إقـــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

الاستدامة و الحفاظ على المياه وما يتعلق بها من طاقة
في المباني السكنية.

Water and Related Energy in Residential Buildings,
Conservation and Sustainability.

أقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وإن هذه الرسالة ككل أو أي جزء منها لم يقدم من قبل لنيل درجة أو لقب علمي أو بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

DECLARATION

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification

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Water and Related Energy in Residential Buildings, Conservation and Sustainability.

الاستدامة و الحفاظ على المياه وما يتعلق بها من طاقة في المباني السكنية.

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بسم الله الرحمن الرحيم

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نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ سلام محمد سعيد عبد الرحمن الزيدة لنيل درجة الماجستير في كلية *الهندسة* قسم الهندسة المدنية– إدارة المشروعات الهندسية وموضوعها:

الاستدامة والحفاظ على المياه وما يتعلق بها من طاقة في المباني السكنية

Water and Related Energy in Residential Buildings -Conservation and Sustainability

وبعد المناقشة التي تمت اليوم السبت 13 ذو الحجة 1436هـ، الموافق 2015/10/03م الساعة الثانية عشرة ظهراً، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

أ.د. عدنان علي إنشاصي	مشرفاً ورئيساً	....
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د. علي إبراهيم تايه	مناقشاً خارجياً	....

وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في كلية *الهندسة*/ قسم الهندسة المدنية- إدارة المشروعات الهندسية.

واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله ولزوم طاعته وأن يسخر علمه في خدمة دينه ووطنه.

والله ولي التوفيق ،،،

نائب الرئيس لشئون البحث العلمي والدراسات العليا

أ.د. عبدالرؤوف علي المناعمة

بسم الله الرحمن الرحيم

قال تعالى:

﴿ قُلْ هَلْ يَسْتَوِي الَّذِينَ يَعْلَمُونَ وَالَّذِينَ لَا يَعْلَمُونَ إِنَّمَا يَتَذَكَّرُ أُولُو الْأَلْبَابِ ﴾

صدق الله العظيم

(سورة الزمر الآية 9)

Dedication

I would like to dedicate this work to my parents souls (رحمهما الله),

To my borthers and my sisters,

To my wife (Eng. Enass),

To my sons (Mohammed and Mustafa),

To my daughters (Noor, Jana and Leen).

Salam El zebdeh

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Secondly, I want to appreciate all respondents from the community of the residential buildings, who generously spent their precious time to participate in the questionnaire survey of this study. In addition, I would like to thank all professional interviewees for their valuable time in participating interviews survey, as well as sharing their knowledge and experience. I also want to thank my entire friends who directly or indirectly assisted me in this project study.

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Salam El zebdeh

Abstract

Gaza Strip is suffering the scarcity of water and energy (electricity) supply and distribution which signify a real catastrophe for residential buildings in this area. Water and energy shortage is accredited to numerous factors ranging from a limited supply, increase in demand, a high loss in serving and distribution network, an absence of water and energy conservation attitudes and behaviors, and the political aspects. The crisis should be managed carefully at two levels: (i) Governmental level to secure the water and energy demand with an appropriate and equitable distribution, and (ii) Public level to activate the conservation attitude and behavior.

This research aimed to highlights the water and related energy consumption and conservation at residential buildings for emphasizing the sustainability at Gaza Strip. The ultimate outputs are to identify the dirvers affecting household`s residents consumption of water and related energy at residential buildings, to pinpoint strategies that guide household`s residents use of water and related energy to conservation and sustainability, and to investigate household`s residents attitudes and behaviors toward the conservation of water and related energy at residential buildings.

To fulfill these objectives, research was carried in three stages: literature review, questionnaire survey and personal interviews. Personal structured interviews with 30 interviewees have been made to obtain more in-depth and valuable information. The interviews were conducted by parcticipating of professionals in the water and energy field. A total number of 123 questionnaires have been completed by household`s residents. Quantitative data analysis methods, including relative importance index (RII), reliability and validity tests, and Pearson and Spearman correlation analyses were applied by SPSS 22.

The study showed that there is a significant correlation between the drivers inspected and the household`s residents consumption of water and energy at residential buildings. Results obtained from interviews indicated that "Climate (seasonal weather) changes" was the most important dirver. It is strongly influencing household`s residents habits of water and energy consumption. Both drivers "Knowledge to conserve water and energy" and "Household size" were found of the most important dirvers. "Environmental value", "Number of household`s residents", " Educational level", and "behavioral control and attitude"; according to openion of the majority of professinals; are also classified of high importance on consumption. While other drivers were found important. Finally, both drivers " Gender" and "Older age residents" were found with neutral influence according to the majority of professinals. This study showed that "Older housholds" has no remarked impact on consumption of water and energy by household`s residents.

In addition, the interview results showed that there is a significant relationship between the household`s residents consumption of water and energy and the inspected strategies for guiding conservation and sustainability. "Periodic maintenance for water

and energy devices and systems" was found the most important strategy. The study revealed that " Leakage control", "Information", "Educational and training programs" and "Demand side management" are of the most important strategies to guide water and energy for conservation and sustainability. Also, the study revealed that the other inspected strategies are important.

Regarding to the household`s residents participation in this study, questionnaire survey revealed that socio-demographic factors as (gender, number of household`s residents and household size), personal attitudes and personal behaviors of households' residents have a significant impact on residential water and related energy conservation and sustainability. This finding emphasized the results founded by professionals via the interview instrument. Moreover, Spearman correlation analysis affirmed the statistical significant relationship between personal attitudes and personal behaviors of the households' residents toward the conservation and sustainability of water and related energy.

The study was concluded by practical recommendations; of which the following are the most important: 1- developing clear and strict policies supporting water and energy conservation and sustainability, 2- providing household`s residents with the necessary information and educational programs to ensure their ability to make conservative decisions, 3- follow up the leakage, monitor and control dispensable use of an inefficient divices as residential water pumps, and 4- emphasizing cooperation and trust between water and energy concerned patries and household residents to improve social equity in supply, distribution and preventing illegalities.

ملخص البحث

يعاني قطاع غزة مشكلة النقص في تزويد وتوزيع المياه والطاقة (الكهرباء)، وهذه المشكلة بدورها تمثل كارثة حقيقية بالنسبة للمباني السكنية في القطاع. إن مشكلة النقص في المياه والطاقة ترجع إلى العديد من الأسباب والتي منها: محدودية التزوبد، الزيادة في الطلب، الفقد العالي في شبكات التزويد و التوزيع العامة، غياب القناعة و السلوك المتعلق بالحفاظ على المياه و الطاقة، و الأمور السياسية. وبناء عليه، فإن هذه الكارثة يجب إدارتها بعناية، وذلك على مستويين: (أ) المستوي الإداري (مؤسسات الدولة)، والذي يرتكز عليه دور تأمين الحاجة (الطلب) للمياه و الطاقة، وذلك من خلال عملية توزيع لكلا المصدرين بشكل مناسب وعادل، (ب) و المستوى العام من خلال تفعيل وتطوير القناعات و السلوك الحفاظي المتعلق بالمياه و الطاقة .

يهدف هذا البحث لتسليط الضوء على إستهلاك المياه و الطاقة المتعلقة بها والمحافظة عليهما في المنازل السكنية لتعزيز الإستدامة في قطاع غزة. بناء عليه، فإن النتائج المرجوة والتي يهدف إليها البحث: أولا : التعرف على محددات إستهلاك المياه والطاقة التي تؤثر على السكان في المباني السكنية ، ثانيا: تحديد الإستراتيجيات التي يمكن أن تقود إلى المحافظة والإستدامة في المباني السكنية فيما يخص المياه والطاقة. ثالثا: إختبار مستوي تأثير قناعات و سلوك السكان تجاه المحافظة على المياه والطاقة في المباني السكنية ،

ولكي يتم تحقيق أهداف الدراسة، لقد تم إجراء البحث على ثلاثة مراحل :مراجعة الدراسات السابقة في المواضيع ذات الصلة ، تلاها بحث ميداني لجمع البيانات من خلال استبانة الدراسة وبالإضافة إلى مقابلات شخصية حتي يتسنى التحقق من دقة النتائج بشكل أفضل. وصل حجم الإستجابة من سكان المباني السكنية إلى 123 استبانة مما يتوافق مع الحد الأدنى المطلوب للدراسة. وقد أجريت 30 مقابلة شخصية مع المهنيين أصحاب القرار في المؤسسات ذات الصلة بتزويد وإدارة المياه والطاقة في محافظات قطاع غزة للحصول على معلومات أكثر دقة وقيمة.وبناء عليه قد تم تطبيق الأساليب الكمية في تحليل البيانات، بما في ذلك تحليل معامل الأهمية النسبي، اختبارات الموثوقية، وتحليلات ارتباط بيرسون وسبيرمان بلستخدام برنامج التحليل الإحصائي SPSS 22.

أظهرت الدراسة أن هناك علاقة ذات دلالة إحصائية بين إستهلاك المياه و الطاقة في المباني السكنية والمحددات ذات التأثير على إستهلاك المياه والطاقة. وأشارت النتائج التي تم الحصول عليها من المقابلات إلى أن " تغييرات المناخ (حالة الطقس الموسمية)" هي المحدد الأكثر أهمية. وبالتالي فإن هذا المحدد يؤثر بقوة على عادات سكان المنازل من حيث استهلاك المياه والطاقة. وكان كلا المحددين "المعرفة عن كيفية الحفاظ على المياه والطاقة" و "مساحة المسكن" قد اعتبرا من المحددات الأكثر أهمية. أما بالنسبة للمحددات "القيمة البيئية"، "عدد سكان المسكن"، "المستوى التعليمي"، و"التحكم بالسلوك والقناعات تجاه السلوك" قد تم تصنيفها من المحددات ذات الأهمية الكبرى، وذلك من وجهة نظر أغلبية المشاركين في المقابلة. قد توصلت الدراسة أيضا أن هناك محددات أخرى ذات أهمية و أثر واضح على الإستهلاك السكاني للمياه والطاقة. وأخيرا، كلا المحددين "الجنس" و "السكان كبار السن" قد إعتبرا من المحددات المحايدة التي يصعب تحديد أثرها أونفيه وذلك وفقا لغالبية وجهة نظر المشاركين في المقابلة. أما المحدد الأخير "عمر المسكن" فقد أظهرت هذه الدراسة أنه لا يوجد له تأثير ملحوظ على استهلاك المياه والطاقة.

بالإضافة إلى ذلك، أظهرت نتائج المقابلة أن هناك علاقة ذات دلالة إحصائية بين الحفاظ على المياه والطاقة والاستراتيجيات التي تم فحصها لتوجيه الاستدامة والحفاظ. أوضحت الدراسة أن إستراتيجية " الصيانة الدورية" هي الإستراتيجية الأكثر أهمية. وأيضا الإستراتيجيات " مراقبة التسريب"، "توفير المعلومات للمجتمع المحلي"، "البرامج التعليمية والتدريبية "، "إدارة الإستهلاك من جانب المستهلك" قد اعتبرت من الاستراتيجيات الأكثر أهمية. بالإضافة إلى ذلك فقد إعتبرت الدراسة بقية الإستراتيجيات الأخرى التي تمت دراستها أنها ذات أهمية كبيرة لتوجيه سكان المباني للحفاظ على المياه والطاقةوإستدامتهما.

وفيما يتعلق بمشاركة سكان المباني في هذه الدراسة، قد أظهرت نتائج الاستبيان أن العوامل الاجتماعية والديموغرافية (الجنس، وعدد السكان و مساحة المسكن)، والقناعات الشخصية والسلوك الشخصي للسكان المباني لها تأثير كبير وواضح على الحفاظ استدامة المياه و الطاقة في المياني السكنية. هذه النتيجة تنسجم مع النتائج التي توصلت لها الدراسة عن طريق أداة المقابلة. وعلاوة على ذلك، أكد تحليل الارتباط سبيرمان أن العلاقة ذات دلالة إحصائية بين القناعات الشخصية والسلوك الشخصي للسكان المباني تجاه حفظ واستدامة المياه والطاقة.

وختاما، تقدم الدراسة عدة توصيات والتي من أهمها : 1- تطوير السياسات لاستهلاك المياه و الطاقة ودعم المحافظة والاستدامة، وصيانة دقيقة لشبكات المياه والطاقة، 2- تزويد سكان المباني بالمعلومات اللازمة للتأكد من قدراتهم على اتخاذ قرارات المتعلقة بالمحافظة على المياه والطاقة، 3- متابعة التسرب ورصد ومراقبة الإستهلاك وكذلك الاستغناء عن الأجهزة والأدوات غير الفعالة مثل مضخات المياه السكنية، وأيضا 4- تعزيز التعاون والثقة المتبادلة بين الجهات المعنية و المسئولة عن إدارة توزيع المياه والطاقة وسكان المباني لتطوير و تعزيز العدالة الاجتماعية ومنع الإستهلاك الغير قانوي.

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List of abbreviations

CMWU	Coastal Municipalities Water Utility
DSM	Demand Side Management
EEA	European Environment Agency
EPRI	Electric Power Research Institute
EPIC	Environmental Policy for Individual Behavior Change
GEDCO	Electricity distribution company
GS	Gaza Strip
IEC	Israli Electrical Company
IHDs	In-Home Consumption Displays
l/c/d	Liter per Capita per Day
MCM	Million Cubic Meters
MW	Miga Watt
NEP	New Environmental Paradigm
OECD	Organization for Economic Co-operation and Development
PCBS	Palestinian Central Bureau of Statistics
RII	Relative Importance Index
SPSS	Statistical Package for the Social Sciences
VSD	Variable Speed Drives
UFW	Un-accounted for Water
UK	United Kingdom
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
WCM	Water Cycle Management
WDM	Water Demand Management
WDS	Water Distribution System
WSSs	Water Supply Systems

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Chapter 1: Introduction

1.1 Background

Gaza Strip is suffering scarcity of water and energy supply. Since population grows, the demand for resources, water and energy is rapidly growing up at about the same rates and, importantly, in many of the same geographic areas. The availability of water and energy in sufficient quantities is not only a prerequisite for human health and well-being but also essential for freshwater ecosystems and the many services that they provide (Werner and Collins, 2012).

Recently, it has been remarkably noticed the interrelationship between domestic water use and energy consumption, particularly in urban residential buildings (Cheng, 2002). Residential buildings are considered as major consumers of water and energy and key contributors to carbon-dioxide emissions have become more and more crucial as a focus for water and energy conservation and environmental protection (Cheng, 2012).

The low price for water, even though the higher for electricity, provides no incentive for water and energy conservation. The misuse of water pumps in Gaza Strip houses as (installation with no need or operating over needed time or capacity) is one of the major causes of interfering the water networks design in addition to the social culture tend to lay stress on the style of living without paying attention to sustainability principles. Therefore, there is an urgent need to improve the efficiency of water consumption and related energy use in Gaza Strip buildings through the application of sustainable design, operation and use principles.

1.2 Problem statement / development of research rationale

There exists an energy and water crises in Gaza Strip. According to one estimate, the people of Gaza over-pump approximately 160 million cubic meters (MCM) of water from the coastal aquifer per year, but the sustainable yield of the Gaza sub-aquifer is about 100 MCM/year (Bohannon, 2006). Sustainable yield is the amount of water that can be extracted from the aquifer annually, while still maintaining ground water levels and chemical composition (Hamdan et al., 2008).

The estimated power demand and the corresponding power shortages as well as the percentage of the power shortage between the years 2010 and 2015 for the Gaza Strip governorates are shown in Table (1.1). Gaza Power Generation Plant is producing a power of 80 MW and the Israli Electrical Company (IEC) supplies 120 MW and Egypt supplies 17 MW(Abu-Jasser, 2012).

Table (1.1): Power demand and Shortage Between 2010 and 2015

Year	Demand Forecast in MW	Power Shortage in MW	Shortage Percentage in MW
2010	308	91	29.5
2011	347	130	37.5
2012	368	151	41
2013	389	172	44
2014	413	196	47.5
2015	438	221	50.5

Source: (Abu-Jasser, 2012).

The number of inhabitants of the Gaza Strip governorates is estimated around 1,763,387 in July 2013, where the population in Gaza Strip increases (population growth rate is 3.01%/year) (CIA, 2011). The consumption of water will increase and the deficit in energy resources water supply will increase, leading to a severe economical catastrophe that will result in a significant rise in the probability of an outbreak of conflict (Hamdan et al., 2008).

According to worldwide concern of environment and sustainable development which has been increasingly emerged, it’s the time for us to start thinking about using water and energy more efficiently. The current situation and its future consequences necessitate the adoption of practical approaches that enhance water and energy efficiency and apply baseline conceptual culture in accordance with national requirements and needs.

Given the relevance of this theme, the present thesis presents a review for sustainabile use of water and related energy among the household`s residents and opportunities to promote water and related energy efficiency and conservation in residential buildings. In water supply and distribution systems, the majority of electricity consumed is generally attributed to the power demand associated with pumping (for water catchment, adduction and distribution). The use of this delimitation in this study was defined based on the widespread use of such systems around the Gaza Strip in addition to the great potential for conservation and sustainability improvement, which typically can be identified in pumping systems specially at the residential buildings (lifting pumps at demand points), a fact which assigns an applied nature to this research.

Thus, this study is focused on management of the demand side and alternatives and does not consider the opportunities and technologies available for energy and water conservation on the supply side of water management. Only the direct energy (electricity) consumption in residential building by lifting pumps is considered, disregarding the energy consumption implicit in the various inputs (e.g., lighting, washing mashines, water heaters, …etc) used in residential buildings; the energy consumed by the inputs is usually evaluated through building design and analysis. The study also disregards other energy flows beyond hydraulic and electrical; for example, the thermal energy embodied in the water masses flowing through the supply and distribution system is not considered here.

1.3 Research aim and objectives

1.3.1 Research Aim

This research aimed to highlights the water and related energy consumption and conservation at residential buildings in Gaza Strip. The ultimate outputs are to identify the dirvers of household`s water and related energy, to establish the level and effectiveness of household`s residents attitudeds and behaviors toward the conservation of water and related energy and to pinpoint strategies/ measures for guiding sustainability and conservation of water and related energy at residential buildings.

1.3.2 Research Objectives

The aim of this research may be divided into the following objectives:

1. To identify the drivers affecting household`s residents consumption of water and related energy at residential buildings.
2. To pinpoint strategies that guide household`s residents use of water and related energy to conservation and sustainability.
3. To investigate the attitude and behavior of household`s residents toward water and energy conservation at residential buildings.

1.4 Brief research methodology

Quantitative method is intended to be used in the research study as a method for easier and more precise thorough analysis. (Creswell, 2012) stated that in quantitative research, the investigator identifies a research problem based on trends in the field or on the need to explain why something occurs. Describing a trend means that the research problem can be answered best by a study in which the researcher seeks to establish the overall tendency of responses from individuals and to note how this tendency varies among people. On this basis, to perform research study on "Water and Related Energy in Residential Buildings – Conservation and Sustainability" (Case sample – The United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) Rehousing Projects in Rafah), thus the quantitative research method will be adopted in this study.

The key tools for data collection that will in this study are:

- ✓ Questionnaire that will be used to collect the primary data required for addressing the second objective. Initially, the questionnaire will be distributed to the participants (residents of the housing units) who will be selected randomly.
- ✓ Structured interview that will be used to collect also primary data required for addressing the first and thirs objectives. This interview will be distributed through non-random purposive sampling. The sample consists of 27 most informant participants who are decision makers in the responsible parties for water and energy supply and management at Gaza Strip. Including at least two to three represntatives from the shareholders of the Re-Housing Project at implemented by UNRWA as (UNRWA, Rafah Municipality, the Coastal Municipalities Water Utility (CMWU) and the Electricity distribution company (GEDCO)).

The literature review will pave the way for designing the study questionnaire. The questionnaire will be used to obtain their perspectives regarding the applicable data and most effective factors affecting the water and relevant energy demand, consumption and supply. The obtained data and effective factors are needed for analysis and design to maintain sustainability in residential buildings through efficient water and energy use. The social culture also will be considered in this regard.

Statistical analysis and tests will be conducted by using (SPSS) program or other statistical package.

1.5 Contents of the thesis / structure of the research

This research was organized into the following six chapters:

Chapter 1: Introduction

Chapter 1 provides the general introduction of this study, in which the background, problem statement, aim and objectives of study, methodology of study, and structure of the research are briefly described.

Chapter 2: Literature review

Chapter 2 discusses inter-relationship between water and relevant consumed energy at residential buildings and through water distribution system (WDS)., simulation software packages for water systems management and relevant energy, attitude and behaviour of the community toward the residential buildings water use and its energy consumption management and conservation and finally look for various measures or strategies to the typical residential buildings to manage water and its energy use more sustainably and in conservative mannar.

Chapter 3: Research methodology

Chapter 3 included the detailed research methodology, questionnaire survey design, interview contents and the various quantitative analytical methods applied were simply described.

Chapter 4: Results, analysis, and discussion

In Chapter 4, the data analyses and results of the contextual data collected were shown, the findings from the large-scale questionnaire survey and the interviews were validated and a refined conceptual framework was developed.

Chapter 5: Conclusion and recommendations

In Chapter 5, the final framework results were also discussed and the conclusion of the whole research study were made. Then, recommendations in both the personal and organizational aspects were included.

References

Appendices

Chapter 2: Literature review

2.1 Introduction

The availability of water and energy in sufficient quantities is not only a prerequisite for human health and well-being but also essential for freshwater ecosystems and the many services that they provide (Coelho and Andrade-Campos, 2014; Werner and Collins, 2012). Water and energy resources are fundamental to human existence, and are regularly subject to economic, technological, demo- graphic and social pressures (Vilanova and Balestieri, 2014). It is very important that water and energy resources are used appropriately as this is a challenge to promote sustainable development (Coelho and Andrade-Campos, 2014; Proença et al., 2011). Water and energy are each recognized as indispensable inputs to modern economies. Moreover, in recent years, driven by the three imperatives of security of supply, sustainability, and economic efficiency, the energy and water sectors have undergone rapid reform (Hussey and Pittock, 2012).

Water conservation, and more broadly environmental regulation, is often developed after a crisis such as a continued scarcity or limited infrastructure capacity, or when firstly there is economic incentive to reconfigure current operations. As a second driver is sometimes public awareness, where constituents put pressure on governments to monitor a particular concern or where other model utilities/governments shine light on how they have improved their operations to reduce resource consumption. Thirdly, independent homeowners, landowners, business owners, or municipal organizations are often motivated to participate in resource conservation because of their belief in environmental protection beliefs and/or because they see the investment as beneficial through savings in operational expenses (Oldford, 2013a) .

The current situation and its future consequences necessitate the adoption of practical approaches that enhance water and energy efficiency and apply baseline conceptual culture in accordance with national requirements and needs.

The following review discusses three themes that are carried throughout this thesis:

1. To identify the drivers affecting household`s residents consumption of water and related energy at residential buildings.
2. To pinpoint strategies that guide household`s residents use of water and related energy to conservation and sustainability.
3. To investigate the attitude and behavior of household`s residents toward water and energy conservation at residential buildings.

2.2 Drivers/ determinants affecting household`s residents consumption of water and related energy at residential buildings.

Water consumption within households is dependent on numerous factors, which include: the number of people in house, age of residents, education levels of residents, lot size of properties, residents' income, efficiency of water consuming devices (i.e. clothes washers, shower heads, tap fittings, dishwashers and toilets) and the attitudes, beliefs and behaviors of consumers (Inman and Jeffrey, 2006; Mayer et al., 1999). Individual behavior, lifestyle, psychological, cultural and social factors and gender preferences are some other factors that may influence end use energy consumption in a residential sector (Yu et al., 2011). The key drivers influencing public water demand are population and household size, income, consumer behavior and tourist activities, technological developments, including water saving devices and measures to address leakage in public water supply systems also play an important role (Werner and Collins, 2012).

Lorek (2004) Stated that the determinants of general consumption patterns identified in the sustainable consumption can be categorized as biological/psychological factors, sociological, technological, demographic and politico-economic factors. Figure 2.1 depicts the influence of these factors on consumption in general, while figure 2.2 summarizes the determinants of direct energy consumption by households.

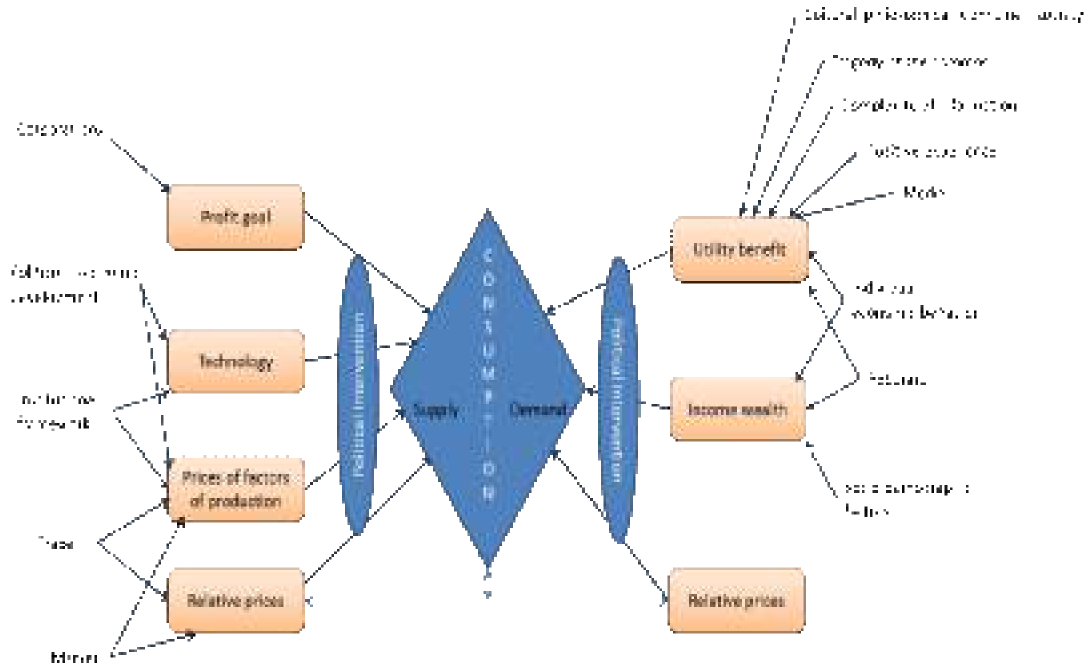


Figure 2.1: Key influences households' consumption. Source: (Lorek, 2004)

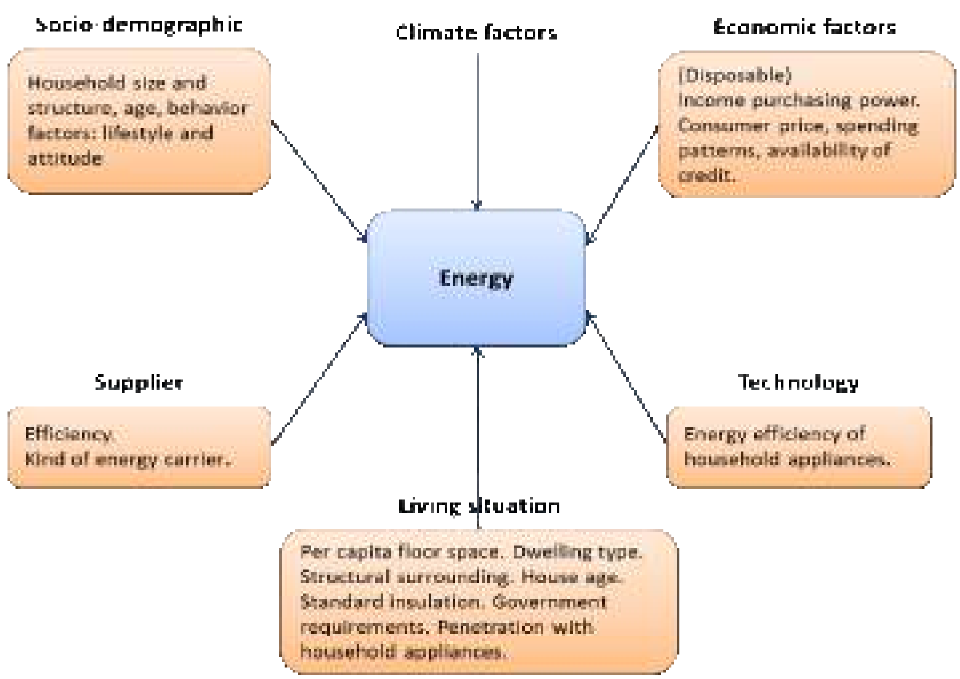


Figure 2.2: Determinants of sustainable energy consumption. Source: (Lorek, 2004)

Using a combination of water billing records and survey responses, (De Oliver, 1999) examined water consumption following voluntary and mandatory water restrictions and investigated whether consumption reductions, if any, were influenced by socio-demographic variables such as family composition and income. The results demonstrated a considerable disconnect between survey responses and expressed actions, of which the latter were influenced in different degrees by income, political persuasion, ethnicity, home ownership and education.

