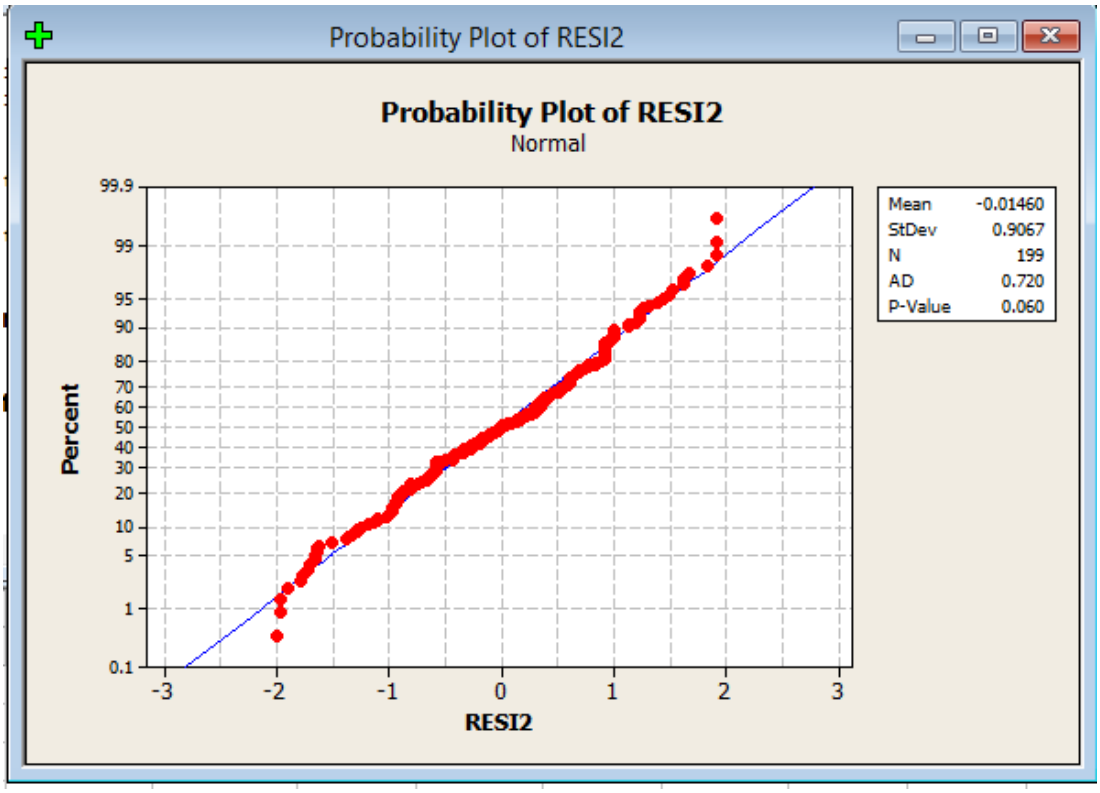
Main multiple regression of first degree polynomial:

General Regression Analysis: willingness versus Awareness, knowledge

```
Box-Cox transformation of the response with rounded lambda = 2
The 95% CI for lambda is (0.895, *)

Regression Equation

willingness^2  =  2.14706 Awareness + 0.423546 knowledge


Coefficients

Term          Coef   SE Coef        T      P      VIF
Awareness  2.14706  0.077911  27.5577  0.000  8.04451
knowledge  0.42355  0.160463   2.6395  0.009  8.04451


Summary of Model

S = 0.909082     R-Sq = 97.36%        R-Sq(adj) = 97.33%
PRESS = 166.177  R-Sq(pred) = 97.30%


Analysis of Variance

Source          DF   Seq SS   Adj SS   Adj MS        F         P
Regression       2  6000.24  6000.24  3000.12  3630.22  0.000000
  Awareness      1  5994.49   627.61   627.61   759.43  0.000000
  knowledge      1     5.76     5.76     5.76     6.97  0.008967
Error          197   162.81   162.81     0.83
  Lack-of-Fit   62    47.16    47.16     0.76     0.89  0.696628
  Pure Error   135   115.64   115.64     0.86
Total          199  6163.05


Fits and Diagnostics for Unusual Observations for Transformed Response

Obs  willingness^2      Fit    SE Fit  Residual  St Resid
 11         7.5625  5.63784  0.068746   1.92466   2.12322  R
 16         3.0625  5.05651  0.153206  -1.99401  -2.22526  R
108         4.0000  5.89197  0.103918  -1.89197  -2.09492  R
147         7.5625  6.06139  0.158578   1.50111   1.67695     X
148         5.0625  6.06139  0.158578  -0.99889  -1.11590     X
170         3.0625  5.02440  0.059015  -1.96190  -2.16267  R
177         7.5625  5.63784  0.068746   1.92466   2.12322  R
185         3.0625  5.02440  0.059015  -1.96190  -2.16267  R
222         7.5625  5.72255  0.068487   1.83995   2.02973  R
223         6.2500  6.06139  0.158578   0.18861   0.21070     X
227         7.5625  5.63784  0.068746   1.92466   2.12322  R


Fits for Unusual Observations for Original Response

Obs  willingness      Fit
 11         2.75  2.37441  R
 16         1.75  2.24867  R
108         2.00  2.42734  R
147         2.75  2.46199     X
```

```
148          2.25  2.46199     X
170          1.75  2.24152  R
177          2.75  2.37441  R
185          1.75  2.24152  R
222          2.75  2.39219  R
223          2.50  2.46199     X
227          2.75  2.37441  R

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large leverage.

Durbin-Watson Statistic

Durbin-Watson statistic = 1.77167
```




Probability Plot of RESI2
Probability Plot of RESI2
Normal
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-3
-2
-1
0
1
2
3
RESI2
Mean -0.01460
StDev 0.9067
N 199
AD 0.720
P-Value 0.060