Al-Ghuraiz (2002) confirmed that water consumption is affected directly with the economic status of the consumers, where the water consumption will increase if the household income increases. Form his study survey on Gaza Strip, Table 2.1 indicates that the higher household income, the higher also the water consumption and Vis versa.

Table (2.1): Income and Water Consumption.

Income (NIS/Household/Month)	Water consumption (l/c/d)
<1000.	81.62.
1001-2000.	115.78.
2001-4000.	122.1.
>4000.	127.35.

Source: (Al-Ghuraiz, 2002).

Also, according to (Al-Ghuraiz, 2002) it is concluded that water consumption increase if the water price decrease and vice versa. This relation is true if the other factors that affect water consumption are unified such as the income of households, water quality and quantity. The results revealed that the highest water consumption was in North and Gaza governorates (154.7 l/c/d and 138.2 l/c/d respectively), where the water prices are the lowest in these two governorates at average price in the north governorate is 0.85 NIS/m^3 and 0.76 NIS/m^3 in Gaza governorate. On the other side, water consumption is lower in the governorates of Middle, Khan Younis and Rafah (86.8 l/c/d, 66.1 l/c/d and 94 l/c/d respectively), where the average price in the middle governorate is 1.6 NIS/m^3 and 1.5 NIS/m^3 in both khan Younis and Rafah governorates (Al-Ghuraiz, 2002).

Worthington and Hoffman (2008) found that demand for water has been shown to vary with seasonal factors, household composition and imposition of water restrictions. However, the income effects may be mixed up with price effects in poorly specified models or the elasticities are only valid in short term and may be substantially more elastic over longer term. Furthermore, most water tariffs have complex structures that combine fixed and variable charges. Because of this, there is a division placed among marginal and average prices and consumers' reaction to these prices will depend on price perception. This is in line with what (Plappally and Lienhard, 2012) agreed that consumption has been determined to be effected by seasonal changes and water WDM strategies as governmental regulations, incentives for conservation, technological features, and influences due to social interactions.

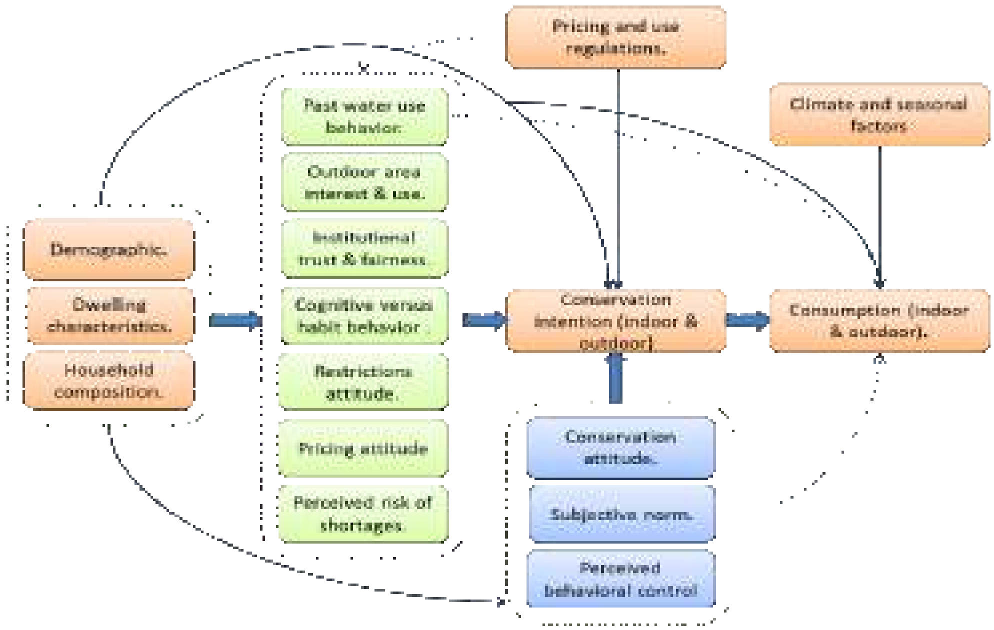
Jorgensen et al. (2009) conducted a literature review study on household water use behavior: an integrated model, where direct and indirect drivers of water saving was tabulated as shown in Table 2.2.

Table (2.2): The direct and indirect drivers of water saving behavior.

Direct divers	In-direct divers
- Climate/seasonal variables. - Incentive/ disincentives (e.g., tariff structure and pricing, rebates on water saving technologies, etc.) - Regulations and ordinances (e.g., water restrictions, local government planning regulations). - Property characteristics (e.g., lot size, pool, bore, tank, house size, house age, etc.). - Person characteristics (e.g., intention to conserve water, knowledge of how to conserve water.).	- Person characteristics (e.g., subjective norms, behavioral control, attitude toward behavior). - Institutional trust (i.e. trust in water provider). - Inter-personal trust (i.e. trust in other consumers). - Environmental values and conservation attitude. - Intergenerational equity. - Socio-economic factors (e.g., income, household composition, age, gender, education, etc.)

Source: (Jorgensen et al., 2009).

Jorgensen et al. (2009) proposed a new integrated social and economic model shown at Figure 2.3, which describes a number of factors that are impacting water use behaviors as well as other authors have found in the summarized previous table. The study suggests that trust may be one of an important factors affecting water consumption. This is because trust in the water authority and trust in others in the community (including different water using sectors as farmers, residents and industry) to take steps to reduce their water consumption will increase the likelihood that people will also take steps to reduce their water use.



Source: (Jorgensen et al., 2009).

Figure 2.3: integrated social and economic household water consumption model.

Schleich and Hillenbrand (2009) investigated economical, environmental and social determinants of residential water consumption in Germany. The (average water use per day) is categorized as dependent variable, while the determinants are categorized as independent variables as (price, income, no. of household members, age of population, sharing household wells, and summer rainfall and summer temperature). It is revealed that the increase in water services prices (e.g. by 2%) due to environmental regulations tend to declination in water consumption (by 10%), while the increase per capita income (e.g. by 1%) will lead to an increase in water consumption (by 5%). Demographical change at Germany results in a decrease in the single household size (estimated between 2003 and 2020), this will be translated into an increase per capita water demand by 1%, it is found also that the increases in population age will lead to an expected increase of water consumption.

Yu et al. (2011) represented in-home and out-of-home energy consumption behavior in Beijing, the study has investigated by building a new type of energy consumption model based on the Multiple Discrete–Continuous Extreme Value modeling framework and by conducting a questionnaire survey collected the information from 1014 households, it explored households' energy consumption (monthly energy consumption or monetary expenditure spent on electricity, gas, water, etc., in four seasons), ownership/ usage of in-home appliances (e.g., refrigerator, air-conditioner and washing machine), households’ attributes (household size, income, composition of members, housing area, dwelling type, and accessibility) and their members’ attributes (gender, age, education and environmental consciousness). Yu et al. (2011) had shown that a set of household and personal attributes affect the ownership and usage of in-home appliances. Furthermore, it is concluded that the unobserved factors (e.g., psychological, habitual, structural, or cultural variables) play a much more important role in explaining energy consumption behavior than the observed attributes (as mentioned above) of households and their members.

According to the aim of identifying the key drivers of household water use, with a view to identifying those factors that could be targeted in water demand management campaign, (Fielding et al., 2012a ; Fielding et al., 2012b) have investigated the drivers of demographics, water efficiency infrastructure, psycho-social variables, and water use habits. The results revealed that these determinants all play a part in how much water is used in households.

Vassileva (2012) found that various factors determining household energy consumption such as dwelling size, income and number of occupants are alongside consumer behavior to influence consumption the most. Furthermore, hourly, daily and monthly energy consumption differences between different years were strongly influenced by the occupants' habits, knowledge level and energy-use awareness. Vassileva (2012) concluded that electricity-use behavior and income level were the only parameters that could explain why apartments with same physical characteristics and same family structures had large differences in their consumption patterns. Moreover, other factors, such as size and number of people per household showed to have an important impact on the overall household energy consumption.

In (Dagnew, 2012) thesis research for assessing factors affecting residential water demand among different households of the town of Merawi, North Western Ethiopia. The factors were hypothesized to affect household water demand were: household expenditure, income (employment) of household members, demographic factors such as family size, age, sex and education, housing ownership and characteristics of house hold head as (an independent variable), while the water source and water consumed per capita are the (dependent variables). The study revealed that demographic and socio-economic factors are significant determinants for residential water demand. It is concluded that if water supply utilities are planning to implement proper demand management strategies, they have to give due emphasis for the changes in the demographic and socio-economic factors that affect demand or should explore and identify those factors that are called shift variables in the demand curve.

According to (Almutaz et al., 2012) case study of Riyadh city in Saudi Arabia on the determinants of residential water demand, the results showed that households with higher incomes are expected to consume water and energy more, further more when number of household members increases, per capita water consumption goes up which suggests that several water uses such as washing or even cooking increase more than proportional to the increase in household size. Finally, the higher temperatures are expected to result in higher residential water demand for drinking and taking showers, where a 100% increase in the temperature would yield an increase of 24% in water consumption.

Fan et al. (2013) conducted a study on factors affecting domestic water consumption in rural households, the study has been investigated 247 households in eight villages at China. The results showed that the household water consumption has a significant correlation with water supply pattern, houses with gardens and is negatively correlated with family size and age of household head. Hygiene habits, appliances usage and garden watering considered as key factors affecting behaviors of water consumption, which can be reduced easily when residents understand their water consumption levels for household activities, if water authorities know the clear information of the perceived and actual water consumption of residents.

Wolters Wolters (2014) examined the socio-demographic factors (age, gender, education, income and rural vs urban residency), political ideology, concern over water quantity and the (NEP) as independent variables affecting the individual water conservation behaviors as dependent variables. The findings suggest that of all factors explored, the following proved reliable predictors of participation in water conservation activities: concern about water scarcity, age (younger respondents), gender (women), income and support of the NEP. However, education and place of residence (rural vs. urban) were not predictors of water conservation behaviors.

According to the study of estimating the determinants of residential water demand in Italy, (Romano et al., 2014) found that increasing the rate charged to customers caused a reduction in residential water consumption, while increasing the income per capita increased consumption. Considering climatic and geographical features, both altitude and precipitation exerted a strongly significant negative effect on consumption. Further, population served has a positive effect on consumption, so that bigger towns showed a higher residential water demand. Moreover, it is found that water utilities ownership itself did not have a significant effect on water consumption.

Serret and Brown (2014) found that socio-economic determinants as income, household size, multi-dwelling, education of residents and their status have a pure influence on energy demand. In addition, Incentive/ disincentives as electricity prices, rebates on energy saving appliances and technologies play a vital role in energy consumption. Likewise, personal characteristic as energy-conservation behaviors and environmental value showed variant impacts on the energy conservation attitude. On the other hand, results confirm earlier findings about the significance of attitudinal variables. Social norms, attitudes and opinions about the environment in general do matter in explaining households' water-saving behaviors and investments, this obviously found in water-saving habits in Australia and France are often among the highest of all countries. The survey revealed that respondents' who express higher concern about the environment and support environmental organizations are more likely to use water-efficiency labels as in Australia, Israel and the Netherlands the countries surveyed where such a label is available.

Given the imperative of water and energy conservation for environmental sustainability, efficient water and energy management, and climate change mitigation, it is critical to understand what factors contribute to water and energy conservation behavior. Being aware of these factors will inform water and energy managers, governments and public policy officers of how best to encourage conserving behaviors, and thus reduce the need to augment existing water and energy supplies (Hurlimann et al., 2009). Given the relevance of this theme, this study aiming to achieve the 2nd objective of identifying the determinants or drivers that are summarized in Table 2.3 for water and related energy consumption in residential buildings. Furthermore, the correlation between these factors and water and energy consumption will be explored.

Table (2.3): Summary key drivers for water and energy consumption.

Driver / Author	Climate/seasonal variables.	Incentive/ disincentives (e.g., tariff structure and pricing, rebates on water and energy saving technologies, etc.).	Regulations and ordinances (e.g., water and energy restrictions, local government planning regulations).	Property characteristics (e.g., lot size, pool, bore, tank, house size, house age,	Personal and cultural characteristics (e.g., intention to conserve water and Energy, knowledge of how to conserve	Person characteristics (e.g., subjective norms, behavioral control, attitude toward behavior).	Institutional trust (i.e. trust in water provider).	Inter-personal trust (i.e. trust in other consumers).	Environmental values and conservation attitude.	Intergenerational equity.	Socio-economic factors (e.g., income, household composition, age, gender, education, etc.)
1. (Mayer et al., 1999)				√		√					√
2. (De Oliver, 1999)			√	√	√						√
3. (Al-Ghuraiz, 2002)		√				√					√
4. (Lorek, 2004)	√	√	√	√	√	√	√	√	√	√	√
5. (Inman and Jeffrey, 2006)				√		√					√
6. (Worthington and Hoffman, 2008)		√	√	√							√
7. (Schleich and Hillenbrand, 2009)	√			√							√
8. (Hurlimann et al., 2009)	√	√				√					
9. (Jorgensen et al., 2009)	√	√	√	√	√	√	√	√	√	√	√
10. (Yu et al., 2011)	√	√		√	√	√					√
11. (Plappally and Lienhard, 2012)	√	√	√					√			
12. (EEA, 2012)		√	√	√	√	√					√
13. (Almutaz et al., 2012)	√			√							√
14. (Fielding et al., 2012a ; Fielding et al., 2012b)		√		√	√	√					√
15. (Vassileva, 2012)				√	√	√					√
16. (Dagnew, 2012)				√							√
17. (Fan et al., 2013)			√	√	√	√			√		√
18. (Wolters, 2014)			√						√	√	√
19. (Romano et al., 2014)	√	√				√				√	√
20. (Serret and Brown, 2014)		√		√	√	√			√		√

2.3 Strategies that guide the residential building`s water and related energy uses for conservation and sustainability.

From a worldwide perspective, many governments and public utilities who are similarly affected by water and energy crises, are investing much in the development and implementation of water and energy measures to ensure future water demands can be met (Inman and Jeffrey, 2006). Without strategies to promote water saving among population, the battle for water demand will effectively be lost (Randolph and Troy, 2008). It is found that effective and relevant implementation of demand management and water conservation strategies is strongly strengthened by an understanding and knowledge of how consumers perceive and use their water (Jones et al., 2011; Jorgensen et al., 2009).

Particularly, water demand management (WDM) initiatives are utilized to assist in shifting consumers towards sustainable water consumption behavior. WDM is defined as the practical development and implementation of strategies aimed at influencing demand (Savenije and Van Der Zaag, 2002). It is characterized by reducing average water consumption to ensure efficient, equity and sustainable use of the resource (Brooks, 2006; Savenije and Van Der Zaag, 2002; Deverill, 2001). WDM measures are generally the most sustainable solutions across environmental, social and economical factors, in the range of options presented for water supply and distribution security (Turner et al., 2007; Savenije and Van Der Zaag, 2002).

WDM strategies can be broadly divided into three major categories as economic, technological and behavioral (Jones et al., 2011; Elizondo and Lofthouse, 2010; Brooks, 2006). Demand management strategies such as water metering, water restrictions, installation of water efficiency appliances, rebate/retrofit programs for high efficiency devices, water efficiency labeling, water conservation or education programs, and leakage control have been proposed and/or implemented for various applications (Lee, 2011; Inman and Jeffrey, 2006). Elías-Maxil et al. (2014) concluded that synergic measures to save water and energy in urban zones such as the installation of water-saving head showers and toilets, installation of tap flow regulators, leakage minimization, water consumption advice and water demand management.

Hassell and Cary (2007) and Nancarrow et al. (1996) stated that in relation to WDM, the factors (i.e. attitudes, beliefs and actual behaviors of consumers) are particularly relevant as water management initiatives often include pressure on residents to reduce household water consumption through undertaking more sustainable water consumption practices. They conclude shifting residents towards sustainable water consumption behavior thus requires the instilling of awareness, appropriate water pricing and policy consistency, understanding and appreciation of the environment and water.

Renwick and Green (2000) conducted a study to assess the prospective of price and alternative demand side management (DSM) policies (such as water allocations, use restrictions, public education) as an urban water resource management tools. The analysis based on cross-sectional monthly time-series data for eight water agencies in California representing 24% of the state's population (7.1 million people). Results showed that both price and alternative DSM policies were effective in reducing demand. However, the magnitude of the reduction in demand varied among policy tools.

Al-Ghuraiz (2002) concluded that as well water pricing, illegal connections as water tariff design are important issues should be taken into consideration as measures for improving the level of water supply service either quality or quantity to satisfy the residential consumption. In addition to improving the public awareness building capacity of decision makers highly affecting the cooperation between the water utility and the consumers. The community participation and engagement in decision making is an important strategy that encourages people to cooperate with water utility and to understand their policies which is lead to the good institutional trust, this goes in line with that concluded by (Boughen et al., 2013). Finally, Al-Ghuraiz (2002) found that controlling and monitoring of water resources and energy resources play a vital role in operation and maintenance which directly influences the consumption.

Inman and Jeffrey (2006) concluded that replacing water intensive appliances can reduce the consumption in existing housing by 35- 50%, while DSM programs can be expected to reduce water consumption by 10 to 20%, furthermore relatively reasonable (5-15%) reductions in aggregate demand can be achieved through modest price increases and voluntary alternative DSM policy instruments. On the other hand, (Qassimi et al., 2010; Inman and Jeffrey, 2006) recommended that metering and consumer engagement in water conservation, pricing mechanisms, DSM policies, Raising awareness of water scarcity on public, regulations, incentive and decentive regime, DSM implementation decision-processes and methods to manage uncertainty are of the effective strategies that influencing residential water conservation.

In addition, incentives for switching to water efficient units (i.e., rebates or unit exchange programs) are considered to be more acceptable by the public in comparison to other water management policies such as price increase or water restrictions (Lee, 2011; Millock and Nauges, 2010; Randolph and Troy, 2008; Mayer et al., 2004). The water demand management focus has shifted to residential customers by implementation of programs that are designed to encourage voluntary water conservation either by utilizing water use efficiency fixtures or altering water use behaviors (Lee and Tansel, 2013; Lee et al., 2011a; Syme et al., 2000).

Johannes et al. (2008) conducted a study on the strategies for water cycle management (WCM). They stated that WCM is a strategic approach for equitable, efficient and sustainable management of water resources and services. The study proposed in an effective water demand management strategies that include:

- Technical such as, amongst others water meter management, sectoring, leak detection and control and pressure management.
- Awareness and education of Councilors, the community and schools.
- Policy and legislation.
- Financial such as credit control, revenue enhancement and indigent policy.

Rosenberg et al. (2008) explored strategies of water management program in Jordan, among nonprice water conservation, infrastructure expansions, leak reduction, operational allocations and installations of water-efficient appliance. It is found that conservation programs for urban water users yield considerable regional benefits. These nonprice conservation programs significantly reduce scarcity costs compared to infrastructure projects and can delay or forestall the need for them. Moreover, installing water-efficient appliances allows existing supplies and facilities to serve a growing demand among physical water use efficiency, also allows user to do the same or less. Results show that a broad mix of targeted installations of water-efficient appliances, leak reduction, infrastructure expansions, and conjunctive operations can respond to growing projected water use forecasted for Jordan through 2020.

Elizondo and Lofthouse (2010) confirmed that changing user behavior is one of the most important measures for reducing water consumption at home. she concluded that approaches as policies, methods and campaigns must be designed in view of the local cultural and social background, alongside financial and technological accessibility, this goes in line with the study of water conservation: customer behavior and effective communications conducted by (Silva et al., 2010). Elizondo and Lofthouse (2010) pointed out that these approaches must be multi-staged, in the sense that they must change behavior in a gradual manner and must interconnect various means, from informing the user and providing feedback to making the use of new products be embraced by users and updating legislation accordingly – not necessarily in that order.

OECD (2011) has recently conducted survey of households' offers insight into what really works and what factors affect people’s behavior toward (water use, energy use, personal transport choices, organic food consumption, and waste generation and recycling). The result is based on responses from over 10000 households in ten OECD countries. It has shown a positive relationship between public policies in general and households’ pro-environmental behaviors. It emphasized the role of price-based incentives to encourage water and energy savings as well as waste recycling, information and education play a significant complementary role, operating on the supply side to complement demand side measures and using a mix of instruments to spur behavioral change matters.

Almutaz et al. (2012) concluded that in the absence of polices to reduce the government subsidies of water; it seems that the faithful option for reducing water consumption is a moral policy for the control of UFW. Voluntary conservation measures, on the other hand, may not yield consistent and clear impact. Serret and Brown (2014) conducted a second round of the OECD Survey on EPIC was implemented in 2011. It provides an overview of the survey data from over 12,000 households in eleven countries (Australia, Canada, Chile, France, Israel, Japan, Korea, the Netherlands, Spain, Sweden and Switzerland). The results reaffirm the importance of providing the right price incentives policies in driving water-related behavior at home, in line with the 2011 survey. In addition, being charged individually for water and energy use significantly increases the likelihood of investment in energy-efficient appliances and in some water-efficient devices such as water tanks or dual flush toilets. Metered households are also more likely to take water and energy efficiency into account.

Tsai et al. (2011) conducted a study on the impact of water conservation strategies on water use. It is concluded that residential audit⁄retrofit and water conservation appliance rebates are vital strategies of water savings. It is shown that modest but significant positive water savings averaging between 3.94 and 5.38 m^3⁄quarter⁄household through the participation in administered water conservation programs (a. free indoor water use audits and fixture retrofit kits; b. low flow toilet and washing machine rebates).

Willis et al. (2011) had shown that WDM measures play a vital role in reducing end use consumption hence offsetting the need for additional water supply and wastewater treatment measures which are costly and can be environmentally and socially detrimental.Willis et al. (2011) concluded that the highest effective household water savings might be achieved through providing water demand management professionals with empathetic educational programs. Furthermore, significant water savings in high end uses within homes can be attained if pro-environmental attitudes can be effectively inspired. This can be developed by directed awareness information focused on improving the current level of understanding of sustainable conservation behaviors among the population (Dolnicar et al., 2012).

Atallah et al. (1999) conducted a study on Mediterranean region to assess water conservation through Islamic public awareness. They pointed out that public awareness is an essential component of water conservation program, and therefore the cooperation of consumers, suppliers, policy makers in design and implementation conservation measures is indispensable. They concluded public awareness activities based on Islamic teaching and concept should not be limited to mosques, but should extend to education system among the materials taught including religion, science, environment and Arabic literature.

Leiby and Burke (2011) stated that promoting and implementing demand-side conservation can help reduce a drinking water utility's energy consumption by reducing the volume of water extracted, treated, and distributed. They proposed several effective water conservation plan strategies as incentive programs for the installation of water-efficient devices, regulations and ordinances aimed at reducing water use, metering water use and (pricing) charging rates based on actual water consumed, water accounting and loss control, information and education programs, outreach developed for specific users, pressure management and alternate water supplies for non-potable water uses.

Fielding et al. (2012b) concluded that voluntary and mandatory approaches that encourage water restrictions, school-based education programs and widespread campaigns that stress the valuable and finite nature of water are strategies that could help to achieve water conservation behaviors and the installation of efficient appliances. The findings suggest the importance of policy makers promoting a culture of water conservation that could persist even when the environmental context changes. This conclusion goes in line with thesis of (Nazer, 2010) who concluded that by legislation and regulations is an important supporting tool for WDM as one of the alternatives that may overcome the scarcity of water at Palestine. In addition to awareness and education about water scarcity and potential methods for dealing with it is crucial to achieve effective management.

Lee and Tansel (2013) adopted a telephone survey; of the customers (single family homes residents) who have participated in the water conservation retrofit program; it was conducted to evaluate the attitudes and opinions of the participants relative to water use efficiency measures and the actual reduction in water consumption characteristics of the participating households. The participant characteristics were analyzed to identify correlations between the socio-demographic factors, program satisfaction and actual water savings. The analysis of survey responses indicated that water conservation behaviors are correlated with the level of satisfaction of the customers with the incentive program as well as high efficiency products. Important findings include:

1. Attitudes: (1) customer satisfaction with the program and performance/use of high efficiency devices lead to strong intentions to engage in water conserving behaviors; (2) customers who have referred the program to others were also interested in trying new devices, suggesting a strong interest for further conservation practices.
2. Habits: changes in water use habits had direct influence on the participants' perception of savings on their water bill.
3. Education level: education level of the participants had no significant effect on savings.

4. Number of water saving appliances installed: the number of high efficiency devices installed in the residences contributed to the changes in water use habits.
5. Synergistic effects: satisfaction level along with water saving potential (i.e., implementation of water efficiency devices) or change of water use habits has provided positive synergistic effect on the actual water savings.

Significant offsetting behavior and rebound effects were observed among the participants. Frequency of the actual water savings of the households showed that there were significant incremental water savings during Year 1 and Year 2. There were no additional savings during Year 3, which suggested that people become accustomed to the water efficiency units over time (Lee and Tansel, 2013).

Fan et al. (2014) found that the majority of the population has misunderstandings on water consumption, thus leading to water wastage in households. The results suggested that improving public water conservation awareness or practices must be implemented to enhance consumer understanding of water consumption. It is concluded that metering, effective mechanism for incentives in pricing, improving transparency in water bills and reforming the bill pricing are effective measures to promote water conservation behavior among residents.

Sønderlund et al. (2014) explored and reviewed the effectiveness of consumption feedback in reduction of water use. In particular, the focus has been on recent technologies, including smart-meters and IHDs. The results indicated reductions between 3% and 53.4%, with an average of 19.6%. It is concluded that the overall potential of smart-meter technology in reduction domestic water use is clear. Thus, using such approaches to inform and educate consumers to lower their overall usage is an effective strategy could be achieved through more detailed, frequent and instant information delivery. This goes in line with the conclusion of (Darby, 2010) that smart metering is heavily promoted as an essential part of the transition to lower impact energy systems, and as a means of consumer engagement.

Vilanova and Balestieri (2014) concluded that the high potential for the application of water and electricity rational use actions in WSSs has been attributed to poor infrastructure and operational procedures, particularly in developing countries. They also concluded that the various energy efficiency and conservation measures applicable to conventional water supply systems are technologically dominated, where water losses (leakage) are the most figurative source of water and energy waste in WSSs, and reductions in water losses must be a priority efficiency measures.

According to (Feldman, 2009) the main improvements in energy efficiency can be obtained with: (I) pump stations design improvement, (ii) systems design improvement, (iii) variable speed drives (VSD) installation, (iv) efficient operation of pumps and (v) leakages reduction through pressure modulation. Other measures to enhance the efficiency of the WSS, can be applied, such as (I) the replacement of inefficient equipment, (ii) the leakage management by regular monitoring and maintenance, preventing from both water and energy wastes, (iii) the simple selection of a suitable energy tariff system, or even (iv) the incorporation of renewable energy sources in the systems, reducing fossil fuel dependency (Coelho and Andrade-Campos, 2014).

Moreira and Ramos (2013) stated that the majority of the life cycle costs of a pump are related to the energy spent in pumping, with the rest being related to the purchase and maintenance of the equipment. Any optimizations in the energy efficiency of the pumps result in a considerable reduction of the total operational cost. They found that it was possible to reduce the original daily energy costs by 43.7%. This was achieved by introducing more appropriate pumps and by intelligent programming of their operation. Goldstein and Smith (2002) confirmed that performing an energy audit or pumping system evaluation is a proactive approach to evaluate all pumping applications and processes to determine if the pumps are properly sized for the specific application and if the pumps are working at their optimum setting for highest possible efficiency.

Prevailing energy crisis and focus of the government on demand-side energy policies (i.e., energy conservation) raises the need of using energy efficient techniques in almost every aspect of life. Accordingly, (Mahmood and Ali, 2013) conducted a study to analyze energy consumption among comparing two different water supply systems namely household (individual) and community (general) in Pakistan. Results revealed that total operational energy cost in case of community (centralized) water supply system is lower than that of under household/individual water pumping units. Besides, average fixed cost under community water supply system is three times less than that incurred under household water supply system. Elizondo and Lofthouse (2010) found that introducing new and more efficient products is one of the choices to reduce water consumption in the household. Some of them replace other appliances keeping the old routines while using less energy and water, while others are meant to push the user to behave more sustainable by giving no option but to change behavior.

To put forward water education in the Kingdom of Bahrain as conventional water management strategy, Es'haqi and Al-Khaddar (2008) evaluated the level knowledge concerning water resources and water issues in Bahrain thru conducting a survey amongst graduating high school students from governmental schools. They recommend the most effective method for strengthening Bahrain's community awareness towards water issues through water education, i.e. by capacity building in conserving water resources by engaging the society in the real existing water situation in Bahrain to look forward in reducing water demand. It is concluded that members of the community of all sectors, genders, ethnics, ages and geographical locations need to change their attitudes towards water issues in which in later stage to become a behavior and style of living and this can be achieved only by raising their awareness through an effective, well managed, informatics and educational programs.

Plappally and Lienhard (2012) indicated that consumption has previously been determined to be effected by seasonal changes and WDM strategies. Several strategies may be used to manage human behavior and help prevent unnecessary expenditures of energy for water end use. These include government regulations, incentives for water conservation, technological features, and influences due to social interactions.

In order to exhibit this acknowledgment, this study aimed to accomplish the objective of demonstrating strategies that guide the residential building`s water and related energy uses for conservation and sustainability. In relation to the previous literature, the several strategies or measures that might lead for water and energy conservation and sustainability are summarized at Table 2.4 will be surveyed in depth to show their importance and validation amongst the policy makers at the Gaza Strip.

Table (2.4): Summary strategies/measures for water and energy conservation in the previous studies (Cont.)

Measure/Strategy / **Author**	Metering	Implementation of water efficiency/ saving devices	Pricing mechanism as taxis, fees...	Funding	Operation and maintenance	Design of water and electricity networks	Leakage control	Pro's and con's of different tariff structures	Consumer engagement in water conservation	Shifting attitude and behavior – Educational level.	Raising awareness of water scarcity on public agendas- Information.	Water and energy trust in supply side and policy maker (institutional trust) and inter-personal trust for use.	Equity of water and energy use.	Planning and implementation for policies to compliment the use of conservation and pricing	Investigation of the use of 'stick's (regulation) and 'carrots' (incentives)	Analysis of the DSM implementation decision-processes and their impact on conservation.
1. (Nancarrow et al., 1996).		√	√						√	√	√			√	√	√
2. (Renwick and Green, 2000).		√	√							√				√		
3. (Deverill, 2001).			√			√	√		√				√			√
4. (Al-Ghuraiz, 2002).	√		√		√		√	√	√		√	√				√
5. (Goldstein and Smith, 2002).		√			√	√										√
6. (Savenije and Van Der Zaag, 2002).			√					√				√				
7. (Mayer et al., 2004).		√	√												√	
8. (Brooks, 2006).			√		√		√	√	√				√	√		√
9. (Inman and Jeffrey, 2006)	√	√	√		√		√		√		√			√	√	√
10. (Hassell and Cary, 2007)		√	√						√	√	√			√	√	√
11. (Turner et al., 2007).	√	√			√		√		√		√					√
12. (Johannes et al., 2008).	√	√			√		√	√	√	√	√	√		√	√	√
13. (Randolph and Troy, 2008).	√	√	√					√	√	√	√	√			√	√
14. (Feldman, 2009)					√	√	√	√								√
15. (Jorgensen et al., 2009).											√					√
16. (Elizondo and Lofthouse, 2010).		√			√				√		√				√	√
17. (Qassimi et al., 2010).			√								√				√	√
18. (Millock and Nauges, 2010).	√	√	√						√							√
19. (Jones et al., 2011).		√	√	√	√		√			√	√	√		√	√	√
20. (Leiby and Burke, 2011)	√	√					√	√	√	√	√	√		√		√
21. (Lee, 2011).	√	√	√						√	√	√				√	√

Table (2.4): Summary strategies/measures for water and energy conservation in the previous studies

Measure/Strategy / Author	Metering	Implementation of water efficiency/ saving devices	Pricing mechanism as taxis, fees…	Funding	Operation and maintenance	Design of water and electricity networks.	Leakage control	Pro's and con's of different tariff structures	Consumer engagement in water conservation	Shifting attitude and behavior – Educational level.	Raising awareness of water scarcity on public agendas- Information.	Water and energy trust in supply side and policy maker (institutional trust) and inter-personal trust for use.	Equity of water and energy use.	Planning and implementation for policies to compliment the use of conservation and pricing	Investigation of the use of 'stick's (regulation) and 'carrots' (incentives)	Analysis of the DSM implementation decision-processes and their impact on conservation.
22. (OECD, 2011)..	√	√	√	√	√				√	√	√	√		√	√	√
23. (Tsai et al., 2011).	√										√				√	√
24. (Willis et al., 2011).	√	√						√	√	√	√					√
25. (Dolnicar et al., 2012).											√					
26. (Fielding et al., 2012b).		√								√	√					
27. (Plappally and Lienhard, 2012).		√						√	√	√	√	√	√		√	
28. (Boughen et al., 2013).	√		√		√		√	√	√		√	√				
29. (Lee and Tansel, 2013).	√	√	√						√	√	√					√
30. (Vilanova and Balestieri, 2014).	√	√	√		√	√	√				√					√
31. (Coelho and Andrade-Campos, 2014).	√	√			√	√	√	√								√
32. (Fan et al., 2014).	√		√								√				√	
33. (Elías-Maxil et al., 2014).	√				√		√				√					√
34. (Serret and Brown, 2014).		√	√								√				√	

2.4 The attitude and behavior of household`s residents toward water and energy conservation at residential buildings.

In fact, residential water and energy end-uses are heterogeneous and vary significantly among households with demographic (household-size), behavioral (use frequency or duration), technological (appliance use volume or flow rate, water heater intake and dispense temperatures, heater energy source, and heater efficiency), and geographic (climate, water availability) factors contributing to variations among users (Suero et al., 2012; Suero, 2010; Rosenberg, 2007). Individual behavior, lifestyle, psychological, cultural and social factors and gender preferences are some other factors that may influence end use energy consumption in a residential sector (Yu et al., 2011).

Residential households are considered to have the potential for significant water and energy savings (Janda, 2011; Willis et al., 2010) observed that building occupants are the real consumers of energy and not the building itself. Therefore, the behavior of the occupants of a building may be more important than the specific features of a particular building. Plappally and Lienhard (2012) and (Shimoda et al., 2010) stated that end use energy intensity is very high relative to most processes and human behavior has a very substantial role in setting water related energy consumption.

Aitken et al. (1994) found that attitudes, habits and values are poor predictors of water use and hence do not support the relationship of water use attitudes to actual behaviour (i.e. water consumption). Accordingly, (Aitken et al., 1994) identified a number of homes in a dissonant situation, and conducted a second study to explore whether this dissonance between perceptions and actual water use would be reduced with interventions such as feedback of the household’s actual water consumption. As a result of this feedback, there was a significant convergence between perceived water conservation and actual water consumption.

Stern (2000) reported that the major causes of water conservation behaviors as attitudes, beliefs, habits or routines, personal capabilities and contextual force. Water conservation behaviors can be divided into two major categories as (1) efficiency behaviors, and (2) curtailment behaviors. Efficiency and curtailment behaviors refer to on-off behaviors (i.e., installing high efficiency fixtures) and conservation actions (i.e., reducing time for showering), respectively. Russell and Fielding (2010) examined five major causes of water conservation behaviors (attitudes, beliefs, habits or routines, personal capabilities and contextual force), they concluded that these are important drivers of water conservation behavior which can be used to inform policy makers about what types of strategies might be most effective to influence these drivers.

Gregory and Leo (2003) itemized averaged household annual billing records with a household survey designed to stimulate information on the habits, attitudes, awareness and contextual factors to explore relationships between water conservation and consumption and psychological drivers. Gregory and Leo (2003) found that lower water users tended to be older, less educated and of lower income than the higher water users. They concluded that attitudes to water usage appeared to be poor predictors of actual water consumption behaviour.

Lipchin (2006) stated that generally, the relative scarcity of water (both in terms of quantity and quality) in Jordan and Palestine drives local perceptions and attitudes towards this resource. Lipchin (2006) explored the impact of water culture on the public's perceptions and attitudes toward water use among three water cultures: Israeli, Palestinian and Jordanian. The results showed that most families use more water than they need, most respondents from all three countries admitted they use more water than required. However, close to a third of Palestinians and Jordanians informants disagreed with this statement whereas less than a third of Israelis respondents disagreed. This phenomena is shaped on the basis of what people think about the availability of their local water supply. For all three countries people were relatively divided between confidence in local water supply meeting current needs versus mistrust in local water supplies meeting the communities' needs. In terms of being able to reduce the amount of water people use, over 50% of respondents from all three countries admitted that this would be difficult to do. Approximately 30% of the respondents said that their household water use could be reduced.

Hassell and Cary (2007) examined models on promoting behavioural change in household water consumption. Hassell and Cary (2007) concluded that change in water consumption behaviour is mostly occur when as many as possible of these elements are present: external factors such as (appropriate water pricing and policy consistency), individuals have formed a strong positive attitude towards saving water, people have the capacity to reduce consumption technology (e.g. low flow shower heads) or water substitutes are available, people believe that the advantages or positive outcomes compensate the disadvantages or negative outcomes of saving water, people perceive more social (normative) pressure to conserve water, individuals' emotional reaction to performing the behaviour is more positive than negative and individuals perceive that water conservation is more consistent with their self image and social identification than inconsistent with it.

Randolph and Troy (2008) discussed the attitudes of households toward water consumption in a search for way in which domestic water demand may be reduced. The study examined attitudes of households in different kinds of housing and was obtained using a telephone interview survey enhanced by information derived from focus groups collected from households in the same areas in Sydney. It was found that residents of Sydney are aware of water conservation as an important issue and have a good intention to make an effort to reduce water consumption. It is cocluded that complexity of drawing demand needs is to be understood in the context of the socio-demographic composition of households in diversity of dwellings, as in the cultural, behavioural and institutional aspects of consumption, if public policy is to be successful in reducing consumption and/or providing alternative domestic supplies of potable water. Randolph and Troy (2008) recommended that much more thought shall put into policy development if the promise of puplic awareness and support for more water conservation is to be made effective in terms of sustained in domestic water usage.

Miller and Buys (2008) in the residential study in Australia's South East Queensland found that most participants report feeling responsible for water conservation, but this attitude is not reflected in their day-to-day water use behaviors. Similar conclusions are drawn by (Gregory and Leo, 2003; Aitken et al., 1994). Given the decreasing amount of fresh water available, making the most out of the water resources available to us should be taken as a personal goal for everyone. Consuming water sustainably should be amongst everyone's priorities: consuming responsibly, even if it means shifting one's consumption habits, and consuming less (Elizondo and Lofthouse, 2010).

In Australia, there is growing evidence to propose that residential consumers' attitudes toward water conservation have become more positive and this alteration in attitudes is complemented with behavioural shifts in water use (Beal et al., 2011a; Willis et al., 2011; Millock and Nauges, 2010). Even though the growing awareness of the need for water conservation amongst the public, some studies have shown that householders' perceptions of their water use are often not well matched with their actual water use (Fan et al., 2014; Beal et al., 2013; Fielding et al., 2010; Millock and Nauges, 2010). The mismatch between water use perceptions and outcomes is one that echoes the low correspondence that is often found between attitudes and behavior (Dolnicar and Hurlimann, 2010). For example, (Kano, 2013; Abrahamse et al., 2005) showed that peoples' self-reported attitudes toward energy conservation and their actual energy consumption differed and observed that people reduce the conflict between attitudes and behaviour by strengthening or confirming their initial attitude.

Marandu et al. (2010) investigated the influence of the Theory of Reasoned Action in explaining conservation of residential water use in Botswana, South Africa. The findings were summarized into three disclosures: First, supporting Reasoned Action theory, where the two main foundations of the theory (attitudes and norms) were statistically significant predictors of water conservation. Second, is that attitude play a slightly larger role in clarifying water conservation behaviour. Third, even of statistical significance, attitudes and norms showed very low explanatory power. The study implication for policy makers is that water conservation communication messages should aim at changing attitudes as well as norms. The study suggests that water conservation is affected, not only by attitudes and norms, but also by many other.

(Fig. 2.4) shows the embodiment of Theory of Reasoned Action ; it incorporates the cognitive, the affective and conative components; however, these are arranged in a different pattern (Marandu et al., 2010; Westaby, 2005; Vallerand et al., 1992). The main contribution of the Theory of Reasoned Action is the proposition that attitude does not determine behavior directly; instead attitude is seen as one of two antecedent factors, attitudes and subjective norms, that determine intention, which in turn determines behavior (Ajzen and Madden, 1986).

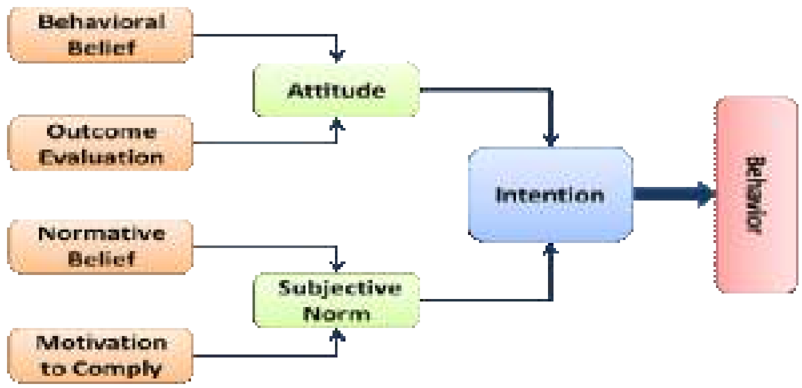


Figure 2.4: Theory of Reasoned Action . Source:(Marandu et al., 2010)

Attitudes and Norms are two conceptually independent determinants of intention. Attitude is a personal factor; it refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of behavior in question. If a person perceives that performing a behavior is positive, he/she will have a positive attitude toward performing that behavior. On the other side if the behavior is thought to be negative. ***Subjective norm*** is a social factor; it refers to a person's perception of the social pressure to perform or not perform the behavior. If a person perceives that these significant others (such as family, friends, co-workers) see performing the anticipated behavior as positive, then a positive norm might be expected and vice versa (Ajzen, 1991; Fishbein and Ajzen, 1975).

Behavioral and Normative Beliefs: In addition, the two predictors are determined as follows: Attitude is a function of behavioural belief or salient information, which is the perceived likelihood that performing the particular behavior will lead to certain outcomes, weighted by the extent to which these outcomes are valued. Subjective norm is a function of normative belief which is the perceived pressure from specified referents to perform the target behaviour, weighted by the motivation to comply with these people one cares about (Ajzen, 1991; Fishbein and Ajzen, 1975)

Ajzen (1991) identified Intention and Behaviour: the intention is the cognitive representation of a person's readiness to perform a given behavior, it is assumed to capture the motivational factors that influence a behavior; it is an indication of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior. As a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance. While behavior is the translation of intention to action, it is an individual`s observable response in a given situation with respect to a given target.

In the context of household water use, there are some studies reporting on perceived and actual water consumption. Beal et al. (2011b) concluded that disparity observed between perceived and actual water use behavior demonstrates that there cannot be exclusive reliance on individual household atitudes and beliefs to reduce water consumption. Mandatory measures such as water restrictions or incentives such as rebates are possibly more reliable in reducing residential demand.

Abrahamse and Steg (2011) explored the linkage between household energy use and householders' intention to reduce their energy use on the one side, and psychological variables and socio-demographic variables on the side. It is found that energy use in residential buildings seemed to be most strongly related to socio-demographic variables (income, household size, age), while attitudinal variables and self- transcendence values (tradition/security and power/achievement) were important also. Intention for reducing energy consumption at household was positively related to perceived behavioral control and attitudes toward energy conservation.

Aktamis (2011) conducted study on Tourkish secondary school students' to determine energy saving behavior and energy awareness and the effects of socio-demographic characteristics (gender, residential area and grade level). It is found that secondary school students had a high level of awareness about renewable energy sources and saving; however, they had a moderate level of interest in energy. The result revealed that there is a significant difference among energy saving and awareness of secondary school students according to gender and that this difference was in favor of females. The difference among the grade levels in energy saving behavior was in favor of 6th grade students. Sixth grade students had more awareness for energy saving than 7th and 8th grade students. Additionally, while the difference in the energy saving dimension was in favor of the rural students, energy awareness was in favor of the urban students.

Accordingly and at the same trend, (Kilic and Dervisoglu, 2013) investigated students' subjective norm, attitude, perceived behavioral control , and behavior towards water saving according to various socio-demographic in Turkey. As a result of the study, it is revealed that female students' average of subjective norm towards water saving is higher compared to male students. There was a meaningful difference in students' attitude towards water saving according to their mothers' level of education. Students with unlettered mothers have a higher attitude compared to other students. It was also demonstrated that students living in separate houses have a higher subjective norm compared to students living in apartment buildings. There was no expressive variance in students' water saving behavior in any of the socio-demographic variables examined in this study.

Fan et al. (2014) investigated the public perception of water consumption and its effects on water conservation behavior on the hypothesis that the usual perception regarding public water consumption bills do not mach their actual water consumption. The study showed that the household water consumption can be reduced easily when residents understand their water consumption levels for household activities if water authorities know the clear information of the perceived and actual water consumption of residents. Fan et al. (2014) concluded that the key drivers for reducing water consumption behavior are awareness, education, gender, elder and residents income and recommended that water price transparency and water bill reform because they enhance the information transparency of residents with their water consumption.

According to (Adams, 2014) study on behavioral attitudes towards water conservation and re-use examined the relationship between socio-economic characteristics of the United States public and water conservation behavior and investigated the linkgae between pro-environmental behavior with three variables (respondents willingness to energy recycling, energy conservation and water conservation attitude), the results showed that although socio-economic characteristics did not significantly predict water conservation behavior, pro-environmental behavior appeared as a significant predictor for water conservation attitude. It is concluded that understanding people's general attitudes towards the environment can help shed more light on the motivations behind water conservation behavior.

Research literature and public institutions recognized the need for adopting personal behaviours that promote water and energy conservation and improve its uses (Hurlimann et al., 2009; Jorgensen et al., 2009). Bates et al. (2008) studies shows that, despite time has passed it is still possible to mitigate (not avoid) problems concerning the future availability of water. Sarabia-Sánchez et al. (2014) concluded that in order to accomplish this objective, it is a requirement that there a change in citizen behaviour. So that people actually adopt water conservation behaviours, it seems coherent that they recognize the problem (both present and future), then these behaviours should generate personal involvement that translates into believing that individual behaviours are indeed effective.

In order to realize this recognition, this study aimed to accomplish the objective of investigating the attitude and behavior of the community toward the residential buildings` water and energy conservation. Therefore, the impact of housholds` socio-demographic charcteristics on water and energy consumption will be examined, the relationship between attitude and behavior headed for water and energy conservation will be explored and on the other side the influence of socio-demographic factors on attitude and behavior toward residential buildings` water and energy conservation will be tested. Regarding to aforementioned literature, a number of studies have examined the attitude, behavior and socio-demographic features of the households residents as factors influencing water and energy conservation and sustainability. Table (2.5) lists some of these studies.

Table (2.5): Summary of studies examined the attitude, behavior and socio-demographic factor impact on water consumption and conservation.

Factor type	Author
Socio-demographic factors as (income, household size, family number, age, gender, education, etc.)	(Abrahamse et al., 2005), (Lipchin, 2006), (Hassell and Cary, 2007), (Randolph and Troy, 2008), (Miller and Buys, 2008), (Hurlimann et al., 2009), (Jorgensen et al., 2009), (Marandu et al., 2010), (Millock and Nauges, 2010), (Shimoda et al., 2010), (Suero, 2010), (Russell and Fielding, 2010), (Willis et al., 2010), (Abrahamse and Steg, 2011), (Aktamis, 2011), (Beal et al., 2011a; Beal et al., 2011b), (Janda, 2011), (Willis et al., 2011), (Yu et al., 2011), (Plappally and Lienhard, 2012), (Suero et al., 2012), (Beal et al., 2013), (Kilic and Dervisoglu, 2013), (Kano, 2013), (Adams, 2014), (Fan et al., 2014), (Sarabia-Sánchez et al., 2014).
Attitude	(Aitken et al., 1994), (Stern, 2000), (Gregory and Leo, 2003), (Abrahamse et al., 2005), (Lipchin, 2006), (Hassell and Cary, 2007), (Miller and Buys, 2008), (Hurlimann et al., 2009), (Jorgensen et al., 2009), (Dolnicar and Hurlimann, 2010), (Fielding et al., 2010), (Elizondo and Lofthouse, 2010), (Marandu et al., 2010), (Millock and Nauges, 2010), (Russell and Fielding, 2010), (Willis et al., 2010), (Abrahamse and Steg, 2011), (Aktamis, 2011), (Beal et al., 2011a; Beal et al., 2011b), (Willis et al., 2011), (Beal et al., 2013), (Kilic and Dervisoglu, 2013), (Kano, 2013), (Adams, 2014), and (Fan et al., 2014).
Behavior	(Aitken et al., 1994), (Stern, 2000), (Gregory and Leo, 2003), (Abrahamse et al., 2005), (Lipchin, 2006), (Hassell and Cary, 2007), (Rosenberg, 2007), (Randolph and Troy, 2008), (Miller and Buys, 2008), (Hurlimann et al., 2009), (Jorgensen et al., 2009), (Dolnicar and Hurlimann, 2010), (Fielding et al., 2010), (Elizondo and Lofthouse, 2010), (Marandu et al., 2010), (Millock and Nauges, 2010), (Shimoda et al., 2010), (Suero, 2010), (Russell and Fielding, 2010), (Abrahamse and Steg, 2011), (Aktamis, 2011), (Beal et al., 2011a; Beal et al., 2011b), (Janda, 2011), (Yu et al., 2011), (Plappally and Lienhard, 2012), (Suero et al., 2012), (Beal et al., 2013), (Kilic and Dervisoglu, 2013), (Kano, 2013), (Adams, 2014), (Fan et al., 2014), (Sarabia-Sánchez et al., 2014).

Chapter 3: Research methodology

3.1 Introduction

This chapter discusses the research strategy and research design. In addition, it discusses the techniques of the adopted methodology. The information included in this chapter clarifying population, sample size, data collection tools, questionnaire design, instrument validity, pilot study and methods for data analysis. The approach undertaken for this research comprised three components, a literature review discussed in the previous chapter, a questionnaire survey and a structured interview.

3.2 Research Strategy

Naoum (2007) defined the research strategy as the way in which the research objectives can be questioned. There are two types of research strategies, namely, ‘quantitative research’ and ‘qualitative research’. Deciding on which type of research to follow, depends on the purpose of the study and the type and availability of the information that is required. Fellows and Liu (2008) acknowledged that quantitative approaches provide ‘snapshots’ and so, are used to address questions such as what, how much, how many?. Thus, the data, and results, are instantaneous or cross-sectional. Quantitative research is ‘objective’ in nature. It is defined as an inquiry into asocial or human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers, and analysed with statistical procedures, in order to determine whether the hypothesis or the theory hold true (Naoum, 2007). Quantitative research problems require that you explain how one variable affects another. *Variables* are an attribute (e.g., attitude toward the school bond issue) or characteristic of individuals (e.g., gender) that researchers study. By explaining a relation among variables, you are interested in determining whether one or more variables might influence another variable (Creswell, 2012).

The strategy of this research has built on quantitative research method where personal structured interviews and a questionnaire survey in this study were conducted simultaneously. Therefore, in view of the characteristics of quantitative research method as a method for easier and more precise thorough analysis, the personal structured interviews were chosen to identify the drivers affecting household`s residents water and energy consumption at residential buildings as for objective one and to pinpoint strategies that guide household`s residents water and related energy uses for conservation and sustainability as for objective two. For the third objective of this research, a questionnaire survey was used for triangulation of the results to investigate the attitude and behavior of household`s residents toward the residential buildings water and energy conservation.

3.3 Research Design

"Research design" is an action plan for getting from ‘here’ to ‘there’, where ‘here’ may be defined as the initial set of questions to be answered, and ‘there’ is some set of conclusion (answers) about these questions. Between ‘here’ and ‘there’ may be found a number of major steps, including the collection and analysis of relevant data (Yin, 1994) as cited by (Naoum, 2007).

The path of the research flowed through **seven stages**:

The **first stage** was defining the research problem, identification of the objectives and development of research plan, **the second one** included literature review, **third stage** included a pilot study which was judged by referees (6 experts in number) from the Islamic University of Gaza and from UNRWA- all of them holds postgraduate degrees and have related experience. The questionnaire design has been also amended to meet the feedback provided by the experts who refereed the questions.

Fourth stage is the main survey, in this stage of the survey a quantitative approach utilized in the thesis. Therefore, both self-administered questionnaire targeted to houses residents (community) and structured interview directed to infrastructure and construction management professionals used as a means cross-validation of the results of the quantitative data collection and analyses. An extensive sampling strategy was used to secure the mandatory number of respondents for meaningful statistical analysis, which included distributing 130 questionnaires to the target groups of population of houses residents (community) and conducting about 30 interviews through collaboration with the local and international institutes, those are responsible for infrastructure (water and energy) and construction management for the respective of defined professions in such field. In order to obtain reliable and representative quantitative data, the questionnaires were distributed to populations of different educational levels and the structured interviews were conducted for infrastructure and construction professionals in different positions and disciplines (i.e. project managers, supervisors, designers and so on) by email, hand and face to face meetings.

Stage five the statistical analysis and results**.** The Data analysis was performed by using (SPSS 22) application. The following statistical methods were utilized:

1. Descriptive analysis (Frequencies and Percentile).
2. Alpha- Cronbach`s Test for measuring reliability of the questionnaire’s items.
3. Pearson and Spearman Rank correlation measuring validity.
4. Kolmogorov-Smirnov test of normality.
5. Parametric Tests (T tests, Analysis of Variance).
6. Relative Importance Index (RII).

Finally, **the stage six** is the conclusion and recommendations: The final phase of the research included the conclusions and recommendations. Figure (3.1) illustrates the research flowchart.

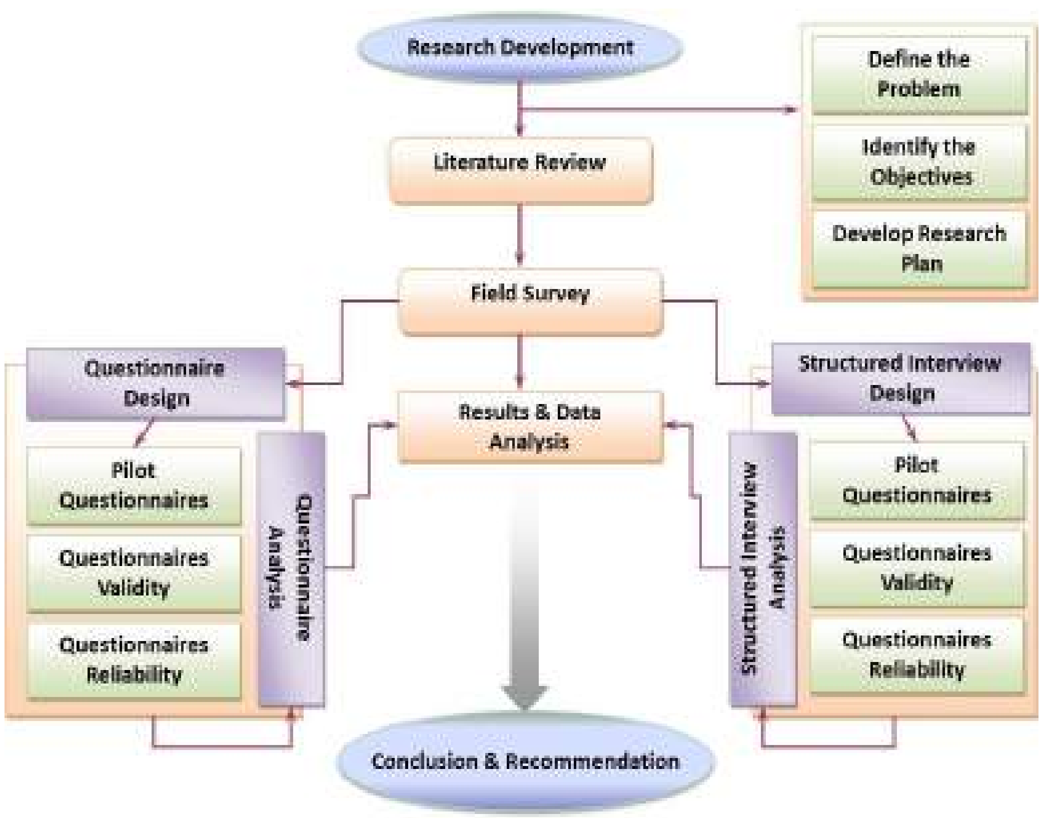


Figure 3.01: Research Flowchart

3.4 Rationale of using the research method

The related fieldwork data to this research were collected by using the survey approach (questionnaire and structured interview) survey which was considered the most widely used data collection technique for conducting surveys. Using questionnaire is mostly suited to surveys whose purpose and objectives are clear enough to be explained in a few paragraphs which are carefully chosen and guaranteed in this research. Moreover, it offers relatively high validity of results and a quick method of conducting the survey. Additionally, the structured interview used for cross validation and to strengthen the results reaveald form the questionnaire.

By looking into the relevant studies mentioned in the literature review, it was figured out that there were different methodologies and data collection approaches used in order to achieve the required objectives. They included questionnaire and interviews which both were adopted by this research, case study approach, focus groups, documents review, and workshops. Table 3.1 shows the surveyed studies and the adopted corresponding methodologies.

Table (3.1): Research methods for previous studies.

Research methods	Research studies
Questionnaire	Abrahamse and Steg (2011), Adams (2014), Al-Ghuraiz (2002), Dagnew (2012), Dolnicar and Hurlimann (2010), Dolnicar et al. (2012), Es'haqi and Al-Khaddar (2008), Fan et al. (2013), Fan et al. (2014), Fielding et al. (2012a), Fielding et al. (2012b), Jones et al. (2011),Kano (2013), , Kilic and Dervisoglu (2013), Lee and Tansel (2013), Lipchin (2006), Marandu et al. (2010), Miller and Buys (2008), OECD (2011), Sarabia-Sánchez et al. (2014), Serret and Brown (2014), Silva et al. (2010), Vassileva (2012), Willis et al. (2011), Willis et al. (2010), Wolters (2014).
Case study	Coelho and Andrade-Campos (2014), De Oliver (1999), Leiby and Burke (2011), Lorek (2004), Nazer (2010), Silva et al. (2010).
Interviews	Deverill (2001), Fielding et al. (2012b), Kano (2013), Marandu et al. (2010), Randolph and Troy (2008), Serret and Brown (2014), Silva et al. (2010).
Action research	Abrahamse and Steg (2011), Beal et al. (2013), Darby (2010), Deverill (2001), Lee (2011), Lee et al. (2011a), Lee et al. (2011b), Mayer et al. (2004), Sønderlund et al. (2014), Tsai et al. (2011), Turner et al. (2007) , Willis et al. (2011),Willis et al. (2010).
Focus groups	Deverill (2001), Es'haqi and Al-Khaddar (2008), Fielding et al. (2010),

Table (3.1): Research methods for previous studies.

Research methods	Research studies
	Lipchin (2006), Randolph and Troy (2008).
Literature review and models	Ajzen and Madden (1986), Aktamis (2011), Almutaz et al. (2012), Brooks (2006), Coelho and Andrade-Campos (2014), Elizondo and Lofthouse (2010), Elías-Maxil et al. (2014), Feldman (2009), Hassell and Cary (2007), Hurlimann et al. (2009), Inman and Jeffrey (2006), Janda (2011), Jorgensen et al. (2009), Leiby and Burke (2011), Mahmood and Ali (2013), Millock and Nauges (2010), Moreira and Ramos (2013), Plappally and Lienhard (2012), Romano et al. (2014), Rosenberg (2007), Russell and Fielding (2010), Schleich and Hillenbrand (2009), Stern (2000), Suero et al. (2012), Syme et al. (2000), (Vilanova and Balestieri (2014)), Worthington and Hoffman (2008),Yu et al. (2011).
Workshops	Abrahamse et al. (2005).

3.5 Research location

The research is carried out in two directions. First: for conducting the questionnaire to collect data relevant to thesis second objective. It was at Rafah (UNRWA rehousing project) as a case representing the opinion householders. Second: for conducting the structured interview to collect data relevant to thesis first and third objectives. It was at all Gaza Strip, which consists of the five governorates: The northern governorate, Gaza governorate, the middle governorate, Khan Younis governorate and Rafah governorate.

3.6 Research population and samples

The population investigated is categorized into two groups. The first group named (professionals) consists of (decision makers) in the field of infrastructure and construction management as managers, supervisors, designers and water operators. The population of professionals involved in this survey is covered as one professional or more per shareholders of the Re-Housing Projects implemented by UNRWA as (UNRWA, Gaza Strip Governorates Municipalities, Coastal Municipalities Water Utility (CMWU) and the Electricity distribution company (GEDCO) distributed overall the Gaza Strip. The total population for sampling is 30 association as show at table 3.2. The sample is selected through non- random purposive sampling to carry out the survey through a structured interview

Table (3.2): Distribution of professionals sample for water and energy management in Gaza Strip.

Concerned Party	North	Gaza	Middle	KhanYouins	Rafah	Gaza strip
UNRWA	0	1	1	1	1	1
Municipalities Head Quarters	0	0	0	3	3	0
CMWU	0	3	2	2	2	1
GEDCO	1	1	2	1	1	1
Water Authority	1	0	0	0	0	1
Sub-Total	2	5	5	7	7	4
Total	30					

The second group named (Household`s residents) consist of the household`s residents who are living at UNRWA Rehousing Project in Rafah, Phase I, as a representative case. This population sample is selected randomly to carry out the survey through structured questionnaire. The participants are selected randomly as per house units, where one participant represents each house units to participate in giving data and to express his opinion. The UNRWA Rehousing Project in Rafah, Phase I consists of 600 housing units.

3.7 Sample size and characteristics

As aforementioned, the first group sample is selected through non- random purposive sampling to carry out the survey through a structured interview. Thus, Thirty (30) structured interviews where held among the concerned parties for professionals through face-to-face meeting and by e-mails.

For the second group, the following statistical equation was used to determine the sample size (Creative Research System, 2015).

$$SS = \frac{Z^2 \times P \times (1-P)}{C^2}$$

Where:

SS: The sample size

Z: Z value *(e.g. 1.96 for 95% confidence interval)*

P: Percentage picking a choice, decimal, (0.50 used for sample size needed)

C: Maximum error of estimation (0.08)

$$SS = \frac{1.96^2 \times 0.5 \times (1-0.5)}{(0.08)^2} = 150$$

Correction for finite population

$$SS_{new} = \frac{SS}{1 + \frac{SS - 1}{pop}}$$

Where: pop is the population;

Population at the second group was equal to 600 housing units for household residents.

So that:

$$SS_{new} = \frac{150}{1 + \frac{150 - 1}{600}} = 120.6 \approx 121$$

The previous calculations showed that the minimum number of the questionnaires needed to be collected is (121). One hundred and thirty (130) questionnaires were distributed randomly among housing units for household residents as targeted group.One hundred and twenty-three (123) questionnaires were received back. The high percentage of received back questionnaires is justified due to the number of UNRWA engineers engaged with the Rehousing Project and their tight relation with the household`s residents who are smoothly interact with the questionnaire survey

3.8 Questionnaire and structured interview design

The questionnaire and the structured interview of this research were designed based upon the literature review, experience and refereed pilot study by experts' consultation.

3.8.1 Literature review

The design of the structured interview and questionnaire steered from previous studies directly related to the research subject. The structured interview is divided into three parts including: first part contains 5 quastions for personal information, the second part including 20 statement investigating drivers affecting household`s residents consumption of water and energy at residential buildings. The drivers were collected from references listed in table (2.3) at chapter 2. Part three of the inetrview contains 15 statement examining strategies to imropve household`s residents water and energy conservation. The strategies were collected from references listed in table (2.4) at chapter 2.

On the other hand the questionnaire is divided into three parts also, including: part one with 10 quastions for socio-demographic and household information. Part two of the questionaire consists of 16 statement investigating attitude of the household`s residents toward water and energy consumption, while the third part of the questionaire consists of 16 statement investigating behavior of the household`s residents toward water and energy consumption and conservation. The socio-demographic information and attitudinal and behavioral statements were collected from references listed in table (2.5) at chapter 2.

3.8.2 Refereed Pilot study

The first questionnaire and the structured interview drafts were designed to be reviewed by pilot study. A pilot study conducted before collecting the results of the sample. It provides a trial run for referee the questionnaire and the structured interview, which involves testing the wordings of question, identifying ambiguous questions, and testing the techniques that used to collect data. Then the questionnaire and the structured interview frameworks were modified and refined based on pilot study, and observations from expert's opinions.

The structured interview aimed to achieve two objectives of this study, which are: Objective one: To identify the drivers affecting household`s residents consumption of water and related energy at residential buildings, Objective two: To pinpoint strategies that guide household`s residents water and related energy uses for conservation and sustainability. Moreover, the questionnaire to achieve one objective of this research, which is Objective three: To investigate the attitude and behavior of the household`s residents toward the residential buildings water and energy conservation. This phase has carried out by engaging six referees to review the questionnaire and the structured interview for judge.

Table (3.3) shows some detailed information about the referees work and their experience in the infrastructure and construction management field.

Table (3.3): Detailed information for the referees

No.	Recent Work	Related experience
Referee 1	Professor at IUG at Civil and Mechanical engineering.	• More than 25 years' experience in civil and mechanical teaching and thesis supervisions. Hydraulics, dynamics and management consultative works.
Referee 2	Manager at UNRWA	• More than 10 years' experience in construction projects management and planning.
Referee 3	Statistician at Alpha` Center for Studies.	• More than 5 years' experience in thesis data measurement and analysis.
Referee 4	Head of Procurement division at CMWU.	• More than 10 years' experience in construction and infrastructure projects management and procurement.
Referee 5	Designer at UNRWA	• More than 20 years' experience in construction and infrastructure management, design and planning.
Referee 6	Designer at UNRWA	• More than 10 years' experience in construction and infrastructure design and management.

Each qualified referee has given a copy of the questionnaire and the structured interview for revision, and after that, the researcher held a meeting with each expert in order to discuss the notes. Each referee declared his own notes for adaptation (see Table 3.4), and some notes were established by more than one experienced referee. Each note was carefully considered in preparing the final questionnaire and structured interview.

Table (3.4): Questionnaire and structured interview notes gathered from referees.

No.	Notes
Referee 1	▪ **<u>Household`s residents questionnaire:</u>** ▪ Statements in items of personal attitude shall be consistent in starting by I think, I believe, I feel. ▪ **For validation**, recurrence of similar meaning phrases (items) and using of opposite meaning phrases (items) shall be avoided. (Both fields personal attitude and personal behavior). o Phrase (Item): I am not affected by the water and energy shortage problem shall be eliminated because of cross validation with first phrase, I feel that Gaza Strip suffering water and energy shortage problem. ▪ **Rewording of some phrases as:** o Energy word should be interpreted as electricity. ▪ **<u>Professional structured interview:</u>** ▪ **Rewording of some phrases as:** o Interpersonal trust: in the items of both drivers and strategies

Table (3.4): Questionnaire and structured interview notes gathered from referees.

No.	Notes
	dimensions, should be explained for more clarification. o Title of Determinants/ Drivers field shall be shorten to one word use instead of both words giving the same meaning, which is enough to be identified in the literature review. The used one: Drivers affecting household water and energy consumption. o Title of Strategies/ Measures field also, shall be shorten to one word use instead of both words giving the same meaning, which is enough to be identified in the literature review. The used one: Strategies to improve household water and energy conservation.
Referee 2	▪ **Household`s residents questionnaire:** ▪ The items mentioning the leakage concept shall be accompanied with pipe in addition to water pump and tank as an example for apparatus that may have the problem. ▪ **For validation**, recurrence of similar meaning phrases (items) and using of opposite meaning phrases (items) shall be avoided. (Both fields personal attitude and personal behavior). o I believe that I need a water pump at my house shall be eliminated also; because of cross validation with phrase I think that I can dispense of water pumps in my house. o I advocate water and energy conservation everywhere and at any time. Shall be eliminated, because of cross validation with phrase advocate water and energy conservation among my family, friends and neighborhood. ▪ **Rewording of some phrases as:** o I feel that it is important and visible that the water and energy (~~governmental parties~~) make strict laws to support water and energy conservation. Changed by concerning sides. ▪ **Professional structured interview:** ▪ **Rewording of some phrases as:** o Climate shall be replaced by seasonal weather change at the phrase Seasonal weather changes (climate) are direct drivers for water and energy consumption. (Drivers dimension field) o Rephrase the driver (The existence of house water pumps consumes more water and energy) by (The existence of house water pumps leads to more consumption in water and energy). o Rephrase the driver (Governmental water and energy restrictions and regulations are direct factors affecting the consumption) by (Governmental water and energy restrictions and regulations directly affect the consumption rate) o Rephrase the driver (Larger household size means more water and energy consumption) by (Larger household size necessarily leads to more water and energy consumption). o Circular shall be replaced by periodic at the phrase Periodic

Table (3.4): Questionnaire and structured interview notes gathered from referees.

No.	Notes
	maintenance for water and energy devices and systems. (strategies dimension field) o The words (in tabulated manner) are omitted from the strategy (Periodic maintenance for water and energy devices and systems in tabulated manner). (Strategies dimension field).
Referee 3	▪ **<u>Household`s residents questionnaire:</u>** ▪ The numbering classification for answer in item 6, no. of home residents could be better if set in ranges as 3-4 instead of just one number. (Personal information field). ▪ The numbering classification for answers including numbers ranges, the second range shall start with adding one to the previous number range as monthly income for family, answer one range <1000 Nis, the second shall be 1001-1500 Nis and so on. ▪ **<u>Professional structured interview:</u>** ▪ **Rewording of some phrases as:** o Intergenerational equity reworded by social equity to be more understandable. (In both drivers and strategies dimensions).
Referee 4	▪ **<u>Household`s residents questionnaire:</u>** ▪ The numbering classification for answer in item 6, no. of home residents could be better if set in ranges as 3-4 instead of just one number. (Personal information field). ▪ **For validation**, recurrence of similar meaning phrases (items) and using of opposite meaning phrases (items) shall be avoided. (Both fields personal attitude and personal behavior). o I use the water pump at my home because of shortage because I live at higher floor levels shall be eliminated, because of cross validation with phrase I use the water pump at my home because of shortage ▪ **Rewording of some phrases as:** o I feel no pressure against the concept of water and energy consumption reworded, as I am not convinced by the concept. ▪ **<u>Professional structured interview:</u>** ▪ Personal intention to conserve water and energy is a direct driver positively affects the water and energy consumption, eliminated to avoid repetition of phrases either in similar meaning. (Drivers dimension field) ▪ **Rewording of some phrases as:** o The word (water motors) is omitted from the driver (The existence of house water pumps (water motors) leads to more consumption in water and energy).

Table (3.4): Questionnaire and structured interview notes gathered from referees.

No.	Notes
Referee 5	▪ **<u>Household`s residents questionnaire:</u>** ▪ **Rewording of some phrases as:** o I believe that turning off my water pump when the roof tanks are full will conserve water and related energy, instead of turning off my water pump when the roof tanks are full is important for water and related energy conservation. o Using water hoses when cleaning at house during water pump operation, reworded by I believe that washing and cleaning the house while water pump is operating is a serious cause of overconsumption. ▪ **<u>Professional structured interview:</u>** ▪ **Rewording of some phrases as:** o Rebates replaced by Discount and incentives at the driver (Discount/ Incentives on water and energy saving technologies is one of the most determinants that positively affecting water and energy consumption) to be more understandable. (Drivers dimension field).
Referee 6	▪ **<u>Household`s residents questionnaire:</u>** ▪ **Rewording of some phrases as:** o I am interested by the regular maintenance of water and energy appliances, reworded by I believe of regular maintenance. ▪ **<u>Professional structured interview:</u>** ▪ **Rewording of some phrases as:** o Adding the word awareness in the strategy (Educational and training programs for rising up the level of public <u>awareness</u> and the workers on the water and energy operational and maintenance field). (Strategies dimension field).

3.8.3 Structured interview and Questionnaire final contents

As aforementioned in the reseach design, the structured interview included 5 questions of personal information for the first part, 20 statements of drivers for the 2nd part, and 15 statements of strategies for the 3rd part. Questions and statements are selected from literature review, experience and consultancy of expeties. All of them closed and multiple choice questions. After referee, amendment and rewording thru the pilot study, as shown at appendix (A), the final refined structured interview was comprised with 5 questions of personal information (remained as selected), 19 statements of drivers (one statement is ommited) , 15 statements of strategies for the 3rd part, remained as selected.

The questionnaire included 10 questions of socio-demographic factors for the first part, 16 statements of attitudes for the 2nd part, and 16 statements of behaviors for the 3rd part. Questions and statements are selected also from literature review, experience and consultancy of expeties. All of them closed and multiple choice questions. After referee, amendment and rewording thru the pilot study, as shown at appendix (B), the final refined questionnaire was comprised with 9 questions of socio-demographic factors (one statement is ommited), 14 statements of attitudes (two statements are ommited), 14 statements of behaviors for the 3rd part (two statements are ommited).

Table (3.5) illustrates the questionnaire and structured interview final design and contents in which each has been divided into three dimensions to meet the reaserch objectives as aforementioned.

Table (3.5): The questionnaire and structured interview final design and contents

S.N	No. of Items			Part Title	Objective
	From L.R	Added or Removed	Final		
The structured interview					
1st Part	5 Questions	0	5 Questions	Personal information	1st and 2nd
2nd Part	20 Statement	-1	19 Statement	Drivers affecting household`s residents water and energy consumption	1st
3rd Part	15 Statement	0	15 Statement	Strategies guide household`s residents uses of water and energy to conservation and sustainability.	2nd
The questionnaire					
1st Part	10 Questions	-1	9 Questions	(Socio-demographic factors)	3rd
2nd Part	16 Statement	-2	14 Statement	Water and energy consumption and conservation personal attitudes	3rd
3rd Part	16 Statement	-2	14 Statement	Water and energy consumption and conservation personal behavior	3rd

Both instruments (interview and the questionnaire) were provided with a covering letter explaining the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage a high response. As mentioned earlier, not as the questionnaire self-administrated by the Houshold`s residents participants, the structured interviews were not purely administered by professional participants. Instead, the adopted approach was closer to the interviewer (researcher) - administered approach, where every professional was briefed on the study problem, objectives and main terminologies. Then, every participant received a copy of the structured interview and answered its structured questions in contact with the researcher and after receiving all required clarifications (when requested in a standard and unified way to avoid any bias in the collection stage). The researcher had discussed questions with the participant for probing and thorough understanding purposes.

Both questionnaire and the structured interview were originally in English language, but the questionnaire was carefully translated into the Arabic Language. The Arabic version is the one judged by the referees for its reliability.

3.9 Data measurement and analysis methods.

The Data analysis was performed by using (SPSS 22) application. The following statistical methods were utilized:

1. Descriptive analysis (Frequencies and Percentile).
2. Alpha- Cronbach`s Test for measuring reliability of the questionnaire’s items.
3. Pearson and Spearman Rank correlation measuring validity.
4. Kolmogorov-Smirnov test of normality.
5. Parametric Tests (Sign tests, Analysis of Variance).
6. Relative Importance Index (RII).

3.9.1 Data measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there was/were an appropriate method/s that can be applied and not others. In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order. The numbers assigned to the important (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels (Naoum, 2007). Based on Likert scale we have the following:

Item	Strongly agree	Agree	Do not Know	Disagree	Strongly Disagree
Scale	5	4	3	2	1

Care has to be taken not to read too much in these ranked scales. They are usually a three, five or seven-point range and ask respondents to indicate rank order of agreement or disagreement by circling the appropriate number (Bell, 2005).

Five points Likert scales was used in this questionnaire. It is used to discover strength of feeling or attitude towards a given statement or series of statements and the implication here is that the higher the category chosen, the greater the strength of agreement. The respondents were asked to rate each statement of the drivers and of the stratgeies by checking the choosed field which represent their scale of agreement. Where, 1 represented " strong disagreement" and 5 represented " strong agreement".

According to using a five-points Likert scale, the RII% (Relative Importance Index) describes drivers importance based on the degree of the agreement per the professionals (decision makers) respondents as (0- 19%) strongly disagree that the tested driver has an effect of impact on consumption of water and energy consumption; (20%- 39%) disagree; (40%-59%) neutral (neither agree nor disagree) means I don’t exactly that the driver has an effect or not; (60%-79%) agree and (80%-100%) strongly agree.

3.9.2 The relative importance index

The relative importance index method (RII) was used to determine the ranks of all performance factors. The relative importance index was computed as (Sambasivan and Soon, 2007):

$$RII = \frac{\sum W}{A \times N}$$

where:

W is the weighting given to each factor by the respondents (ranging from 1 to 5)
A = the highest weight (i.e. 5 in this case)
N = the total number of respondents.

The RII value had a range from 0 to 1 (0 not inclusive), the higher the value of RII, the more impact of the attribute. However, RII doesn’t reflect the relationship between the various attributes.

3.9.3 Non-parametric tests

Non-parametric methods were widely used for studying populations that take on a ranked order. The use of non-parametric methods may be necessary when data have a ranking but no clear numeric interpretation, or for data on ordinal scale non-parametric methods make fewer assumptions; their applicability is much wider than the corresponding parametric methods. In particular, they may be applied in situations where little is known about the application in question. In addition, due to the reliance on fewer assumptions, non-parametric methods are more robust.

Another justification for the use of non-parametric methods is simplicity. In certain cases, even when the use of parametric methods was justified, non-parametric methods may be easier to use. Due both to this simplicity and to their greater robustness, non-parametric methods were seen by some statisticians as leaving less room for improper use and misunderstanding.

Sign test was used to determine if the mean of a paragraph was significantly different from a hypothesized value 3 (Middle value of Likert scale). If the P-value (Sig.) is smaller than or equal to the level of significance, $\alpha = 0.05$ then the mean of a paragraph was significantly different from a hypothesized value 3. The sign of the Test value indicates whether the mean is significantly greater or smaller than hypothesized value 3. On the other hand, if the P-value (Sig.) is greater than the level of significance, $\alpha = 0.05$, then the mean a paragraph is insignificantly different from a hypothesized value 3.

Mann-Whitney test was used to examine if there was a statistical significant difference between two means among the respondents toward the work stress among professionals in the construction projects in Gaza Strip due to (Age, gender, educational level, type of company… etc.).

Kruskal-Wallis test was used to examine if there was a statistical significant difference between several means among the respondents toward the work stress among professionals in the construction projects in Gaza Strip due to (marital status, number of children, profession, and number of staff in the company, experience in the organization, experience in construction industry, project nature, and location).

3.9.4 Validity of the questionnaire

In order to test the suitability, validity and reliability of the scales before committing to the complete sample population, testing the pilot study for the questionnaire was steered. It is as stated earlier, for identifying ambiguous questions, testing the techniques that used to collect data, and measuring the effectiveness of standard invitation to respondents. Statistical validity is used to evaluate instrument validity, which include criterion-related validity and Structure validity. Statistical validity of the questionnaire refers to the degree to which an instrument measures what it is supposed to be measuring (Polit and Beck, 2004).

To insure the validity of both questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Spearman test) which measures the correlation coefficient between each paragraph in one field and the whole field, this done by finding Spearman correlation coefficient and P-value for each field items. Accordingly, if P-values found to be less than 0.05 or 0.01, so the correlation coefficients of this field is significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it could be said that the paragraphs of this field is consistent and valid to measure what it was set for.

The second test is the structure validity test (Spearman test also) that is used to test the validity of each field and the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level, the significance values if P-values found to be less than 0.05 or 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it could be said that the fields is valid to be measured what it was set for to achieve the main aim of the study.

a. Criterion related validity

Internal consistency of the questionnaire is measured by a scouting sample (pilot), which consisted of 30 questionnaires through measuring the correlation coefficients between each paragraph in one field and the whole filed.

Table (3.6) clarifies the correlation coefficient for each item of water and energy personal attitudes field and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that paragraphs of this field are consistent and valid to be measure what it was set for.

Table (3.6): Correlation coefficient of each item of water and energy personal attitudes and the total of this field

No.	Item	Spearman Correlation Coefficient	P-Value (Sig.)
A.1	I feel that Gaza Strip suffering water and energy shortage problem	0.168	0.033*
A.2	I think that I am a part of water and energy shortage problem	0.740	0.000*
A.3	I am convinced by the concept of water and energy conservation and sustainability at Gaza Strip.	0.466	0.000*
A.4	I believe that more attention for water and energy conservation is needed.	0.535	0.000*
A.5	I believe that changing attitudes and beliefs affects the water and energy conservation.	0.681	0.000*
A.6	I believe that I can play additional positive role toward water energy conservation.	0.556	0.000*
A.7	I feel that my neighbors are not aware about water and energy conservation issue.	0.183	0.022*
A.8	I think that I can dispense of water pumps in your house.	0.503	0.000*
A.9	I believe that I could make more efforts to conserve water and energy.	0.719	0.000*
A.10	I believe of regular maintenance for water and energy appliances as leakage problems arise (ex. the roof water tank, water pump…).	0.397	0.000*
A.11	I believe that turning off my water pump when the roof tanks are full will conserve water and related energy.	0.563	0.000*
A.12	I think that leakage in my home appliances or hoses during operating the water pump is an important cause of over consumption.	0.502	0.000*
A.13	I feel that it is important and visible that the water and energy concerning sides make strict laws to support water and energy conservation.	0.403	0.000*
A.14	I believe that washing and cleaning the house while water pump is operating is a serious cause of over consumption.	0.504	0.000*

* Correlation is significant at the 0.05 level

According to the pilot study, one statement was eliminated which is "I believe that design of water and energy are not efficient" from field "Water and energy personal attitudes" because the value of spearman correlation coefficient equals -0.064 with P-value (sig.) = 0.242 which is greater than the level of (sig.) α = 0.05.

Table (3.7) clarifies the correlation coefficient for each item of water and energy personal behavior field and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at α = 0.05, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table (3.7): Correlation coefficient of each item of Water and energy personal behavior and the total of the field.

No.	Item	Spearman Correlation Coefficient	P-Value (Sig.)
B.1	I directly change my behavior when I feel the action do conserve water and energy consumption.	0.499	0.000*
B.2	I use the water pump at my home because of shortage.	0.301	0.000*
B.3	I dispense of my water pump if I convinced that the design of the water network.	0.183	0.021*
B.4	I conserve water and energy wherever and all the time.	0.312	0.000*
B.5	I advocate water and energy conservation everywhere and at any time.	0.437	0.000*
B.6	I dispense of water pump at my house when I see the neighbors and people at the neighborhood dispense of their water pumps.	0.761	0.000*
B.7	I use the water pump at my home because the entire neighborhood uses water pumps at homes.	0.557	0.000*
B.8	I dispense of my water pump if I convinced that the water supply and operating system work efficiently.	0.309	0.000*
B.9	I immediately repair any water and energy conservative appliances as leakage problems arise (ex. the roof water tank, water pump and pipes.	0.441	0.000*
B.10	I do a regular maintenance for water and energy appliances as leakage problems arise (ex. the roof water tank, water pump and pipes.	0.367	0.000*
B.11	I immediately turn off my water pump when the roof tanks are full.	0.330	0.000*
B.12	I make sure that there is no leakage in my home appliances or hoses during operating the water pump.	0.324	0.000*
B.13	I comply with the governmental restricting laws relevant to water and energy conservation at my home.	0.260	0.002*
B.14	I used to wash the house by water hose while water pump is operating	0.577	0.000*

*Correlation is significant at the 0.05 level

b. Structure validity of the questionnaire

Structure validity was the second statistical test that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of likert scale.

Table (3.8) clarifies the correlation coefficient for each field and the whole questionnaire. The p-values (Sig.) are less than 0.05, so the correlation coefficients of all the fields are significant at $\alpha = 0.05$, so it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the study.

Table (3.8): Correlation coefficient of each field and the whole of questionnaire

No.	Field	Spearman Correlation Coefficient	P-Value (Sig.)
1.	Water and energy personal attitudes	0.937	0.000*
2.	Water and energy personal behavior	0.885	0.000*

* Correlation is significant at the 0.05 level

Reliability analysis

The reliability of an instrument was the degree of consistency, which measures the attribute it was supposed to be measuring (George and Mallery, 2003). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test was repeated to the same sample of people on two occasions and then compared the scores obtained by computing a reliability coefficient (George and Mallery, 2003).

Cronbach's Coefficient Alpha

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0 (Fellows and Liu, 2008), and the higher values reflects a higher degree of internal consistency. The Cronbach's coefficient alpha was calculated for each field of the questionnaire.

Table (3.9) shows the values of Cronbach's Alpha for each field of the questionnaire and the entire questionnaire. For the fields, values of Cronbach's Alpha were in the range from 0.655 and 0.762. This range is considered high; the result ensures the reliability of each field of the questionnaire. Cronbach's Alpha equals 0.823 for the entire questionnaire, which indicates an excellent reliability of the entire questionnaire.

Table (3.9): Cronbach's Alpha for each field of the questionnaire and the entire questionnaire

No.	Field	Cronbach's Alpha
1.	Water and energy personal attitudes	0.762
2.	Water and energy personal behavior	0.655
3.	Water and energy personal attitudes and behavior for the entire questionare.	0.823

Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

Chapter 4: Results and discussion

4.1 Introduction

This chapter presents the analysis of the survey data and discussion of the results for tested field surveys. It consists three sections. For the thesis objectives sequence purpose, first section debates the first and second parts of the structured interview e considering the first objective of the study. The second section discusses survey results of the structured interview third part, which investigating the second objective. However, the third section displays the entire questionnaire survey results and discussion, which covers the third and last objective.of the study.Data is analyzed using (SPSS 22) application including descriptive and inferential statistical tools.

4.2 First Section: Structured interview survey results and discussion

As mentioned previously, the structured interview aimed to achieve two objectives of this research, which are: Objective 1: To identify the drivers affecting household`s residents consumption of water and related energy at residential buildings. Objective 2: To pinpoint strategies that guide the household`s residents use of water and related energy for conservation and sustainability. This structured interview was divided into three main parts, which included (I) Personal information of the professionalsas respondents, (II) Drivers affecting household`s resindents consumption of water and related energy at residential buildings, (III) Strategies that guide residential building`s water and related energy uses for conservation and sustainability. This section of discussion will addresses the three parts I, II, and III.

4.2.1 Part I: Personal information

This part of the structured interview mainly aimed to provide general information about the professionals in terms of major type of profession, the organization or authority working in and its location, the educational level and experience of professionals. Table (4.1) lists the servying results.

Table (4.1): Socio-demographic and household information.

General information	Categories	Frequency	%
Respondents Profession	Project engineer	10	34
	Project Manager	9	30
	Designer	7	23
	Others	4	13
	Total	**30**	**100.0**
Respondents` Organization	CMWU	10	33
	Electricity D.Co.	7	23
	UNRWA	5	17
	Municipality of Rafah	3	10
	Municipalityof Kh.Y.	3	10
	Water Authority	2	7
	Total	**30**	**100.0**
Distribution of Respondents locations	North area	2	7
	Gaza	5	17
	Middle area	5	17
	Khan Younis	7	23
	Rafah	7	23
	Gaza Strip	3	13
	Total	**30**	**100.0**
Education level	High Diploma	2	7
	Bachelor Degree.	15	50
	Master Degree	7	23
	PhD	6	20
	Total	**30**	**100.0**
Experience in water and energy field	> 15	11	37
	10-15	8	27
	5-10	7	23
	< 5	4	13
	Total	**123**	**100.0**

4.2.2 Part II: Derivers affecting household`s residents consumption of water and related energy at residential buildings.

This section of the structured interview mainly designed to conduct the first objective of this study research in which the researcher attempt to identify the drivers affecting household`s residents consumption of water and related energy at residential buildings.

Table (4.2) included 19 drivers that have been queried by professionals to assess their influence on the household`s residents consumption of water and related energy at residential buildings. These drivers were subjected to the view of respondents, and outcomes of the analysis were conducted. The descriptive statistics, i.e mean, standard deviation (SD), relative importance index (RII), test value, probablilties (P-value) and rank were calculated and presented at herein under table (4.2).

Table (4.2): RII and Test value for "Drivers affecting household`s residents consumption of water and energy at residential buildings".

No.	Drivers	Mean	RII (%)	SD	Test value	P-value (Sig.)	Rank
D.1	Seasonal weather changes (climate) are direct drivers for water and energy consumption.	4.44	88.9	0.70	4.51	0.000*	1
D.2	Knowledge of how to conserve water and energy is a direct driver that positively affect the water and energy consumption	4.04	80.7	0.65	4.37	0.000*	2
D.3	Larger household size necessarily leads to more water and energy consumption.	4.04	80.7	0.81	4.05	0.000*	3
D.4	Environmental values and conservation attitude are of the main drivers for water and energy consumption.	3.81	76.3	0.68	3.99	0.000*	4
D.5	Decrease in family number leads to lower water and energy consumption.	3.81	76.3	0.88	3.54	0.000*	5
D.6	Education level for householder residents is an effective driver for water and energy consumption.	3.81	76.3	0.92	3.46	0.000*	6
D.7	Behavioral control and attitude toward behavior are main determinants for water and energy consumption.	3.81	76.3	1.00	3.31	0.000*	7
D.8	Institutional trust (i.e. trust in water provider) is a factor that positively affects water and energy consumption.	3.70	74.1	0.95	3.11	0.001*	8
D.9	Social equity is an important factor positively affects water and energy conservation.	3.58	71.5	0.90	2.78	0.003*	9
D.10	Increase in household income leads to less water and energy consumption.	3.56	71.1	0.97	2.62	0.004*	10
D.11	Tariff/ pricing system is one of the most determinants that positively affecting water and energy consumption.	3.52	70.4	0.80	2.84	0.002*	11
D.12	Discount/ Incentives on water and energy saving technologies is one of the most determinants that positively affecting water and energy consumption.	3.52	70.4	0.85	2.73	0.003*	12
D.13	The existence of water pumps leads to more consumption in water and energy.	3.48	69.6	0.94	2.38	0.009*	13

Table (4.2): RII and Test value for "Drivers affecting household`s residents consumption of water and energy at residential buildings".

No.	Drivers	Mean	RII (%)	SD	Test value	P-value (Sig.)	Rank
D.14	Governmental water and energy restrictions and regulations directly affect the consumption rate.	3.44	68.9	0.97	2.18	0.015*	14
D.15	The existence of water tanks conserves more water and energy.	3.38	67.7	0.94	1.97	0.025*	15
D.16	Inter-personal trust (i.e. trust between populations at the same neighborhood) is a determinant that positively affects the water and energy consumption.	3.3	66.2	0.88	1.7	0.050	16
D.17	Gender is an important factor for water and energy consumption.	3.15	63.0	1.10	0.74	0.231	17
D.18	Older house residents tend to consume less water and energy consumption.	2.93	58.5	0.78	-0.50	0.309	18
D.19	Older houses consume less water and energy.	2.59	51.9	0.84	-2.30	0.011*	19
	Drivers affecting household water and energy consumption	3.57	71.4	0.31	4.55	0.000*	

* The mean is significantly different from 3

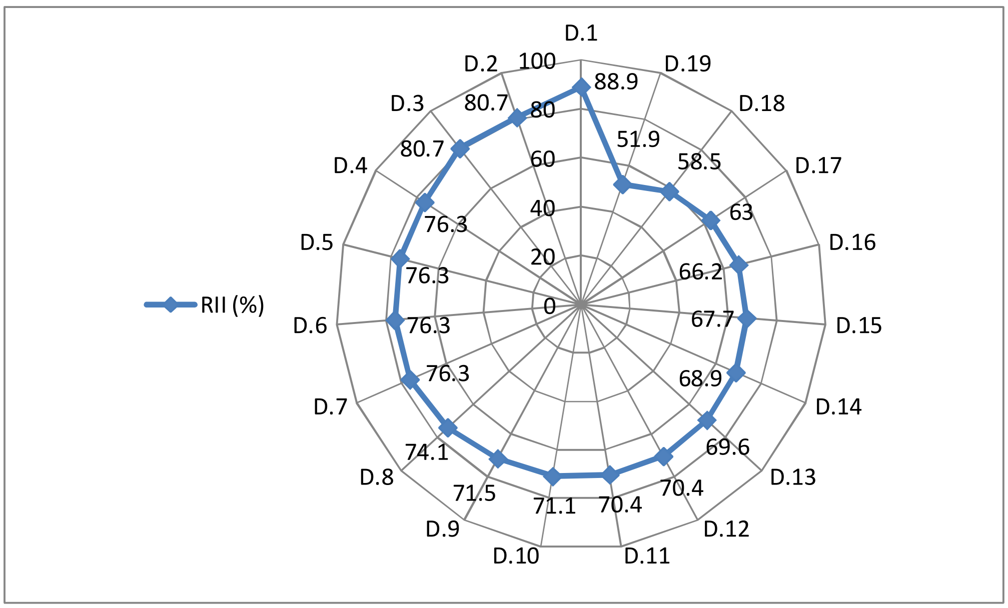


Figure 4.1: RII for drivers (D1-D19) affecting residents consumption of water and energy.

Table (4.2) provides RIIs and ranks of drivers, respectively. It is valuable to mention that ranking of the drivers was based on the highest mean, RII and the lowest SD. Accordingly, when similarity is encountered in means and RII for different drivers as in (D.2) and (D.3) ranking will be based on the lower SD, thus the driver with lower SD will has the priority in higher ranking eventhough they have the same rank value.

The finding indicated that the driver " Seasonal weather changes (climate) are direct drivers for water and energy consumption " (D.1) was ranked in the first position with (RII) = 88.89% and Mean= 4.44 according to overall professionals respondents. The value of the test-value = 4.51 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. This statistical result illustrates that this dirver has got the strong agreement from the majority of the professionals. This finding interprets the high effect of the climate changes on water and related energy consumption. The higher values of climate imply that weather is less humid and the temperature is higher specially at summer where the evapotranspiration rate is higher, this condition induces more consumption and more water for planting. Moreover, seasonal weather changes affect the hourly variations of water and energy demand, which show high impact on domestic energy consumption thru the intensive use of appliances as residential water pumps. This result is in line with (Romano et al., 2014; Statzu and Strazzera, 2009; Inman and Jeffrey, 2006; Vassileva, 2012; Bartusch and Porathe, 2011) who stated that "Seasonal weather changes (climate) " is a vital driver affecting the household`s residents consumption of water and energy consumption at residential buidlings.

" Knowledge of how to conserve water and energy" driver (D.2) with RII = 80.7% and and Mean = 4.04 has got the 2nd rank. The value of the test-value = 4.37 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Knowledge about consumption of water and energy and how to minimize it, will increase household`s residents willingness to change their attitudes and behaviors toward conservation. There is a need for knowledge to manage the household`s residents demand of water and energy by the providers. This result is agreed with other studies of (Wolters, 2014; Estrada, 2013; Vassileva, 2012; Gregory and Leo, 2003; Syme et al., 2000; Aitken et al., 1994).

Although, the same RII = 80.7% and Mean = 4.04 as driver (D.2), driver (D.3) " Larger household size necessarily leads to more water and energy consumption " was ranked in the the 3rd position. That, because it is considered a less degree of agreement among the respondents due to its higher SD = 0.81. This driver has the test-value = 4.05 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Larger households size in term of area (m^2) is associated with additional number of rooms or even wider living areas or more water and energy appliances. Therefore, the water consumed for cleaning or energy used for lighting or oprating residential water pumps ultimately will be higher than the smaller households. This result is in line with (Vassileva, 2012; Yu et al., 2011; Santin et al., 2009; Statzu and Strazzera, 2009; Domene and Saurí, 2006; Renwick and Green, 2000). Accordingly, it is concluded that these both dirvers " Larger household size" and " Knowledge of how to conserve water and energy " represent important drivers that have high impact on the residential water and energy consumption.

Furthermore, driver (D.4) " Environmental values and conservation attitude " was ranked in the 4th position with RII = 76.3% and Mean = 3.81. The value of the test-value = 3.99 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Environmental value is the focus of attention and concern of people that are interested and value things follows her relationship to the environment. Thus, if people value water and energy, conserving them will become a priority. On the other hand, the conservation attitude is the belief by using objects or resources carefully, to secure their wise and sustainabile use, and to maintain their quality and value. Therefore, household`s residents who have greater environmental value and conservation attitude shall report more water and energy conservative practices. This result is consistent with the reported by (Serret and Brown, 2014; Wolters, 2014; Grafton et al., 2011; Willis et al., 2011; Gilg and Barr, 2006; Gregory and Leo, 2003)

As well, driver (D.5) " Decrease in family number leads to lower water and energy consumption" was ranked in the 5th position with the same RII = 76.3% and Mean = 3.81 as (D.4), but with higher value of SD. The value of the test-value = 3.54 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Regardless of investing in efficient appliances to conserve water and energy, household area, family income, regulations or other factors, decrease in household`s residents number leads to less water and energy consumption. This finding agrees with the results obtained by (Serret and Brown, 2014; Fan et al., 2013; Almutaz et al., 2012; Dagnew, 2012; Fielding et al., 2012a ; Vassileva, 2012; Yu et al., 2011; Schleich and Hillenbrand, 2009; Domene and Saurí, 2006; Gregory and Leo, 2003; Renwick and Green, 2000).

Similarly, " Education level " driver (D.6) with RII = 76.3% , Mean = 3.81 and SD =0.92, has got the rank 6. The value of the test-value = 3.46 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Education plays a role in promoting environmental values and thus urging water and energy conservation behaviors and investments in water and energy efficient devices. Consistently (Serret and Brown, 2014; Fan et al., 2013; Dagnew, 2012; Fielding et al., 2012a ; Vassileva, 2012; Gregory and Leo, 2003; De Oliver, 1999) found that educational level of household residents is a predictor for household water and energy consumption. While, in contrary (Wolters, 2014; Yu et al., 2011) have been shown that education and place of residence did not produce statistically significant impacts on cumulative water and energy use.

" Behavioral control and attitude toward behavior " driver (D.7) was ranked in the 7^{th} position with the RII = 76.3% , Mean = 3.81 and SD = 1. The value of the test-value = 3.31 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Particularly, behavioral responses of residents to water and energy conservation may explain differences in consumption rates. When water tanks are fully filled, shutting off the residential water pumps is an example of behavioral control. Additionally, positive attitudes contribute in households water and energy savings and lead to strong intentions of conservative behaviors. This finding is in line with (Hong and Chang, 2014; Estrada, 2013; Fielding et al., 2012b; Gregory and Leo, 2003).

Driver (D.8) " Institutional trust (i.e. trust in water and enegy provider) " with RII = 74.1% and Mean = 3.7 has got the rank 8. The value of the test-value = 3.11 with positive sign of the test and P-value = 0.001 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Highlighting the trust between household`s residents and providers of water and energy, makes people feel of unbiased and fairness either in supply or in bills. Hence, they will look for consuming water or energy in conservative manner, promising with bills reimbursing and not to think in illegal connections. This findings is supported by studies of (Serret and Brown, 2014; Boughen et al., 2013; Jones et al., 2011; Jorgensen et al., 2009; Lipchin, 2006; Al-Ghuraiz, 2002; Corral-Verdugo et al., 2002).

What's more, " Social equity " driver (D.9) was ranked in the 9th position with RII = 71.5% and Mean = 3.58. The value of the test-value = 2.78 with positive sign of the test and P-value = 0.003 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Social equity is an important ingredient in the institutional trust formation. Equity in pricing, supply and distribution emphasize the perception of residents for having the same magnitude of water and energy. This will increase the conservation motivations and will lead to reduction in water and energy consumption. It is important to give due attention to equity to prevent weakest people to bear high liability. This result is in line with (Jorgensen et al., 2009; Al-Ghuraiz, 2002; Savenije and Van Der Zaag, 2002; Deverill, 2001).

Driver (D.10) " household income " was ranked in the 10th position with RII = 71.1% and Mean = 3.56. The value of the test-value = 2.62 with positive sign of the test and P-value = 0.004 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Low income residents consider the water and energy efficiency is an important aspect, but less able to take action. The price of water is relatively low at Gaza strip. Water expenditures normally accounting for a small percentage of household income, which results in households not being responsive to water pricing signals. Generally, when income increases, water and energy conservation behaviors increase. This because of the ability to invest in water and energy efficient devices which lead to reduction in consumption and ultimately to conservation. This finding agrees with the results obtained by (Romano et al., 2014; Wolters, 2014; Boughen et al., 2013; De Oliver, 1999).

" Tariff/ pricing system " driver (D.11) with RII = 70.4% and Mean = 3.52 has got the rank 11. The value of the test-value = 2.84 with positive sign of the test and P-value = 0.002 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. The water or energy tariff is a regime followed by providers of service to consumers. It is designed to cover part or all of the costs of providing water or energy services and reduction measures. It includes documented rates, rules, regulation or conditions. Thus, the effectivness of such tariffs or pricing systems is signified in penalizing extreme use of water and energy. The results agrees with (Romano et al., 2014; Serret and Brown, 2014; Fan et al., 2013; Almutaz et al., 2012; Dagnew, 2012; Vassileva, 2012; Schleich and Hillenbrand, 2009; Al-Ghuraiz, 2002; Corral-Verdugo et al., 2002; Renwick and Green, 2000).

Alike, driver (D.12) " Incentives/Discount on water and energy saving technologies" was ranked in the 12th position with the same RII = 70.4% and Mean = 3.52 as (D.11), but with higher value of SD. The value of the test-value = 2.73 with positive sign of the test and P-value = 0.003 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Variety of measures used by providers to promote water and energy conservation at households. Measures are ranged from economic instruments such as rebates on water/energy charges or incentives to install water/energy-efficient equipment, to direct regulations or temporary restrictions. Examples of restrictions as stopping the use of residential water pumps for household near the resource of supply. This finding is in line with (Serret and Brown, 2014; Vassileva, 2012; Renwick and Green, 2000).

" The existence of house water pumps " driver (D.13) with RII = 69.6% and Mean = 3.48 was ranked in 13th position. The value of the test-value = 2.38 with positive sign of the test and P-value = 0.009 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Residential water pumps is needed in some households. It is used to compensate low pressure (due to headloss) in water network and to deliver demand within the limited time of source operation, specially at Gaza Strip. But, it could be an inefficient device. Utilizing water pumps in households adjacent to supply source; will lead to more consumption of water, energy loss and unfairness or inequity in distribution. This finding was supported by (Plappally and Lienhard, 2012; Lee, 2011; Mahmood and Ali, 2013; Elías-Maxil et al., 2014; Moreira and Ramos, 2013; Vilanova and Balestieri, 2014; Weissman and Miller, 2009).

Driver (D.14) " Governmental regulations or restrictions " was ranked in 14th position with RII = 68.9% and Mean = 3.44. The value of the test-value = 2.18 with positive sign of the test and P-value = 0.015 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Regulations are important when rigid limits on resource use is needed. The effectiveness of such regulations existed in areas suffering water and energy scarcity. Regulations may define the criteria of water and energy quantities, or require the use of best available technique for delivery to guarantee equity in supply and distribution. Restrictions applied to set constraints. Restrictions as eliminating the use of residential water pumps at areas of high pressure, or prohibiting the wash down of roads and sidewalks, are useful for conservation. This result is in line with (Serret and Brown, 2014; EEA, 2012; Fielding et al., 2012b; Lee, 2011; Statzu and Strazzera, 2009; Domene and Saurí, 2006; Inman and Jeffrey, 2006; Renwick and Green, 2000) .

" The use of water tanks" driver (D.15) with RII = 67.7% and and Mean = 3.38 has got the rank 15. The value of the test-value = 1.97 with positive sign of the test and P-value = 0.025 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. Water tanks are considered as an efficient devices used at households. Unlike residential water pumps , households elevated water tanks mostly used as an efficient apparatus. If they filled directly from the supply source and maintained periodically, they will be effecient tool for water and energy conservation. They used for water storage and provide water to households without extra energy (electricity) consumption and promise social equity. This resut was supported by (Serret and Brown, 2014; Vilanova and Balestieri, 2014; Mahmood and Ali, 2013; Dagnew, 2012; Fielding et al., 2012a ; Statzu and Strazzera, 2009).

" Inter-personal trust " driver (D.16) was ranked in 16th position with RII = 66.2 % and Mean = 3.3. The value of the test-value = 1.7 with positive sign of the test and P-value = 0.05 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and greater than the hypothesized value 3. A perception that others are wasting water and energy, will decrease conservation motivations, and will decrease the probability that individuals will take steps to reduce their water and energy use. That is, when people do not trust others to save water and energy (inter-personal trust), they feel no obligation to save water and energy themselves. This demonstrates the discrepancy between perceived and actual consumption. Acoordingly, trust is considered as one of the important attidudinal and behavioral influencing factors. Similarly, the importance of " Inter-personal trust " or " social trust" has been discussed and reported by (Boughen et al., 2013; Jones et al., 2011; Jorgensen et al., 2009; Al-Ghuraiz, 2002).

Driver (D.19) "Older houses consume less water and energy consumption" with RII = 51.9 % and Mean =2.59 was ranked in 19th position. The value of sign Test-value = -2.3 with negative sign of the test and P-value = 0.011 which is smaller than the level of significance α = 0.05, so the mean of this driver is significantly different and smaller than the hypothesized value 3. This statistical result indicates that this driver was disagreed according to the majority of professionals. Professionals declare that older houses have no remarkable effect on the residential water and energy consumption. Contrary found by (Breyer, 2014; Hong and Chang, 2014; Santin et al., 2009) that Older houses is elastic for water and energy consumption.

Drivers (D.17 and D.18) " Older house residents tend to consume less water and energy consumption " and " Gender is an important factor for water and energy consumption " with RIIs = 63, 58.5 and Means = 3.15, 2.93 have ranked in 17th and 18th positions respectively. They have the values of P-value = 0.231 and 0.309 respectively, both values are greater than the level of significance α = 0.05. Thus; regardless of their other testing values; the means for these two drivers are insignificantly different from the hypothesized value 3. Therefore, it is revealed that both drivers are approaching to neutral, which means that the respondents majority have no undoubtedly decision over the agreement or disagreement. Differing from other studies which obviously found that age and gender are vital factors that have a clear impact on the water and energy consumption as revealed by (Serret and Brown, 2014; Fan et al., 2013; Fielding et al., 2012a ; Vassileva, 2012; Schleich and

Hillenbrand, 2009). But in the study of (Wolters, 2014) found that while gender did not produced statistically significant impacts on cumulative water conservation behaviors but age did.

Concluding remarks :

The results showed that the majority of the drivers have got RII value in the range (60% - 90%). To evaluate this result, it is substantial to calculate the neutral value of RII and compare it with the each driver RII value. Based on that, the average of the five points scale used for rating the drivers equal 3. Accordingly, the neutral value of RII is (3/5)*100 = 60%, where (5) refers to the rating scale used for rating the highest scale (strong agreement) by respondents. Thus, under the average rating scale value (3), the RII value will be less than 60% representing the disagreenet of respondents regarding to the inspected driver. This means that, the driver with RII value less than 60% is weak and has no effect on has household`s residents consumption of water and energy.

Overall results for the field " Drivers affecting household`s residents consumption of water and energy at residential buildings " with total RII = 71.43% and Mean = 3.57 has got the agreement of the overall repondents. The value of sign Test-value = 4.55 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this driver is significantly different and greater than the hypothesized value 3. Thus, it is concluded that this part of the structured interview is statistically significant and the inspect drivers are significantly affecting the household`s residents consumption of water and energy at residential buildings.

4.2.3 Part III: Strategies that guide household`s residents use of water and related energy to conservation and sustainability.

This section of the structured interview mainly designed to conduct the second objective of this study research in which the researcher attempt to pinpoint strategies that guide household`s residents use of water and related energy to conservation and sustainability.

Table (4.3) depicts 15 strategies that have been inspected by professionals to evaluate their impact to improve residential building`s water and related energy uses. These strategies were subjected to the view of respondents, and outcomes of the analysis were conducted. The descriptive statistics, i.e mean, standard deviation (SD), relative importance index (RII), test value, probablilties (P-value) and rank were considered and presented at herein under table (4.3).

Table (4.3): RII and Test value for "Strategies that guide household`s residents use of water and related energy to conservation and sustainability"

No.	Strategy	Mean	RII (%)	SD	Test value	P-value (Sig.)	Rank
S.1	Periodic maintenance for water and energy devices and systems.	4.23	84.6	0.65	4.34	0.000*	1
S.2	Leakage control.	4.19	83.7	0.68	4.34	0.000*	2
S.3	Information: Media and workshops for rising awareness level within the household residents of water and energy scarcity.	4.07	81.8	0.83	4.01	0.000*	3
S.4	Educational and training programs for rising up the level of public awareness and the workers on the water and energy operational and maintenance field.	4.07	81.5	0.73	4.22	0.000*	4
S.5	Apply a demand side management for energy and water to manage shortage and illegalities.	4.04	80.7	0.65	4.32	0.000*	5
S.6	Metering: monitoring and controlling of water and energy household meters.	3.93	78.5	0.62	4.29	0.000*	6
S.7	Planning and implementation for polices toward energy and water conservation commitment.	3.93	78.5	0.78	3.92	0.000*	7
S.8	Funding: funding water and energy conservation programs (e.g., households water and energy efficiency devices or conservation programs).	3.89	77.8	0.70	4.07	0.000*	8
S.9	Monitoring and controlling of water and energy devices and systems.	3.89	77.8	0.71	4.07	0.000*	9

Table (4.3): RII and Test value for "Strategies that guide household`s residents use of water and related energy to conservation and sustainability"

No.	Strategy	Mean	RII (%)	SD	Test value	P-value (Sig.)	Rank
S.10	Incentive/ disincentives mechanisms (e.g., rate structure and pricing, taxes regulations, rebates on water saving technologies, cancelling house lifting water pumps, etc.).	3.85	77.0	0.72	3.96	0.000*	10
S.11	Social equity: equity in water and energy supply and distribution between neighborhoods and between residents at the same neighborhood.	3.81	76.3	0.88	3.51	0.000*	11
S.12	Working on water and energy efficiency/ saving devices (e.g., installing dual flush toilets or stopping use of house water lifting pumps).	3.78	75.6	0.89	3.42	0.000*	12
S.13	Institutional trust: Emphasize the trust between population and the energy and water supply sides.	3.69	73.9	1.05	2.75	0.003*	13
S.14	Consumers' engagement in water and energy conservation planning and decision-making.	3.56	71.1	0.75	3.10	0.001*	14
S.15	Inter-personal trust: Emphasize trust between population at the same neighborhood (i.e. between neighbors) of energy and water conservation.	3.41	68.2	0.80	2.40	0.008*	15
	Strategies to improve household water and energy conservation.	3.89	77.8	0.44	4.47	0.000*	

* The mean is significantly different from 3

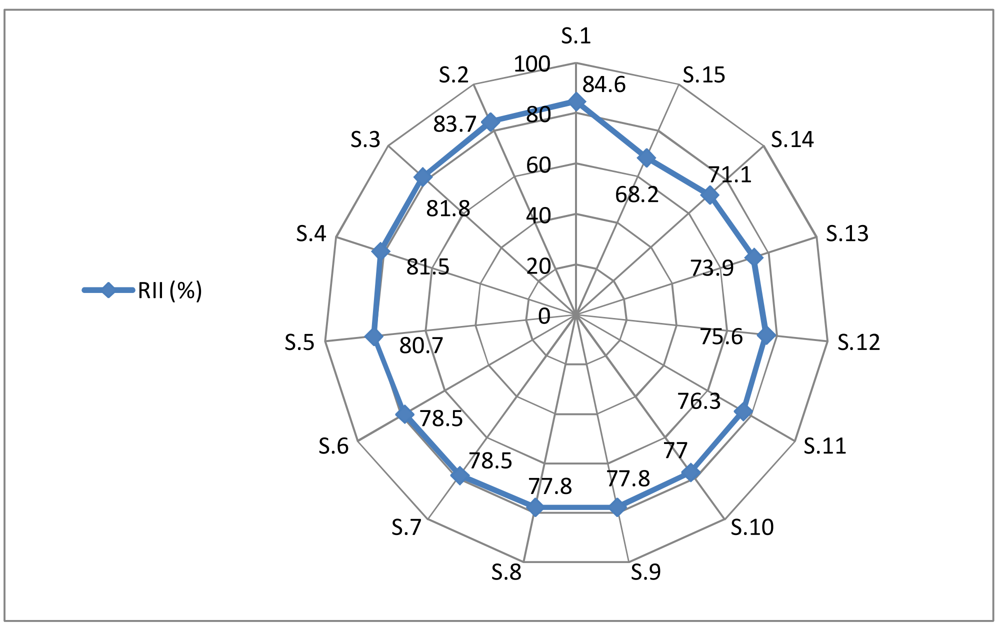


Figure 4.2: RII for strategies (S1-S15) to improve residents consumption of water and energy.

Table (4.3) provides RIIs and ranks of strategies, respectively. It is valuable to mention that ranking of the strategies was based on the highest mean, RII and the lowest SD. Accordingly, when two different trategies have the same RII and mean as for (S.4) and (S.5), the ranking will be based on the lower SD. Thus the strategy with lower SD will has the priority in higher ranking eventhough they have the same rank value.

The results showed that the strategy "Periodic maintenance for water and energy devices and systems" (S.1) was ranked in the first position with (RII) = 84.6% and Mean= 4.23 according to overall professionals respondents. The value of the test-value = 4.34 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this startegy is significantly different and greater than the hypothesized value 3. Keep up regular and preventative maintenance for households water and energy devices such as toilets, water tanks, and water lifting pumps helps to preserve its performance. Also, regular maintenance extends the devices life, minimizes their downtime, and reduce water and energy wastes due to expected leakage. Accordingly, the need for periodic audits and appropriate maintenance is required to ensure water and energy conservation.This result is in line with (Coelho and Andrade-Campos, 2014; Vilanova and Balestieri, 2014; Leiby and Burke, 2011; Weissman and Miller, 2009).

" Leakage control " strategy (S.2) with RII = 83.7% and and Mean = 4.19 has got the 2nd rank. The value of the test-value = 4.34 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this driver is significantly different and greater than the hypothesized value 3. The strategy is beneficial to save water and energy, since minimizing or reducing leakage could help in: (1) reducing water and energy consumption by the residents, (2) reduce the waste of water and energy, (3) reduce water and electricity flows and headloss in the networks and (4) significantly reduce water and energy scarcity and costs to levels that the need for other alternative resouces for supply as desalination is avioded. This finding is agreed with other studies of (Coelho and Andrade-Campos, 2014; Elías-Maxil et al., 2014; Nazer, 2010; Feldman, 2009; Giugni et al., 2009; Rosenberg et al., 2008; Inman and Jeffrey, 2006; Mayer et al., 2004).

Strategy (S.3) " Information thru media and workshops for rising awareness level within the household residents about water and energy scarcity " was ranked in the 3rd position with RII = 81.8% and Mean = 4.07. The value of the test-value = 4.01 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Thus, this strategy provide residents with needed information and feedback to assist in decision-making of reduction and manging water and energy use. This result is in line with (Romano et al., 2014; Dolnicar et al., 2012; Jones et al., 2011; Leiby and Burke, 2011; Dolnicar and Hurlimann, 2010; Silva et al., 2010).

" Educational and training programs " strategy (S.4) with RII= of 81.5% and Mean = 4.04 has got the rank 4. The value of the test-value = 4.22 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Thus, this strategy is classified one of the most important strategies and measures that might to be set forth into water and energy conservation plans. Most probably, education is one of the tools for rising up the level of public awareness toward the water and energy conservation attitudes. It also, provides the workers at the field of water and energy operation and maintenance with the tips necessary to conservation. Therefore, education supports the institutional water and enery management theme. This finding is supported by (Leiby and Burke, 2011; Willis et al., 2011; Qassimi et al., 2010; Millock and Nauges, 2010; Es’haqi and Al-Khaddar, 2008; Inman and Jeffrey, 2006; Gregory and Leo, 2003; Syme et al., 2000).

" Apply demand side management " strategy (S.5) was ranked in the 5th position with RII = 80.7% and Mean = 4.04. The value of the test-value = 4.32 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Focusing on shifting households residents to conservation behaviors by implementation of management strategies will encourage voluntary energy and water saving. As examples, enforcing residents to use efficient fixtures or dispense of ineffecient ones as (residential water pumps). Also, metering systems at the demand side help in control leakage and illegalities. Thus, this strategy promote households residents at the demand side to have more attention a toward water and energy consumption. This result is in line with (Coelho and Andrade-Campos, 2014; Almutaz et al., 2012; Fielding et al., 2012b; Lee, 2011; Leiby and Burke, 2011; Darby, 2010; Qassimi et al., 2010; Feldman, 2009; Brooks, 2006; Deverill, 2001).

" Metering" strategy (S.6) with RII = 78.5% , Mean = 3.93 and SD =0.62, has got the rank 6. The value of the test-value = 4.29 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Actually, metering strategy is used as a tool for monitoring and controlling of water and energy residents consumption through meters. Metering as mentioned before is an adequate process for leakage identification, over consumption due to illegalities and/or unequal distribution. This revlead result is consistent with (Fan et al., 2014; Boughen et al., 2013; Darby, 2010; Feldman, 2009; Mayer et al., 2004).

As well, startegy (S.7) " Planning and implementation for polices toward energy and water conservation commitment " with the same RII = 78.5% and Mean = 3.93 as (S.6), but with higher value of SD = 0.78 was ranked in the 7th position. The value of the test-value = 3.92 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Planning and implementation for polices toward energy and water consumption is an integrating strategy with metering startegy. Polices as regulations and ordinances prohibit daytime watering, electricity usage and water and energy wasting. This result is in line with (Jones et al., 2011; Dolnicar and Hurlimann, 2010; Randolph and Troy, 2008; Goldstein and Smith, 2002).

Both strategies (S.6 and S.7) are appropriate for changing consumers needs, emerging technologies, and adopting with available resources. Similar to this research findings, other studies as (Serret and Brown, 2014; Sønderlund et al., 2014; Lee, 2011; Lee et al., 2011b; Leiby and Burke, 2011; OECD, 2011; Willis et al., 2011; Qassimi et al., 2010; Millock and Nauges, 2010; Nazer, 2010; Silva et al., 2010; Inman and Jeffrey, 2006) found that both metering and planning and implementation for polices as regulations are vital strategies for water and energy conservation and reduction management.

Regarding to " Funding " strategy (S.8) with RII = 78.5% and Mean = 3.89 has got the rank 8. The value of the test-value = 4.07 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Actually, planning and implementing any water and energy management program for conservation purpose is evidently depends on fund. Therefore, funding is necessary for water utilities to implement water and energy efficiency options. Funding is also essential for water and energy providers to conduct studies and pilot projects as well as financial incentive and rebate programs. Similarly, this result was revlead by (Jones et al., 2011; Leiby and Burke, 2011; Deverill, 2001).

Likewise, strategy (S.9) " Monitoring and controlling of water and energy devices and systems " with the same RII = 78.5% and Mean = 3.89 was ranked in the 9th position, because it has higher SD= 0.71. The value of the test-value = 4.07 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Water and energy devices include the water tanks, residential water pumps, water heates, toilets and water heaters. This strategy promises the system performance of water and energy usage, tools and devices, assiss in managing and controlling consumption. And accordingly improve the conservation attitude and behavior. This finding is agreed with (Coelho and Andrade-Campos, 2014; Moreira and Ramos, 2013; Leiby and Burke, 2011; Qassimi et al., 2010; Silva et al., 2010; Giugni et al., 2009; Mayer et al., 2004; Deverill, 2001; Vilanova and Balestieri, 2014).

" Incentive/ disincentives mechanisms" strategy (S.10) with RII = 77.0% and Mean = 3.85 has got the rank 10. The value of the test-value = 4.07 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Rate structure and pricing, taxes regulations, rebates on water and energy saving technologies, eliminating residential water pumps are of the incentives and disincentives mechanisms. These mechanisms are significantly affect water and energy consumption attitude and behavior. This result is consistent with (Fan et al., 2014; Lee and Tansel, 2013; Jones et al., 2011; Leiby and Burke, 2011;

Qassimi et al., 2010; Hassell and Cary, 2007; Inman and Jeffrey, 2006; Al-Ghuraiz, 2002; Deverill, 2001).

Furthermore, strategy (S.11) " Social equity " was ranked in the 11th position with RII = 76.3% and Mean = 3.81. The value of the test-value = 4.07 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Demand management does not improve the efficiency of water and energy only, but aslo, it consists the social equity in supply and distribution for residents at the same neighborhood. Including the Gaza Strip, in many developing countries the social equity in water and energy is absents. Both the equity and efficiency criteria could be met by: (1) using cross-supported minimum consumption and increasing rates for higher consumption, (2) monitoring and controlling consumption by metering, and (3) restriction of using residential water pumps at households adjacent to supply source. It is important to give due attention to social equity in order to protect the weakest people from carrying high liability. This result is in line with (Al-Ghuraiz, 2002; Savenije and Van Der Zaag, 2002; Deverill, 2001).

" Working on water and energy efficiency/ saving devices" strategy (S.12) with RII = 75.6 % and mean 3.78 has got the rank 12. The value of the test-value = 3.42 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. The existence of water and energy saving devices at residential households impacted the consumption. Efficient device particularly as low flowshowerheads, dual flush toilets, washing machines, water tanks and automatic controled residential water pumps could increase conservation. However, changes in water and energy use habits could be developed gradually over time**,** where household`s residents gradually perceive the use of water and energy efficient device. This finding is consistent with studies (Serret and Brown, 2014; Lee and Tansel, 2013; Leiby and Burke, 2011; Willis et al., 2011; Millock and Nauges, 2010; Silva et al., 2010; Randolph and Troy, 2008; Inman and Jeffrey, 2006; Mayer et al., 2004).

Strategy (S.13) " Institutional trust" was ranked in the 13th position with RII = 73.9% and Mean = 3.69. The value of the test-value = 2.75 with positive sign of the test and P-value = 0.003 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. This strategy emphasizes the trust between household`s residents and the energy and water providers. Individuals are less likely to conserve water and energy if they have no trust in providers. That is, when people did not trust others to save water, they felt no obligation to save water themselves. Furthermore, miss-trust between the water and energy utilities and the residents would affect negatively the pricing polices. This situation could bring some people to delay in paying for water and electricity bills and some others to connect illegally leading to unfair of distribution. This result is agree with (Boughen et al., 2013; Jones et al., 2011; OECD, 2011; Jorgensen et al., 2009; Al-Ghuraiz, 2002).

" Consumers' engagement in water and energy conservation planning and decision-making" strategy (S.14) was ranked in the 14th position with RII = 71.1% and Mean = 3.56. The value of the test-value = 3.10 with positive sign of the test and P-value = 0.001 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. The consumers participation in decision making regarding to water and energy issues; as regulations of conservation; is a high motive to assure trust and cooperation between residents and providers. This strategy increases the willingness of residents to change their attitudes and behaviors, and to interact with providers conservation plans. This result is in line with (Serret and Brown, 2014; Boughen et al., 2013; Jones et al., 2011; Silva et al., 2010; Es'haqi and Al-Khaddar, 2008; Brooks, 2006; Inman and Jeffrey, 2006; Al-Ghuraiz, 2002; Deverill, 2001).

Last strategy (S.15), " Inter-personal trust " with RII = 68.2% and Mean = 3.41 has got the rank 15. The value of the test-value = 2.4 with positive sign of the test and P-value = 0.008 which is smaller than the level of significance α = 0.05, so the mean of this strategy is significantly different and greater than the hypothesized value 3. Emphasizing trust between population at the same neighborhood (i.e. between neighbors) will develop the spirit of cooperation and the sense of social responsibility toward shared interests as water and energy conservation. When people mistrust others to save water and energy, they felt no obligation to save water themselves. If some one at the neighborhood clean his car spending much of water, others could behave similarly. Or if one of the neighbors used a residential water pump, others might act in the same mannar. This finding is in line with (Boughen et al., 2013; Jones et al., 2011; Jorgensen et al., 2009; Al-Ghuraiz, 2002).

Concluding remarks :

The results showed that the majority of the strategies have got RII value in the range (60% - 90%). To evaluate this result, it is substantial to calculate the neutral value of RII and compare it with the each startegy RII value. Based on that, the average of the five points scale used for rating the startegies equal 3. Accordingly, the neutral value of RII is (3/5)*100 = 60%, where (5) refers to the rating scale used for rating the highest scale (strong agreement) by respondents. Thus, under the average rating scale value (3), the RII value will be less than 60% representing the disagreenet of respondents regarding to the inspected startegy. This means that, the strategy with RII value less than 60% is weak and has no effect on has household`s residents consumption of water and energy.

Overall results for the field " Strategies that guide the household`s residents use of water and related energy uses to conservation and sustainability " with total RII = 77.8% and Mean = 3.89 has got the agreement of the overall repondents. The value of sign Test-value = 4.47 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this startegy is significantly different and greater than the hypothesized value 3. Thus, it is concluded that this part of the structured interview is statistically significant and the tested strategies are significantly guiding the household`s residents use of water and related energy to conservation and sustainability.

4.3 Second section: Questionnaire survey results and discussion

The questionnaire aimed to achieve the second objective of this research, which is: Objective three: To Investigate the attitude and behavior of household`s residents toward water and energy conservation at residential buildings. This questionnaire was divided into two main parts, which included (I) Personal information of the participants, (II) Household`s residents attitudes and behaviors toward water and energy conservation which manipulates three dimentions. Dimention one: Household`s residents attitudes toward water and energy conservation, Dimention two: Household`s residents behaviors toward water and energy conservation and Dimention three: The relationship between household`s residents attitudes and behaviors toward water and energy conservation.

4.3.1 Part I: Socio-demographic and household information.

This part of the questionnaire survey essentially aimed to represents the general information about the Household residents and characteristics in terms of age of the head of household, gender, material status, educational level, monthly income of the family, family size, area of the house and finally the floor level and quantities of water and energy (electricity) consumption per month. Table (4.4) lists the servying results.

Table (4.4): Socio-demographic and household information.

General information	Categories	Frequency	Percentage
Age of the head of household (years)	Less than 20	7	5.7
	20 – < 30	22	17.8
	30 – < 40	28	22.8
	40 – < 50	45	36.6
	More than 50	21	17.1
	Total	123	100.0
Sex of Household Head	Male	85	69.1
	Female	38	30.9
	Total	123	100.0
Material Status of Household Head	Married	103	83.7
	Single	12	9.7
	Widower	4	3.3
	Divorced	4	3.3
	Total	123	100.0

Table (4.4): Socio-demographic and household information.

General information	Categories	Frequency	Percentage
Head of Household educational level	High Diploma	44	35.8
	Bachelor Degree.	24	19.5
	Master Degree	4	3.2
	High Certificate	0	0
	Others	44	35.8
	Null	7	5.7
	Total	123	100.0
Monthly family income (Nis)	Less than or =	24	119.8
	1001 – 1500	23	19
	1501 – 2000	32	26.4
	More than 2000	42	34.7
	Total	123	100.0
No. of house residents:	1-2	7	5.7
	3-4	27	22
	5-6	35	28.5
	> 7	54	43.9
	Total	123	100.0
House Area	40-100	51	41.5
	101-120	23	18.7
	121-140	24	19.5
	141-270	123	20.3
	Total	123	100.0
Quantity of water consumed (m^3/ month)	10 - < 20	59	48.0
	20 - < 25	40	32.5
	25 - < 42	24	19.5
	Total	123	100.0
Quantity of electricity consumed	120 - < 180	21	17.1
	180 - < 200	9	7.3
	200 - < 220	13	10.6
	220 - < 240	25	20.3
	240 - < 420	55	44.7
	Total	123	100.0

4.3.1.1 Correlation between socio-demographic and household information and water and energy consumption.

This sub-part discusses the the significance in the relationship between the surveyed socio-demogrhaphic factors including (the age of the head of household, gender, material status, educational level, monthly income of the family, family size, area of the house and finally the floor level) and quantities of water and energy (electricity) consumed per month.

A. Relationship between age of the head of the household and quantity of water consumed m^3/month.

The value of the Chi-Square X^2 = 5.491 and the p-value (Sig.) = 0.481, which is greater than the level of significance α = 0.05, so the relationship between age of the family head and quantity of water consumed is statistically insignificant at α = 0.05 Table (4.5). This result is consistent with what found by (Adams, 2014; Lee and Tansel, 2013). However, some studies have shown a strong correlation between the age of household residents and water consumption as (Beal et al., 2013; Fielding et al., 2012a ; Schleich and Hillenbrand, 2009; Corral-Verdugo et al., 2003) revealed that age of household head had a significant influence on the amount of water used per person for younger than the older, which suggests that older people would invest more time in water consuming activities than younger people. By contrast, (Fan et al., 2014; Fan et al., 2013) study shows that older people tended to use less water because of traditional practices of water usage washing hands, showering, and their unfamiliarity with water appliances.

Table (4.5): Relationship between Age and Quantity of water consumed

Age		Quantity of water consumed m^3/month			Total	Test value	Sig.
		10 - < 20	20 - < 25	25 and more			
20 to < 30	N	12	11	5	28		
	%	20.7%	27.5%	20.8%	23.0%		
30 to < 40	N	15	8	5	28		
	%	25.9%	20.0%	20.8%	23.0%		
40 to < 50	N	18	18	9	45		
	%	31.0%	45.0%	37.5%	36.9%		
50 and older	N	13	3	5	21		
	%	22.4%	7.5%	20.8%	17.2%		
Total	N	58	40	24	122		
	%	100.0%	100.0%	100.0%	100.0%	5.491	0.481

B. Relationship between age and quantity of electricity (energy) consumed KWH/month

The value of the Chi-Square X^2 = 17.87 and the p-value (Sig.) = 0.120, which is greater than the level of significance α = 0.05, so the relationship between age of the household head and quantity of electricity (energy) consumed is statistically insignificant at α = 0.05. It is revealed that there is insignificant relationship between age of the household head and quantity of electricity (energy) consumed, similary revealed by (Adams, 2014) . This result is inconsistent with what found by (Serret and

Brown, 2014; Vassileva, 2012; Santin et al., 2009), they have shown a significant correlation between the age of household residents and energy use (Table 4.6).

Table (4.6): Relationship between Age and Quantity of electricity (energy) consumed

Age		Quantity of electricity consumed KWH/month					Total	Test value	Sig.
		120 - < 180	180 - < 200	200 - < 220	220 - < 240	240 and more			
20 to < 30	N	9	2	1	4	9	25		
	%	42.9%	22.2%	7.7%	16.7%	16.4%	20.5%		
30 to < 40	N	5	1	5	6	12	29		
	%	23.8%	11.1%	38.5%	25.0%	21.8%	23.8%		
40 to < 50	N	5	3	5	13	20	46		
	%	23.8%	33.3%	38.5%	54.2%	36.4%	37.7%		
50 and older	N	2	3	2	1	14	22		
	%	9.5%	33.3%	15.4%	4.2%	25.5%	18.0%		
Total	N	21	9	13	24	55	122		
	%	100%	100%	100%	100%	100%	100%	17.87	0.120

C. Relationship between gender and quantity of water consumed m^3/month.

As shown in Table (4.7) the Chi-Square X^2 = 13.925 and the p-value (Sig.) = 0.001. The p-value (Sig.) is smaller than the level of significance $\alpha = 0.05$, so the relationship between gender of the household head and quantity of water consumed is statistically significant at $\alpha = 0.05$. Therefore, it is found that the there is a significant correlation between gender of the household head and household water consumption. It clarifies real differences between male and female responses toward the household consumption which tends to male who consume more water with less conservation. The results suggests that women may have more responsibility for some water-related tasks than men and therefore their behaviors may be more conservative of household water use than males. This result runs in line with the results of (Fielding et al., 2012a ; Dagnew, 2012; Serret and Brown, 2014). This was inconsistent with other scholarly findings that males are more pro-environmental than females (Adams, 2014).

Table (4.7): Relationship between Gender of Household Head and Quantity of water consumed

Gender		Quantity of water consumed m^3/month			Total	Test value	Sig.
		10 - < 20	20 - < 25	25 and more			
Male	N	32	31	22	85		
	%	54.2%	79.5%	91.7%	69.7%		
Female	N	27	8	2	37		
	%	45.8%	20.5%	8.3%	30.3%		
Total	N	59	39	24	122		
	%	100.0%	100.0%	100.0%	100.0%	13.925	0.001*

* Relationship is statistically significant at 0.05 level

D. Relationship between gender and quantity of electricity (energy) consumed KWH/month.

As shown in Table (4.8), the value of the Chi-Square X^2 = 17.546 and the p-value (Sig.) = 0.002. The p-value (Sig.) is smaller than the level of significance α = 0.05, so the relationship between gender and quantity of electricity consumed is statistically significant at α = 0.05. Consequently, it is found that females had a higher energy saving than males. It can be suggested that females had a higher energy saving awareness than males. Females. Females generally have more positive environmental attitudes; their pro-environmental behaviour is reported to be even stronger than their attitudes. Also, males always show more aware of advanced elestrical technology. Thus, it is concluded that there is a significant correlation between gender and energy consumption. This was found by (Aktamis, 2011; Abrahamse and Steg, 2011). On the other hand, this was inconsistent with other scholarly findings that males are more pro-environmental than females (Adams, 2014).

Table (4.8): Relationship between Gender and Quantity of electricity (energy) consumed

Gender		Quantity of electricity consumed KWH/month					Total	Test value	Sig.
		120 - < 180	180 - < 200	200 - < 220	220 - < 240	240 and more			
Male	N	15	4	7	12	47	85		
	%	71.4%	44.4%	53.8%	48.0%	87.0%	69.7%		
Female	N	6	5	6	13	7	37		
	%	28.6%	55.6%	46.2%	52.0%	13.0%	30.3%		
Total	N	21	9	13	25	54	122		
	%	100%	100%	100%	100%	100%	100%	17.546	0.002*

* Relationship is statistically significant at 0.05 level

E. Relationship between marital status and quantity of water consumed m^3/month.

Relationship between marital status and quantity of water consumed m^3/month with the value of the Chi-Square X^2 = 5.282 and the p-value (Sig.) = 0.508, the relationship between marital status and quantity of water consumed is statistically insignificant at α = 0.05, see Table (4.9). It is noted that majority of the sample is biased in the direction of mareied status. So, there is a difficulty to evaluate the percentage of water consumption for the other smaller marital samples. Therefore, with this limitation of the sample or specification, there was no sufficient evidence to prove that marital status has significant impacts on water consumption. Contrary found by (Dagnew, 2012; Amori, 2012) that a significant relationship between marital status and quantity of water consumed.

Table (4.9): Relationship between Marital status and Quantity of water consumed

Marital status		Quantity of water consumed m3/month			Total	Test value	Sig.
		10 - < 20	20 - < 25	25 and more			
Married	N	48	35	19	102		
	%	82.8%	87.5%	79.2%	83.6%		
Single	N	4	4	4	12		
	%	6.9%	10.0%	16.7%	9.8%		
Widower	N	3	0	1	4		
	%	5.2%	0.0%	4.2%	3.3%		
Divorced	N	3	1	0	4		
	%	5.2%	2.5%	0.0%	3.3%		
Total	N	58	40	24	122		
	%	100.0%	100.0%	100.0%	100.0%	5.282	0.508

F. Relationship between marital status and quantity of electricity (energy) consumed KWH/month.

Alike, Table (4.10) shows the relationship between marital status and quantity of electricity consumed KWH/month with the value of the Chi-Square X^2 = 11.834 and the p-value (Sig.) = 0.459, the relationship between marital status and quantity of electricity consumed is statistically insignificant at $\alpha = 0.05$. It is noted that majority of the sample is biased in the direction of mareied status. So, there is a difficulty to evaluate the percentage of energy consumption for the other smaller marital samples. Therefore, with this limitation of the sample or specification, there was no adequate proof to demonstrate that marital status significantly infleunces the energy use. Opposing stated by (Brounen et al., 2012; Morrison et al., 2013; Frederiks et al., 2015).

Table (4.10): Relationship between Marital status and Quantity of electricity consumed

Marital status		Quantity of electricity consumed KWH/month					Total	Test value	Sig.
		120 - < 180	180 - < 200	200 - < 220	220 - < 240	240 and more			
Married	N	17	6	12	21	46	102		
	%	81.0%	75.0%	92.3%	84.0%	83.6%	83.6%		
Single	N	1	1	0	2	8	12		
	%	4.8%	12.5%	0.0%	8.0%	14.5%	9.8%		
Widower	N	1	1	0	1	1	4		
	%	4.8%	12.5%	0.0%	4.0%	1.8%	3.3%		
Divorced	N	2	0	1	1	0	4		
	%	9.5%	0.0%	7.7%	4.0%	0.0%	3.3%		
Total	N	21	8	13	25	55	122		
	%	100%	100%	100%	100%	100.	100%	11.834	0.459

G. Relationship between head of household educational level and of water consumption m^3/month.

Table (4.11) clarifying the value of the Chi-Square X^2 = 8.030 and the p-value (Sig.) = 0.236. The p-value (Sig.) is greater than the level of significance α = 0.05, so the relationship between educational level and quantity of water consumed is statistically insignificant at α = 0.05. It is revealed that the education level of the head of the household had no significant impact on water savings. It maight interpreted that residents with high levels of education are not necessarily pro-environmental, or have attitude and behavior toward water conservation. Therefore, it is concluded that there is insignificant relationship between educational level and quantity of water consumed. This result is similar to the findings reported by other studies (Hong and Chang, 2014; Serret and Brown, 2014; Wolters, 2014; Lee and Tansel, 2013; Fielding et al., 2012a) . On the other side, some other studies found the contrast where (Fan et al., 2014; Beal et al., 2013; Dolnicar et al., 2012; Gilg and Barr, 2006; Keshavarzi et al., 2006; De Oliver, 1999) reported that the level of education is correlated with lower water consumption and higher water conservation behaviours.

Table (4.11): Relationship between Educational level and Quantity of water consumed

Educational level		Quantity of water consumed m^3/month 10 - < 20	20 - < 25	25 and more	Total	Test value	Sig.
High Dip.	N	24	13	7	44		
	%	42.1%	35.1%	31.8%	37.9%		
Bachelor Deg.	N	7	11	6	24		
	%	12.3%	29.7%	27.3%	20.7%		
Master Deg	N	1	1	2	4		
	%	1.8%	2.7%	9.1%	3.4%		
Other	N	25	12	7	44		
	%	43.9%	32.4%	31.8%	37.9%		
Total	N	57	37	22	116		
	%	100.0%	100.0%	100.0%	100.0%	8.030	0.236

H. Relationship between head of household educational level and energy consumption KWH/month.

Table (4.12) illustrates the value of the Chi-Square X^2 = 10.230 and the p-value (Sig.) = 0.596. The p-value (Sig.) is greater than the level of significance α = 0.05, so the relationship between educational level and quantity of electricity consumed is statistically insignificant at α = 0.05. It is shown that the education level of the head of the household had no significant impact on energy conservation. It maight interpreted that inhabitants with high levels of education are not necessarily pro-environmental, or have attitude and behavior toward energy conservation. Therefore, it is concluded that there is insignificant correlation between educational level and energy consumption. This result is similar to the findings reported by other studies, notably (Yu et al., 2011; Adams, 2014). While, some other studies found the contrast where (Beal et al., 2013; Vassileva, 2012; Aktamis, 2011) reported that the level of education is significantly correlated with the energy consumption, where elders inhabitants not concerned with environmental matters tends to consume more water than do concerned younger people.

Table (4.12): Relationship between Educational level and Quantity of electricity consumed.

Educational level		Quantity of electricity consumed KWH/month					Total	Test value	Sig.
		120 - < 180	180 - < 200	200 - < 220	220 - < 240	240 and more			
High Dip.	N	9	4	6	5	20	44		
	%	42.9%	50.0%	50.0%	21.7%	38.5%	37.9%		
Bachelor Deg.	N	5	0	2	5	12	24		
	%	23.8%	0.0%	16.7%	21.7%	23.1%	20.7%		
Master Deg	N	1	0	0	0	3	4		
	%	4.8%	0.0%	0.0%	0.0%	5.8%	3.4%		
Other	N	6	4	4	13	17	44		
	%	28.6%	50.0%	33.3%	56.5%	32.7%	37.9%		
Total	N	21	8	12	23	52	116		
	%	100%	100%	100%	100%	100%	100%	10.23	0.596

I. Relationship between monthly income for family and Quantity of water consumed m^3/month.

Event hrough the Table (4.13) illustrated the residents with higher income tend to be more water consumers, but with the values of the Chi-Square X^2 = 8.039 and the p-value (Sig.) = 0.235, it is verified that the family monthly income had no significant impact on water consumption because the p-value (Sig.) is greater than the level of significance α = 0.05. Accordingly the relationship between monthly income for family and quantity of water consumed is statistically insignificant at α = 0.05. Hence, it is concluded that there is no correlation between family monthly income and quantity of water consumed. The price of water is relatively low at Gaza strip. Water expenditures normally accounting for a small percentage of household income, which results in households not being responsive to water pricing signals. This outcome consistently revealed by (Hong and Chang, 2014; Serret and Brown, 2014; Fielding et al., 2012a), they reported that daily person household water use was not influenced by household income. This appears consistent with the strong probability that the income elasticity of residential water demand is indeed low or even inelastic. By contrast, (Romano et al., 2014; Fan et al., 2013; Almutaz et al., 2012; Schleich and Hillenbrand, 2009; Worthington and Hoffman, 2008; De Oliver, 1999; Corral-Verdugo et al., 2003) found that household income had a significant effect on the residential water consumption.

Table (4.13): Relationship between Monthly income for family and Quantity of water consumed

Monthly income		Quantity of water consumed m^3/month			Total	Test value	Sig.
		10 - < 20	20 - < 25	25 and more			
< 1000 NIS	N	11	8	5	24		
	%	19.0%	20.0%	21.7%	19.8%		
1001-1500 NIS	N	11	7	5	23		
	%	19.0%	17.5%	21.7%	19.0%		
1501-2000 NIS	N	21	9	2	32		
	%	36.2%	22.5%	8.7%	26.4%		
> 2000 NIS.	N	15	16	11	42		
	%	25.9%	40.0%	47.8%	34.7%		
Total	N	58	40	23	121		
	%	100%	100%	100%	100%	8.039	0.235

J. Relationship between family monthly income and Quantity of electricity consumed KWH/month.

Contrary, the Table (4.14) illustrated the residents with higher income tend to be more electricity (energy) consumers, with value of the Chi-Square X^2 = 21.167 and the p-value (Sig.) = 0.048. So it is confirmed that the family monthly income had significant impact on electricity (energy) consumption since the p-value (Sig.) is smaller than the level of significance $\alpha = 0.05$. Consequently, the relationship between monthly income for family and quantity of electricity (energy) consumed is statistically significant at $\alpha = 0.05$. Therefore, it is concluded that family monthly income is correlated to energy consumption. Energy expenditures normally accounting for higher percentage than water of households income. For that households of lower income residents will be more responsive to energy pricing bills. Higher income residents can afford bigger houses or more appliances, and as a consequence use more energy. This outcome consistently revealed by (Abrahamse and Steg, 2011; Vassileva, 2012; Yu et al., 2011; Santin et al., 2009; Lorek, 2004), they found that low income consumers are more aware about their consumption and strive to reduce it, whereas the high income consumers lack the economic pressure and therefore, have little incentive to lower their energy usage.

Table (4.14): Relationship between Monthly income for family and Quantity of electricity consumed

Monthly income		Quantity of electricity consumed KWH/month					Total	Test value	Sig.
		120 - < 180	180 - < 200	200 - < 220	220 - < 240	240 and more			
< 1000 NIS	N	8	1	3	4	6	22		
	%	38.1%	11.1%	23.1%	16.7%	11.1%	18.2%		
1001-1500 NIS	N	5	3	1	6	8	23		
	%	23.8%	33.3%	7.7%	25.0%	14.8%	19.0%		
1501-2000 NIS	N	1	1	7	7	16	32		
	%	4.8%	11.1%	53.8%	29.2%	29.6%	26.4%		
> 2000 NIS.	N	7	4	2	7	24	44		
	%	33.3%	44.4%	15.4%	29.2%	44.4%	36.4%		
Total	N	21	9	13	24	54	121		
	%	100%	100%	100%	100%	100%	100%	21.2	0.048

K. Relationship between No. of home residents (family size) and Quantity of water consumed m^3/month.

Table (4.15) illustrated that as the number of household members increases, per capita water consumption goes up which suggests that several water uses such as washing or even cooking increase proportionally to the increase in household size. With value of the Chi-Square X^2 = 28.89 and the p-value (Sig.) = 0.000, it is shown that the relationship between No. of household residents and quantity of water consumed is statistically significant at $\alpha = 0.05$. So it is confirmed that the family size significantly influences the water consumption. This result is consistent with findings stated by other studies (Fan et al., 2013; Almutaz et al., 2012; Schleich and Hillenbrand, 2009; Gilg and Barr, 2006) that have shown a strong correlation between net family size and water consumption. In contrary, (Lee and Tansel, 2013) reported that there is no significant relation between the family size and the observation of savings on the water bill. In the other hand, (Keshavarzi et al., 2006; Martin and Lutz, 1999) showed that water consumption per capita is lower in large families than in small families because some water usage activities (use for kitchen, vegetable gardening, livestock needs, and house and yard cleaning) are relatively independent of family size.

Table (4.15): Relationship between No. of household residents and Quantity of water consumed

No. of household residents		Quantity of water consumed m3/month			Total	Test value	Sig.
		10 - < 20	20 - < 25	25 and more			
1-2	N	7	0	0	7		
	%	11.9%	0.0%	0.0%	5.7%		
3-4	N	20	7	0	27		
	%	33.9%	17.5%	0.0%	22.0%		
5-6	N	16	14	5	35		
	%	27.1%	35.0%	20.8%	28.5%		
7 and more	N	16	19	19	54		
	%	27.1%	47.5%	79.2%	43.9%		
Total	N	59	40	24	123		
	%	100.0%	100.0%	100.0%	100.0%	28.89	0.000*

* Relationship is statistically significant at 0.05 level

L. Relationship between No. of home residents and quantity of electricity consumed KWH/month.

Similarly when investigating and comparing overall energy consumption with the household size, Table (4.16) illustrated that as the number of household occupants increases the house energy consumption rises.With value of the Chi-Square X^2 = 69.909 and the p-value (Sig.) = 0.000, it is shown that the relationship between No. of household residents and quantity of electricity consumed is statistically significant at $\alpha = 0.05$. Different consumption rates is highly dependent on per capita energy usage. Larger number of people living in the house, definitely tends to higher occurrence of use for energy appliances and ultimately to higher consumption rate. So it is confirmed that the family size significantly influences the energy consumption. This also reported by (Vassileva, 2012; Yu et al., 2011).

Table (4.16): Relationship between No. of home residents and Quantity of electricity consumed

No. of household residents		Quantity of electricity consumed KWH/month					Total	Test value	Sig.
		120 - < 180	180 - < 200	200 - < 220	220 - < 240	240 and more			
1-2	N	6	1	0	0	0	7		
	%	28.6%	11.1%	0.0%	0.0%	0.0%	5.7%		
3-4	N	11	3	5	6	2	27		
	%	52.4%	33.3%	38.5%	24.0%	3.6%	22.0%		
5-6	N	3	3	5	11	13	35		
	%	14.3%	33.3%	38.5%	44.0%	23.6%	28.5%		
7 and more	N	1	2	3	8	40	54		
	%	4.8%	22.2%	23.1%	32.0%	72.7%	43.9%		
Total	N	21	9	13	25	55	123		
	%	100%	100%	100%	100%	100%	100%	69.91	0.000*

* Relationship is statistically significant at 0.05 level

M. Relationship between Area of the house and quantity of water consumed m^3/month.

Spearman correlation coefficient tests usined to perform the relationship between area of the house and quantity of water consumed. Table (4.17) illustrates that the correlation coefficient between area of the house and quantity of water consumed = 0.232 and the p-value (Sig.) = 0.005. Thus, the correlation coefficient is statistically significant at $\alpha = 0.05$. Larger households size in term of area (m^2) is associated with additional number of rooms or even wider living areas or more water appliances. Therefore, the water consumed for cleaning or washing ultimately will be higher than the smaller households. Consequently, it is concluded that is significant positive relationship between residence area and water consumption.This result goes inline with the results of (Grafton et al., 2011).

Table (4.17): Correlation coefficient between house area and water consumed

Field	Spearman Correlation Coefficient	P-Value (Sig.)
Quantity of water consumed	0.232	0.005*

* Relationship is statistically significant at 0.05 level

N. Relationship between Area of the house and quantity of electricity consumed KWH/month.

However, when inspecting and comparing the energy consumption in relation to the households surface area, Table (4.18) clarifies that the correlation coefficient between area of the house and quantity of water consumed = 0.279 and the p-value (Sig.) = 0.001. Thus, the correlation coefficient is statistically significant at $\alpha = 0.05$. Larger households size in term of area (m2) is associated with additional number of rooms or even wider living areas or energy appliances. Therefore, the energy consumed for lighting, heating or oprating residential water pumps ultimately will be higher than the smaller households. As a result, it is concluded that is significant positive relationship between residence area and energy consumption.This result runs inline with the results of (Vassileva, 2012; Yu et al., 2011; Schleich and Hillenbrand, 2009; Gregory and Leo, 2003).

Table (4.18): Correlation coefficient between house area house and electricity consumption

Field	Spearman Correlation Coefficient	P-Value (Sig.)
Quantity of electricity consumed	0.279	0.001*

* Relationship is statistically significant at 0.05 level

Table (4.19) and Figure (4.8) shows the summary of the p-values for both of residential water conservation (WC) and energy conservation (EC) with all the tested socio-demographic and households characteristics factors.

Table (4.19): p-values for water consumption (WC) and energy consumption (EC) with Socio-demographic factors.

Variables	Variable						
	Age	Gender	Marital status	Educational level	Monthly income	No. of home residents	Area of the house
WC	0.481	0.001*	0.508	0.236	0.235	0.000*	0.005*
EC	0.120	0.002*	0.459	0.596	0.048	0.000*	0.001*

* Relationship is statistically significant at 0.05 level

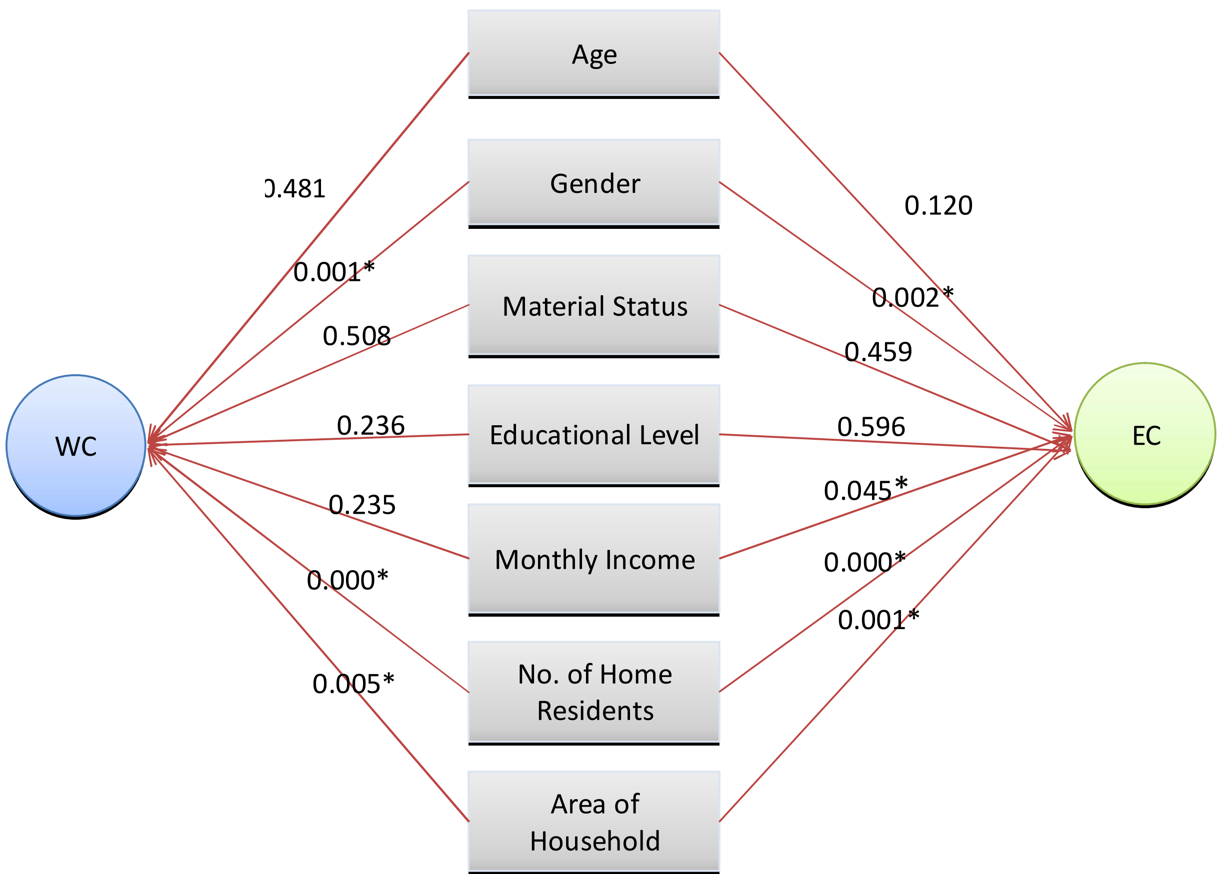


Figure 4.3: p-values for (WC) and (EC) with Socio-demographic factors.

4.3.2 Part II: Household`s residents attitudes and behaviors toward water and related energy conservation at residential buildings.

This part of the questionnaire mainly designed to conduct the third objective of this study research in which the researcher attempt to investigate the attitude and behavior of the household`s residents water and energy conservation at residential buildings.

A. **Dimention one - Household`s residents personal attitude toward water and related energy conservation.**

At this part, the researcher examines the personal attitudes of the household`s residents toward water and related energy conservation. These households, as pointed out at the introductory chapter, are located at UNRWA re-housing project at Rafah.

Table (4.20) depicts 14 attitudes that have been queried by household`s residents to assess their perception and beliefs toward water and related energy conservation at residential buildings. These attitudes were subjected to the view of respondents, and outcomes of the analysis were conducted. The descriptive statistics, i.e mean, standard deviation (SD), relative importance index (RII), test value, probablilties (P-value) and rank were considered and presented at herein under table (4.20).

Table (4.20): RII and Test value for " Water and energy conservation personal attitudes"

No.	Water and energy conservation personal attitudes	**Mean**	**RII (%)**	**SD**	**Test value**	**P-value (Sig.)**	**Rank**
A.1	I feel that Gaza Strip suffering water and energy shortage problem	4.29	85.83	0.69	10.27	0.000*	1
A.2	I am convinced by the concept of water and energy conservation and sustainability at Gaza Strip.	4.12	82.31	0.63	10.03	0.000*	2
A.3	I believe of regular maintenance for water and energy appliances (ex. the roof water tank, water pump…).	4.10	81.98	0.70	9.88	0.000*	3
A.4	I believe that turning off my water pump when the roof tanks are full will conserve water and related energy.	4.09	81.82	0.85	9.35	0.000*	4
A.5	I believe that more attention for water and energy conservation is needed.	4.03	80.67	1.08	8.28	0.000*	5
A.6	I think that leakage in my home appliances or hoses during operating the water pump is an important cause of over consumption.	3.93	78.51	1.01	8.38	0.000*	6

Table (4.20): RII and Test value for " Water and energy conservation personal attitudes"

No.	Water and energy conservation personal attitudes	Mean	RII (%)	SD	Test value	P-value (Sig.)	Rank
A.7	I believe that washing and cleaning the house while water pump is operating is a serious cause of over consumption.	3.64	72.89	1.15	6.54	0.000*	7
A.8	I feel that it is important and visible that the water and energy concerning sides make strict laws to support water and energy conservation.	3.50	69.92	1.06	5.53	0.000*	8
A.9	I believe that I could make more efforts to conserve water and energy.	3.33	66.67	1.38	4.10	0.000*	9
A.10	I believe that changing attitudes and beliefs affects the water and energy conservation.	3.31	66.22	1.31	3.69	0.000*	10
A.11	I believe that I can play additional positive role toward water energy conservation.	2.94	58.83	1.24	-0.33	0.743	11
A.12	I feel that my neighbors are not aware about water and energy conservation issue.	2.93	58.68	1.14	-0.43	0.668	12
A.13	I think that I am a part of water and energy shortage problem.	2.09	39.83	1.37	-5.29	0.000*	13
A.14	I think that I can dispense of water pumps in my house.	1.79	35.76	1.16	-7.46	0.000*	14
	Water and energy personal attitudes	3.44	68.80	0.53	6.22	0.000*	

* The mean is significantly different from 3

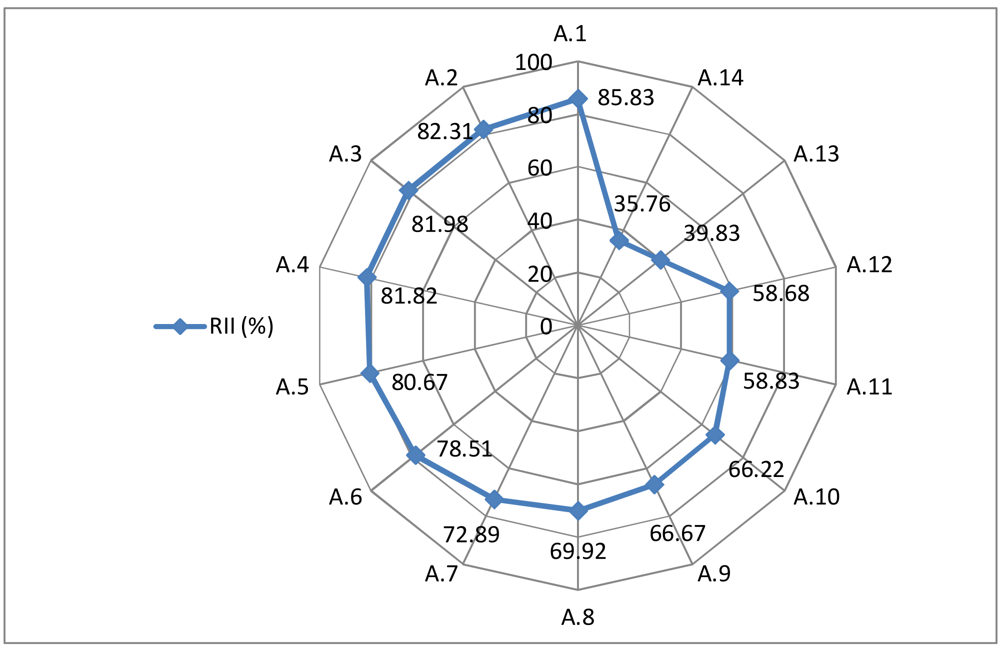


Figure 4.4: RII for attitudes (A.1 – A.14) of residents toward water and energy conservation.

The results showed that the attitude (A.1) " I feel that Gaza Strip suffering water and energy shortage problem" was ranked in 1st position with RII = 85.83% and Mean = 4.9 according to overall professionals respondents. The value of the test-value = 10.27 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Feeling or perceiving water and energy shortage problem or scarcity creates an attitudinal concern, which might be transmitted into conservative behavior toward these resources. This result is agreed with (Wolters, 2014) study survey in which a majority of respondents indicated concern that water quantity is a problem of scarcity and that this concern proved to be a significant predictor of water conservation behaviors. Also, this results in line with (Dolnicar and Hurlimann, 2010; Lipchin, 2006; Corral-Verdugo et al., 2003; Syme et al., 2000).

The attitude (A.2) " I am convinced by the concept of water and energy conservation and sustainability at Gaza Strip " with RII = 82.31% and Mean = 4.12 has got the 2nd rank. The value of the test-value = 10.03 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Convincing in something is a type of belief which is conceptually independent determinant of attitude. However, it is a challenge to convince others by water or energy conservation. Nonetheless, when people are convinced by the concept of water and energy sustainability and conservation, their attitudes ultimately will tend to concern about conservation. This result agrees with (Dolnicar and Hurlimann, 2010).

Attitude (A.3) " I believe of regular maintenance for water and energy appliances (ex. the roof water tank, water pump…)" was ranked in the 3rd position with RII = 81.98% and Mean = 4.10. The value of the test-value = 9.88 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Regular maintence for water and energy households appliances as house water pumps and roof water tanks to control leakage problems is considered as one of the most important strategies. And it has a significant impact on conservation and sustainability. Therefore, beliving in this strategy showing that residents have high conservative attitudes and concern directed to both resource (water and energy). This result is in line with (Vilanova and Balestieri, 2014; Weissman and Miller, 2009).

" I believe that turning off my water pump when the roof tanks are full will conserve water and related energy" attitude (A.4) with RII = 81.82% and Mean = 4.09 has got the rank 4. The value of the test-value = 9.35 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Similarly, attitude (A.7) " I believe that washing and cleaning the house while water pump is operating is a serious cause of over consumption" was ranked in the 7th position with RII = 72.89% and Mean =3.64. The value of the test-value = 6.54 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Both attitudes (A.4 and A.7) assure the validity of water and energy conservation attitude among household residents. Where, people believing in shutting or turning off water and energy devices at the no need time, always have the concern about conservation. The finding is consistent with (Fan et al., 2014; Beal et al., 2013; Kano, 2013; Kilic and Dervisoglu, 2013; Willis et al., 2011; Marandu et al., 2010; Millock and Nauges, 2010; Hassell and Cary, 2007; Gilg and Barr, 2006).

Additionally, " I believe that more attention for water and energy conservation is needed " attitude (A.5) with RII = 80.67% and Mean = 4.03 has got the 5th rank. The value of the test-value = 8.28 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Attention is considered as a part of attitudinal concern. An increase in the attention of water and energy consumptin most likely will inspire residents for more conservation attitude and behavior. This result is in line with (Serret and Brown, 2014; Dolnicar et al., 2012; Dolnicar and Hurlimann, 2010; Millock and Nauges, 2010).

Attitude (A.6) " I think that leakage in my home appliances or hoses during operating the water pump is an important cause of over consumption" was ranked in the 6th position with RII = 78.51% and Mean = 3.93. The value of the test-value = 8.38 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Believing in leakage as a problem will emphasize the necessity for maintenance of household appliances. However, maintenance is considered as one of the most important strategies that have a significant impact on conservation**.** Reduction of water and energy leakage will lead to decrease in consumption. Therefore, people have the perception of leakage problem, mostly will have the conservational attitude. This finding is agreed with other (Wolters, 2014; Beal et al., 2013; Suero et al., 2012; Fielding et al., 2010)

Furthermore, " I feel that it is important and visible that the water and energy concerning sides make strict laws to support water and energy conservation" attitude (A.8) with RII = 69.92% and Mean = 3.5 has got the rank 8. The value of the test-value = 5.53 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Regulations as restrictions is measured as one of the most important strategies that have a significant impact on water and energy conservation. Therefore, believing in restrictions is a step toward successful attitudinal change. That is, if these restrictions are efficiently introduced by the govenrnment or water and energy utilities. This result is in line with (Beal et al., 2013; Dolnicar et al., 2012; Dolnicar and Hurlimann, 2010; Fielding et al., 2010; Millock and Nauges, 2010; Hurlimann et al., 2009; Jorgensen et al., 2009; Randolph and Troy, 2008).

"I believe that I could make more efforts to conserve water and energy" attitude (A.9) was ranked in the 9^{th} position with RII = 66.67% and Mean = 3.33, The value of the test-value = 4.10 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Efforts are required for all aspects of conserving water and energy. As example, believing in efficiency and conservation emphasizes the efforts exerted to use efficient devices or eliminating the use of inefficient ones. Efforts to inspire residents to reduce water and energy consumption have unpredictable degrees of success. This degree of success depends on the integrity of the appeal by household`s residents and the message by the providers. This result is agreed with (Elías-Maxil et al., 2014; Lee, 2011; Dolnicar and Hurlimann, 2010; Fielding et al., 2010; Hurlimann et al., 2009; Corral-Verdugo et al., 2003).

Moreover, attitude (A.10) " I believe that changing attitudes and beliefs affects the water and energy conservation" with the RII = 66.22% and Mean = 3.31 has got the rank 10. The value of the test-value = 3.69 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitude is significantly different and greater than the hypothesized value 3. Attitudes refer to the degree to which a person has a favorable or unfavorable evaluation of a given behavior. Therefore, behavioural intention is formed as a result of the attitude formation. Accordingly, if household`s residents are intent to conserve water and energy, they have to change their attitudes and beliefs. This finding is in line with (Adams, 2014; Beal et al., 2013; Kano, 2013; Kilic and Dervisoglu, 2013; Abrahamse and Steg, 2011; Dolnicar and Hurlimann, 2010; Elizondo and Lofthouse, 2010; Fielding et al., 2010; Russell and Fielding, 2010; Hurlimann et al., 2009; Cary, 2008; Hassell and Cary, 2007; Gilg and Barr, 2006; Abrahamse et al., 2005).

Attitudes (A.11 and A.12) " I believe that I can play additional positive role toward water energy conservation" and " I feel that my neighbors are not aware about water and energy conservation issue " were rankd in the 11th and 12th positions with RIIs = 58.83 and 58.68, and Means = 2.94 and 2.93 respectively. They have the values of P-value = 0.743 and 0.668 respectively, both values are greater than the level of significance α = 0.05. Thus, the means for these two attitudes are insignificantly different from the hypothesized value 3. Therefore, it is revealed that both attitudes are neutral according to the majority of respondents, where their RIIs in the range of (40%-59%). Therefore, there was no sufficient evidence to prove that these both attitudes have substantial impacts on perceiving water and energy conservation. In contrary found by (Dolnicar and Hurlimann, 2010; Roseth, 2006) that 80% and 79% of respondents admit they could do more to conserve water and energy.

Last attitudes (A.13 and A.14), " I think that I am a part of water and energy shortage problem " and " I think that I can dispense of water pumps in my house" with RIIs = 39.83 and 38.76 and Means = 2.09 and 1.79 have got the ranks 13 and 14 respectively. The value of sign Test-value = -5.29 and -7.46 in sequence, with negative sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this attitudes are significantly different and smaller than the hypothesized value 3. Based upon these statistical results, both attitudes have (RII) in the range of (20%-39%) , which indicates that both attitudes are disagreed according to most of respondents. Therefore, it is concluded that eventhough residents convinced that changing attitudes and beliefs affects the water and energy conservation, but they exempt themselves as a part of the water and energy problem. Thus, they feel no pressure on them or they are not responsibe about the problem. On the other hand, unwillingness to dispense of water pumps; regardless of other arguments; signify their carelessness with conservation. This result is in line with (Roseth, 2006).

Concluding remarks :

The results showed that the majority of the attitudes have got RII value in the range (60% - 90%). To evaluate this result, it is substantial to calculate the neutral value of RII and compare it with the each attitude RII value. Based on that, the average of the five points scale used for rating the attitudes equal 3. Accordingly, the neutral value of RII is (3/5)*100 = 60%, where (5) refers to the rating scale used for rating the highest scale (strong agreement) by respondents. Thus, under the average rating scale value (3), the RII value will be less than 60% representing the disagreenet of respondents regarding to the inspected attitude. This means that, the attitude with RII value less than 60% is weak such as attitudes (A. 13 and A.14) with RIIs = 39.83% and 35.76, respectively. These both attitudes were disagreed according to majority of respondents, and have no remarked on household`s residents conservation of water and energy.

Overall results for the field " Water and energy personal attitudes " with the total RII = 68.8% and Mean = 3.44 has got the agreement of the overall repondents. The value of sign Test-value = 6.22, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. This result indicated the admission by the residents that water conservation is important, and that there is a strong willingness by them to conserve water and energy. This finding is agreed with (Dolnicar and Hurlimann, 2010; Russell and Fielding, 2010).

B. **Dimention two - Household`s residents personal behavior toward water and related energy conservation.**

At this part, the researcher examines the personal behavior of the household`s residents through the households' residents toward water and related energy conservation.

At this part, the researcher examines the personal attitudes of the household`s residents toward water and related energy conservation. These households, as pointed out at the introductory chapter, are located at UNRWA re-housing project at Rafah.

Table (4.21) shows 14 behaviors that have been queried by household`s residents to assess their actions toward water and related energy conservation at residential buildings. These behaviors were subjected to the view of respondents, and outcomes of the analysis were conducted. The descriptive statistics, i.e mean, standard deviation (SD), relative importance index (RII), test value, probablilties (P-value) and rank were considered and presented at herein under table (4.21).

Table (4.21): RII and Test value for " Water and energy personal behavior "

No.	Water and energy personal behavior	**Mean**	**RII (%)**	**SD**	**Test value**	**P-value (Sig.)**	**Rank**
B.1	I conserve water and energy where ever and all the time.	4.20	83.90	0.69	10.12	0.000*	1
B.2	I use the water pump at my home because of shortage.	4.17	83.41	0.74	10.08	0.000*	2
B.3	I immediately repair any water and energy leakage problems arise (ex. the roof water tank, water pump and pipes).	4.16	83.25	0.66	10.17	0.000*	3
B.4	I advocate water and energy conservation everywhere and at any time.	4.15	82.93	0.61	10.35	0.000*	4
B.5	I make sure that there is no leakage in my home appliances or hoses during operating the water pump.	4.12	82.44	0.59	10.35	0.000*	5
B.6	I immediately turn off my water pump when the roof tanks are full.	4.08	81.64	0.75	9.65	0.000*	6
B.7	I dispense of my residential water pump if I convinced that the design of the water network.	4.02	80.49	0.85	9.17	0.000*	7
B.8	I dispense of my residential water pump if I convinced that the water supply and operating system work efficiently.	4.01	80.16	0.88	8.75	0.000*	8

Table (4.21): RII and Test value for " Water and energy personal behavior "

No.	Water and energy personal behavior	Mean	RII (%)	SD	Test value	P-value (Sig.)	Rank
B.9	I directly change my behavior when I feel the action do conserve water and energy consumption.	3.96	79.17	0.83	8.92	0.000*	9
B.10	I comply with the governmental restricting laws relevant to water and energy conservation at my home.	3.76	75.12	0.94	7.72	0.000*	10
B.11	I do a regular maintenance for water and energy appliances (ex. the roof water tank, water pump and pipes).	3.74	74.80	0.85	7.40	0.000*	11
B.12	I used to wash the house by water hose while water pump is operating	2.48	49.59	1.57	-2.61	0.009*	12
B.13	I dispense of water pump at my house when I see the neighbors and people at the neighborhood dispense of their water pumps.	2.27	45.37	1.31	-4.82	0.000*	13
B.14	I use the water pump at my home because all of the neighborhood use water pumps at homes.	2.00	40.00	1.31	-6.29	0.000*	14
	Water and energy personal behavior	3.58	71.62	0.44	10.55	0.000*	

* The mean is significantly different from 3

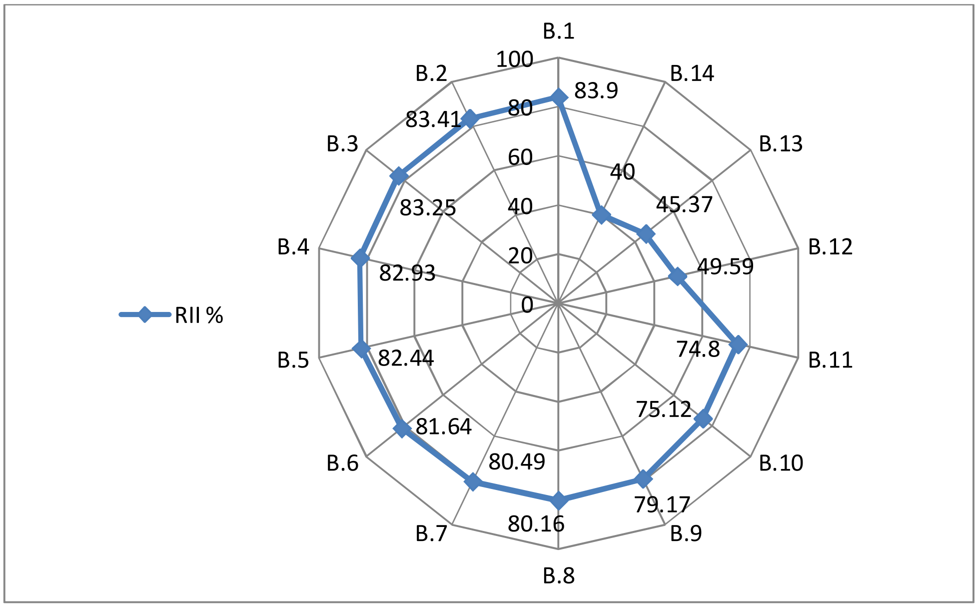


Figure 4.5: RII for attitudesbehaviors (B.1 – B.14) of residents toward water and energy

The findings indicated that the behavior (B.1) " I conserve water and energy where ever and all the time" was ranked in 1st position with RII = 83.9% and Mean = 4.2 according to overall professionals respondents. The value of the test-value = 10.12 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Regardless of the reasons of saving mony, concern of the resouce aviability or doing the right thing, exercising the conservation action is very obvious indicator exemplifying the residents conviction by the conservsation behavior. This result is in line with (Dolnicar and Hurlimann, 2010; Silva et al., 2010; Roseth, 2006; Corral-Verdugo et al., 2003).

" I use the water pump at my home because of shortage" behavior (B.2) with RII = 83.41% and Mean = 4.17 has got the rank 2. The value of the test-value = 10.08 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Under some circumstances, where households adjacent to water supply source, residential water pumps is considered as an inefficient devices for water and energy; and causing unfairness in consumption. Accordingly, using these pumps could represnts as a non conservative behavior. But, shoratge of water and energy at households is 'top-of-mind' for the residents compared to other environmental and social issues. This result in contratry with (Roseth, 2006).

Behavior (B.3) " I immediately repair any water and energy leakage problems arise (ex. the roof water tank, water pump and pipes " was ranked in the 3rd position with RII = 83.25% and Mean = 4.16. The value of the test-value = 10.17 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Likewise, Behavior (B.5) " I make sure that there is no leakage in my home appliances or hoses during operating the water pump " was ranked in the 5th position with RII = 82.44% and Mean = 4.12. The value of the test-value = 10.17 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Both behaviors (B.9 and B.12) assure the validity of water and energy conservation behavior among household residents. Checking up/monitoring and reparing leakage definitely leads to a reduction of wastage in water and energy. Thus, chek and then prompt action of repairing leakage problems, illustrating the consern and conservative behavior toward water and energy. This finding is agreed with (Sarabia-Sánchez et al., 2014; Wolters, 2014; Fielding et al., 2010; Marandu et al., 2010; Suero, 2010; Cary, 2008).

"I advocate water and energy conservation everywhere and at any time" behavoir (B.4) with RII = 82.93% and Mean = 4.15 has got the rank 4. is also stated as a significant predictor for conservation behavior. The value of the test-value = 10.35 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Commonly, adovcating others to do something is due the conviction of its advantageous or feeling of doing the right thing. Therefore, advocating the conservation of water and energy is an action expressing residents conservative behavior or believe. This result is similar to (DERVİŞOĞLU and KILIÇii, 2013; Dolnicar and Hurlimann, 2010).

Moreover, behavior (B.6) " I immediately turn off my water pump when the roof tanks are full " was ranked in the 6^{th} position with RII = 81.64% and Mean = 4.08. The value of the test-value = 9.65 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Practicing the action of shutting or turning off the water and energy appliances at times of needless, or immediately after usage represents concern about conservation. Thus, turning off residential water pump when roof tanks are filled, or turning taps off during shaving and teeth brushing are conservative behavioral predictors. This finding is in line with (Serret and Brown, 2014; Kano, 2013; Fielding et al., 2010; Millock and Nauges, 2010; Randolph and Troy, 2008; Gilg and Barr, 2006).

" I dispense of my residential water pump if I convinced that the design of the water network " behavior (B.7) with RII = 80.49% and Mean = 4.02 has got the rank 7. The value of the test-value = 9.17 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this behavior is significantly different and greater than the hypothesized value 3. As well, the behavior (B.8) " I dispense of my residential water pump if I convinced that the water supply and operating system work efficiently " with RII = 80.16% and Mean = 4.01 has got the rank 8. The value of the test-value = 8.75 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and greater than the hypothesized value 3. The action of dispense residential water pump describes the elimination of useage water and energy inefficient appliance. Thus, both behaviors (B.4 and B.8) describing conditional conservative behavior. Looking into both conditions: design of the network and efficient water system operation, both are relevant to water and energy needed demand coverage. This means that residents behaving in a conservative manner, when they convinced that their water or energy demand is insured. Therefore, it is revealed that the level of residents conservation behavior is ultimately linked with the level of insuring their needs. This result is agrees with (Cary, 2008; Kano, 2013; Lipchin, 2006; Willis et al., 2011; Yu et al., 2011).

Behavior (B.9) " I directly change my behavior when I feel the action do conserve water and energy consumption" was ranked in the 9th position with RII = 79.17% and Mean = 3.96. The value of the test-value = 8.92 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and greater than the hypothesized value 3. This reveals that believing in conservation action for water and energy, emphasizes the residents` attitude which derive their conservative behavior. This result is strengthened by behavior (B.12) " I used to wash the house by water hose while water pump is operating " with RII = 49.59% and Mean = 2.48 has got the rank 12. The value of sign Test-value = - 2.61 with negative sign of the test and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$, so the mean of this behavior is significantly different and smaller than the hypothesized value 3. This statistical result indicates that majority of residents disagreed the behavior expressing unconservative action. Hence, it is confirmed that when residents have a perception toward some conservative action, they behave conservatively. On the other hand, if they feel that the action will lead for more water and energy consumption, they will preserve to do such action. This result is consistent with (Adams, 2014; Fan et al., 2014; Beal et al., 2013; Abrahamse and Steg, 2011; Beal et al., 2011a; Willis et al., 2011; Dolnicar and Hurlimann, 2010; Fielding et al., 2010; Millock and Nauges, 2010; Russell and Fielding, 2010).

" I comply with the governmental restricting laws relevant to water and energy conservation at my home " behavior (B10) with RII = 75.12% and Mean = 3.76 has was ranked in the 10th position. The value of the test-value = 7.72 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Restrictions are considered as one of the most important strategies that have a significant impact on water and energy conservation. Therefore, complying with restrictions granted by the government; as one of the water and energy concerned parties; is a step toward successful conservation behavioral change in which represent a significant instrument affectiong the reduction in consumption. This finding is agreed with other studies by (Serret and Brown, 2014; Dolnicar et al., 2012; Beal et al., 2011a; Millock and Nauges, 2010; Willis et al., 2010; Randolph and Troy, 2008; Roseth, 2006).

Furthermore, the behavior (B.11) " I do a regular maintenance for water and energy appliances (ex. the roof water tank, water pump and pipes) " with RII = 74.80% and Mean = 3.74 has got the rank 11. The value of the test-value = 7.40 with positive sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of this behavior is significantly different and greater than the hypothesized value 3. Regular maintence for water and energy households appliances to control leakage problems is considered as one of the most important strategies with a significant impact on conservation. Consequently, practicing the action of maintenance regularly, proves that residents behave conservatively toward the resources of water and energy. The result is in line with (Nazer, 2010; Weissman and Miller, 2009; Vilanova and Balestieri, 2014).

" I dispense of water pump at my house when I see the neighbors and people at the neighborhood dispense of their water pumps " behavior (B.13) was ranked in the 13th position with RII = 45.37% and Mean = 2.27. Consecutively, behavior (B.14) " I use the water pump at my home because all of the neighborhood use water pumps at homes. " was ranked in 14th position with RII = 40.00% and Mean = 2. Both have the value of sign Test-value = - 4.82 and - 6.29 respectively with negative sign of the test and P-value = 0.000 which is smaller than the level of significance α = 0.05, so the mean of these behaviors are significantly different and smaller than the hypothesized value 3. This result indicates that both behaviors (B.13 and B.14) are disagreed according to majority of respondents. The action of dispense or use of residential water pump is no a result for action taken by others. Thus, this result shows that the Palestinian household residents conservative behavior of reducing water or energy consumption is not necessarly dependent on or relevant to any step taken by others. Consequently, it is assured that residents water and energy conservation behavior is definitely linked with the level of insuring their needs and is not ultimately influenced (inter-personal trust). Contrary is stated by (Jorgensen et al., 2009; Lipchin, 2006).

Concluding remarks :

The results showed that the majority of the behaviors have got RII value in the range (60% - 90%). To evaluate this result, it is substantial to calculate the neutral value of RII and compare it with the each behavior RII value. Based on that, the average of the five points scale used for rating the behaviors equal 3. Accordingly, the neutral value of RII is (3/5)*100 = 60%, where (5) refers to the rating scale used for rating the highest scale (strong agreement) by respondents. Thus, under the average rating scale value (3), the RII value will be less than 60% representing the disagreenet of respondents regarding to the inspected behavior. This means that, the behavior with RII value less than 60% is weak such as behaviors (B.12, B.13 and B.14) with RIIs = 49.59% , 45.37 and 40, respectively. These behaviors were disagreed according to majority of respondents, and have no remarked on household`s residents conservation of water and energy.

Overall results for the field " Water and energy personal behavior " with total RII = 71.62% and Mean = 3.58 has got the agreement of the overall repondents. The value of sign Test-value = 10.55, and P-value = 0.000 which is smaller than the level of significance α = 0.05. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. In summery, this finding indicated the admission by household`s residents that water and energy conservation is important. And, they behave conservatively and independently unless their needs are affected, where the needs is ‘top-of-mind’ for the residents compared to other environmental and social issues.

C. **Dimention three - The relationship between household`s residents attitudes and behaviors toward water and energy conservation.**

At this part, the researcher tests the relationship between personal attitudes and behaviors of the household`s residents through the households' residents toward water and related energy conservation.

Table (4.22) shows that the correlation coefficient between water and related energy personal attitude and personal behavior toward conservation equals 0.689 and the p-value (Sig.) equals 0.000. The p-value (Sig.) is less than 0.05, so the correlation coefficient is statistically significant at $\alpha = 0.05$. Therefore, it can be said that there exists a significant relationship between personal attitudes and personal behaviors toward the conservation of residential water and related energy.

Although, this study results revealed that there is a significant relationship between attitudes and behaviors toward the conservation of residential water and related energy as shown in Table (4.21) for both fields, it can be noticed as in Table (4.22) that there is some particular tested attitudes are not coincide with related behaviors. This do not detract the significant relationship between both fields (attitudes and behaviors), nonetheless this result has confirmed that water and energy conservation attitudes and behavior are closely related as reported by (Willis et al., 2011; Gilg and Barr, 2006). In contrary, (Fan et al., 2014) found a big gap exists between attitude and behavior. While in between, (Jorgensen et al., 2009) study has revealed that residents with positive attitudes may not always exhibit positive behavior.

Table (4.22): Correlation coefficient between water and related energy conservation personal attitude and personal behavior

Spearman Correlation Coefficient	P-Value (Sig.)
0.689	0.005*

* Correlation is statistically significant at 0.05 level

Table (4.23): Correlation between Water and energy personal attitudes and Water and energy personal behaviors.

No.	Paragraph		P-value (Sig.)	Spearman Corr. Coefficient
	Attitudes A	Behaviors B		
1.	I feel that Gaza Strip suffering water and energy shortage problem.	I directly change my behavior when I feel the action do conserve water and energy consumption.	0.000	0.342
2.	I think that I am a part of water and energy shortage problem.	I use the water pump at my home because of shortage.	0.319	0.092
3.	I am convenced by the concept of water and energy conservation and sustainability at Gaza Strip.	I conserve water and energy where ever and all the time.	0.196	0.119
4.	I believe that more attention for water and energy conservation is needed.	I dispense of my water pump if I convinced of the design of the water network.	0.001*	0.294
5.	I believe that changing attitudes and beliefs affects the water and energy conservation.	I advocate water and energy conservation everywhere and at any time.	0.000*	0.303
6.	I believe that I can play additional positive role toward water energy conservation.	I dispense of water pump at my house when I see the neighbors and people at the neighborhood dispense of water pumps.	0.000*	0.349
7.	I feel that my nieghbours are not aware about water and energy conservation issue.	I use the water pump at my home because all of the neighborhood use water pumps at homes.	0.323	-0.042
8.	I think that I can dipense of water pumps in my house.	I dispense of my water pump if I convinced that the water supply and operating system work efficiently.	0.013*	-0.206
9.	I believe that I could make more efforts to conserve water and energy.	I immediately repair any water and energy conservative appliances as leakage problems arise (ex.roof water tank, water pump and pipes).	0.021*	0.185
10.	I believe of regular maintenance for water and energy appliences as leakge problems arise (ex. the roof water tank, pipes, water pump).	I do a regular maintenance for water and energy appliances as leakage problems arise (ex.water tank, water pump and pipes.	0.006*	0.226
11.	I believe that turning off my water pump when the roof tanks are full will conserve water and related energy.	I immediately turn off my water pump when the roof tanks are full.	0.000*	0.466
12.	I think that leakage in my home applencies or hoses during operating the water pump is an important cause of over consumption.	I make sure that there is no leakage in my home appliances or hoses during operating the water pump.	0.000*	0.422
13.	I feel that it is important and visible that the water and energy concerning sides make strict laws to support water and energy conservation.	I comply with the governmental restricting laws relevant to water and energy conservation at my home.	0.000*	0.349
14.	I believe that washing and cleaning the house while water pump is operating is a serious cause of over-consumption.	I used to wash the house by water hose while water pump is operating.	0.001*	-0.291

* Correlation is statistically significant at 0.05 level

Table (4.23) shows that the correlation coefficient between each of water and related energy conservation personal attitudes and relevant itemized one of water and related energy conservation personal behaviors.

Looking over the coincide and those not coincide items of attiutudes and behaviors, it is found that, the incompatibility between attitude (A.2) " I think that I am a part of water and energy shortage problem" and behavior (B.2) " I use the water pump at my home because of shortage" clarifying the refusal of the population to admit that they are part of the water and energy shortage problem, while they confirmed that they are using the residential water pumps which on some instances is considered as inefficient devices for water and energy. Although, the use of the wasteful instrument is justified, it represents contradiction between the population personal attitude and behavior which interpret the disagreement. The reasons behind such discrepancy include lack of environmental values and conservation attitude, water and energy saving behavior knowledge, water and energy consumption awareness and perception, or might refers to their conviction that shortage is caused by other reasons. If residents have untrue perceptions of water and energy values and saving methods such as proper education to change behavior and the use of water-saving devices to improve efficiency will be ineffective. This reveals reported by (Corral-Verdugo et al., 2002) who emphasized the importance of public awareness on water consumption because this perception helps develop both attitudes and behaviors that lead to water conservation.

On the othe hand mismatch is noted between attitude (A.3) " I am convenced by the concept of water and energy conservation and sustainability at Gaza Strip " and behavior (B.3) " I conserve water and energy where ever and all the time ". Even though each of the mentioned items has strongly agreed by residents with high significance to influence the attiude and behavior sperately, but the contradictory between both stress the concept of perons with positive attitudes may not always exhibit positive behavior or vise versa. As an example of smokers who are practicing the smoking habit as a daily behavior, not essential to be coincide or have the positive attitude and perception toward smooking. This result is found by (Jorgensen et al., 2009).

Alike, the inconsistency between attitude (A.7) " I feel that my nieghbours are not aware about water and energy conservation issue " which has a neutral participant descion in the survey, the residents have not a real or solid attitude about their neighbours awareness about water and energy conservation. As a result, their disagreed behavior (B. 7) " I use the water pump at my home because all of the neighborhood use water pumps at homes " is expected to be irrealted to that uncertain attitude. As aforementioned, residents justify their use for residential water pumps for the shortage reason, this suggests that the people perceive an insured attitude or interperonal trust will mostly not affected by thier action. This finding runs with what revealed by (Wolters, 2014; Jorgensen et al., 2009; Corral-Verdugo et al., 2002).

Finally, efforts to measure water and energy attitudes and behaviour are limited by possible biases related to self-reported attitudes and behaviour: a socially desirable customs are more likely to be over-reported by household residents. Although positive attitudes to conserve water and energy do not agree to actual behavior of water and energy reductions all the time. A perceived environmental hazard, such as strong perceptions of the severity of a water and energy shortage, has been found to be closely related to intentions to conservation by changing behaviour (Millock and Nauges, 2010; Gilg and Barr, 2006).

Therefore, it could be concluded that, in addition to peronal strong positive attitude towards saving water and energy, change in water and energy consumption and conservation behaviour is most likely to occur when as many as possible of the following factors are exist: external factors, such as appropriate tariff pricing and policy consistency, encourage appropriate behaviour, technology (eg. reduction in use of residential water pumps inefficiently), personal believe that the advantages or positive outcomes compensate the disadvantages or negative outcomes of saving water and energy, perceive more social pressure (interpersonal trust) to conserve water than to not to conserve water and energy. This finding is in line with (Hassell and Cary, 2007).

Chapter 5: Conclusions and Recommendations

5.1 Introduction

The aim of this research is to assess the water and related energy consumption practices of existing housing in Gaza Strip. The ultimate outputs are to identify the dirvers of household`s water and related energy, to establish the level and effectiveness of household`s residents attitudeds and behaviors toward the conservation of water and related energy and to pinpoint measures/ strategies for guiding sustainability and conservation of water and related energy in residential buildings.

This chapter discuses the key findings and recommendations that the researcher suggests to enhance and promote the water and energy conservation and sustainability practices amongst the household`s residents at residential buildings and also amongst the water and energy concerned parties to overcome the shortage scarcity for both resources at the Gaza Strip. This chapter is divided into three main sections: conclusion, recommendations and proposed further studies.

5.2 Conclusions and recommendations

Outcomes related to objective one: To identify the drivers affecting household`s residents consumption of water and related energy at residential buildings.

The study revealed that there is a significant statistical relationship between the inspected drivers and the household`s residents consumption of water and energy at residential buildings. Results obtained from personal structured interviews revealed the following:

With RII = 88.9 %, " climate (seasonal weather) changes due to weather humidity and temperature " was the most important dirver. It is strongly influencing household`s residents habits of water and energy consumption. Moreover, driver " Knowledge of how to conserve water and energy " with RII = 80.7% was found to be one of the most important dirver. How knowledge are recognized and addressed today will greatly influence the uptake route of consumption. Accordingly, improving these knowledge well strongly affect the water and energy conservation and sustainability.

Likewise driver " household size " with RII = 80.7% was also revealed as one of the most important dirvers affecting water and energy consumption.

The drivers: environmental value, number of household`s residents, educational level, and behavioral control and attitude have got RII in the range (76% - 80%). According to openion of the majority of professinals, thses drivers are classified of high importance to influence household`s residents water and energy consumption. The other dirvers with RII in range of (70% - 75%) as: institutional trust, Social equity, residents income, tariff, and incentives on water and energy saving devices are found as important drivers affecting the consumption. As well the dirvers with RII range (65% - 69%), existence of water pumps and water tanks as effecient and ineffcient devices, governmental regulations and inter-personal trust. These dirves also revealed to have impact on household`s residents water and energy consumption.

Finally, both drivers gender and old age residents with RIIs = 63% and 58.5 % found to be with neutral influence on residents water and energy consumption, according to the majority of professinals. On the other side, this research concluded that older housholds has no remarked impact on consumption of water and energy by household`s residents.

According to these research findings, the recommendations related to this objective were:

- ✓ There is a serious need for developing water and energy policies at the Gaza Strip, it could be acheived by the use of 'stick's (regulation) and 'carrots' (incentives).
- ✓ Additional effort is required by the water and energy concerned parties to ensure household`s residents are provided with the knowledge needed to ensure conservation and sustainability.
- ✓ It is recommended to start the manage of quantity of the water and energy supply and distribution services in the Gaza Strip. This shall be done thru the cooperation with residents to overcome critical situations as climate (seasonal weather) changes.
- ✓ Improving trust and respectful relationships between the households residents and the water and energy concerned parties at governmental level.

This trust will be imperative for the future of Gaza Strip water and energy sectors to improve conservation and sustainability.

Outcomes related to objective two: To pinpoint strategies that guide household`s residents use of water and related energy to conservation and sustainability.

The study revealed that there is a significant statistical relationship between the inspected strategies and the household`s residents use of water and related energy for guiding conservation and sustainability. Results obtained from personal structured interviews revealed the following:

With RII = 84.6 %, " Periodic maintenance for water and energy devices and systems" was the most important strategy. It is strongly influencing household`s residents habits of water and energy conservation. Regular maintenance extends the devices life, minimizes their downtime, and reduce water and energy wastes due to expected leakage. Moreover, strategy " Leakage control " with RII = 83.7% was found to be one of the most important strategies. Since minimizing or reducing leakage could help in: (1) reducing water and energy consumption by the residents, (2) reduce the waste of water and energy, (3) reduce water and electricity flows and headloss in the networks and (4) significantly reduce water and energy scarcity and costs to levels that the need for other alternative resouces for supply. Likewise strategies " Information " , " Educational and training programs " and " Demand side management " with RIIs = 81.8% , 81.5% and 80.7% respectively, were also revealed to be of the most important strategies that guiding water and energy conservation and sustainability.

The startegies: " Metering", " Planing and implementation for conservation polices ", " Funding ", Moitoring and controlling devices ", " Incenrtives and disincentives", " Social equity", and Using water and energy efficient devices " have got RII in the range (76% - 80%). According to openion of the majority of professinals, thses startegies are classified of high importance to guide household`s residents water and energy conservation. Metering as mentioned before is an adequate process for leakage identification, over consumption due to illegalities and/or unequal distribution. Planning and implementation for polices toward energy and water consumption is an integrating strategy with metering startegy. Polices as regulations and ordinances prohibit daytime watering, electricity usage and water and energy wasting. However, funding is necessary for water utilities to implement water and energy efficiency options. Funding is also essential for water and energy providers to conduct studies and pilot projects as well as financial incentive and rebate programs.

Rate structure and pricing, taxes regulations, rebates on water and energy saving technologies, eliminating residential water pumps are of the incentives and disincentives mechanisms. These mechanisms are significantly affect water and energy consumption attitude and behavior. Both strategies: social equity and improving efficiency criteria could be met by: (1) using cross-supported minimum consumption and increasing rates for higher consumption, (2) monitoring and controlling consumption by metering, and (3) restriction of using residential water pumps at households adjacent to supply source. It is important to give due attention to social equity in order to protect the weakest people from carrying high liability.

Finally, the other startegies with RII in range of (68% - 75%) as: institutional trust, consumer` engagement in palnning and decision making, and inter-personal trust, were found as important strategies, which also guiding the conservation. Institutional trust strategy emphasizes the relationship between household`s residents and the energy and water provider. Individuals are less likely to conserve water and energy if they have no trust in providers. Miss-trust between both residents and providers would affect negatively the pricing polices. This situation could bring some people to delay in paying for water and electricity bills and some others to connect illegally leading to unfair of distribution. Accordingly, consumer` engagement in palnning and decision making is a high motive to assure trust and cooperation between residents and providers. This strategy increases the willingness of residents to change their attitudes and behaviors, and to interact with providers conservation plans.

According to these research findings, the recommendations related to this objective were:

- ✓ It is recommended that it is more valuable and significant to enhance the household`s residents participation concerning water and energy decision making, especially in regard of water and energy conservation and sustainability issues. This household`s residents participation can be achieved through many activities such as invitations of household`s residents leaders and specialist persons.

- ✓ Additional effort is required by the water and energy concerned parties to ensure that residents are provided with the necessary information to ensure they are able to make conservation decisions.
- ✓ Metering has the potential to engage consumers in (demand side management) DSM programs by improving their knowledge about personal water and energy consumption. Thus it is recommended to explore innovative methods to allow consumer's to follow their water and energy consumption on a daily basis (e.g. via the internet, massages via mobiles).
- ✓ Water and energy utilities should maintain precisely and adequately water and energy network, follow up the leakage and monitor and control dispensable use of an inefficient divices as residential water pumps. They also should detect continuously the illegal connections to reduce the losses in the network and consequently upgrade the cost of the water and energy supply service.

Outcomes related to objective three: To Investigate the attitude and behavior of household`s residents toward water and energy conservation at residential buildings. .

The study revealed that there is a significant statistical relationship attitude and behavior of household`s residents toward water and energy conservation at residential buildings. Results obtained from questionnaire survey revealed the following:

With RII = 68.8 %, " Attitutes of household`s residents toward water and related energy " has got the confession by the majority of residents that conservation of water and energy is very important. Eventhough residents exempt themselves as a part of the water and energy shortage problem, they convinced that changing attitudes and beliefs affects the water and energy conservation. The residenst have shown a strong willingness for conservation of water and energy at residential buildings.

As for examples, with mean value = 4.1, residents have shown their strong believe in regular maintenance for water and energy household`s devices. Also, they exposed strong believe in turning off water pumps (as a household device delivering water and consuming energy) with mean value = 4.09. Both of these attitudes assure the validity of water and energy conservation attitude among household residents. Where, people believing in regular maintenance or in turning off water and energy devices at the no need time, always have the concern about conservation.

With RII = 71.62 %, " Behavior of household`s residents toward water and related energy " has got the confession by the majority of residents that consumption of water and energy is a vital issue. This finding indicated the acknowledgement by household`s residents that water and energy conservation is important. Accordingly, they behave conservatively and independently unless their needs are affected, where their needs is ‘top-of-mind’ for the residents compared to other environmental and social issues.

As for examples, with mean value = 4.16, residents have shown their conservative behavior by the immediate repaire for any water and energy leakage arise in their household`s devices. Also, they exposed a conservative action by advocating water and energy conservation everywhere and at any time. This behavior got the mean value = 4.15. Both of these actions assure the validity of water and energy conservation behavior among household residents.

According to these research findings, the recommendations related to this objective were:

- ✓ Emphasizing water and energy attitudes and conservative behaviors among household`s residents. The water and energy utilities should take serious steps to activate the public awareness programs through periodic meeting with household`s residents, publications, workshops, conferences, and media.
- ✓ Educational curriculums shoud be enriched with the environmental values subjects, and with positive attitudes and behaviors toward sustaining environment. This highlight the value of environmental realted issues as water and energy conservation amongst people.
- ✓ The use of incentives and disincentives mechanisim by the government or water and energy concerned parties like utilities, will also stress residents attitudes and behaviors toward conservation.

5.3 Limitations and further research

- ✓ For the quantitative study, the data collected from the structured inteview scales may result in uncertain reliability and common method variance. However, it should be noted that the survey sample of professional respondents who working in water and energy concerned parties is small, eventhough they are specielists with high experience. Small sample size could result in reduced accuracy of parameter estimates and reduced power for testing. To minimize the limitations of the research results, survey study with larger sample size is recommended.
- ✓ To enhance the degree of confidence of the current study results, action reserach study is recommended to collect data repetitively over an extended period, like repetitive interviews with household`s residents to follow up their attitude and behavior change toward some action.
- ✓ The questionnaire and structured interview survey provides a generalizable study of the relationship between attitudes and behaviors of Gaza Strip households` residents for the study. In order to carry out an in-depth study of this topic, qualitative research methods are suggested. Further unstructured interviews or case studies on some specific cases are recommended for cross-validating the results found in this study and uncovering the reasons behind the results.
- ✓ In order to explore the integrated relationships between water and energy consumption and conservation of the households in the Gaza Strip, simulation for water networks thru computrized models is recommended as further research.
- ✓ Upon completion of the research with the given research objectives, questions and the scope, it is observed that some critical and relevant issues have not been covered by this research. To facilitate the application of households` residents participation approach in both the municipal planning and funding, further researches might be conducted to set practical models for covered by this research. To facilitate application of households` residents participation process.
- ✓ As already mentioned, if pricing mechanisms are to be used as part of a DSM strategy they should be accompanied by a number of other DSM policies. Combinations of pricing and complimentary policies that achieve the goals of efficiency, equity, and sustainability require further research.
- ✓ Analysis of the DSM implementation decision-processes and methods to manage uncertainty. We recommend that more carefully designed and monitored pilot-scale studies are required during evaluation.

5.4 Practical implications:

Attitues and behaviors toward water and energy conservation and sustainability shall be strengthen thru educational programs and training by academic institutions and universities. As well as water and energy concerned parties could provide training for engineers and technicians who are responsible about operation, distribution and maintenance of water and electicity networks. Changing attitudes and behaviors approaches as policies, methods and campaigns must be designed in view of the local cultural and social background, alongside financial and technological accessibility. The government agencies must take progressive steps to apply thses approaches. These approaches must be multi-staged, in the sense that they must change behavior in a gradual manner and must interconnect various means, from informing the user and providing feedback to making the use of new products be embraced by users and updating legislation accordingly.

5.5 Originality/ value:

This research is the first study that contribute significantly to consider the attiudes and behaviors of household`s residents for water and energy conservation in Gaza strip. This study could be used as a foundation for future development and improving understanding to increase knowledge and shifting the public culture in order to strengthen the enviromentsal values and suatainability concept.

5.6 Contribution to knowledge and benefits to water and energy field:

This study has presented remarkable findings in the investigation about water and energy conservation and sustainability. This research has identified the most important drivers and most valuable strategies for water and energy concerned parties. These drivers and strategies enable the concerned parties to guide household`s residents for water and energy conservation at residential buildings in Gaza strip. The contributed knowledge has established a good platform for future researchers to identify meaningful ways for providing solution to come over the challenges in terms of water and energy scarcity.

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Appendix A : Structured Interview for Decision Makers **(English)**

Engineering **P**roject **M**anagement
Civil **E**ngineering **D**epartment
Islamic **U**niversity of **G**aza
Master **D**issertation in **C**onstruction **M**anagement

(STRUCTURED INTERVIEW SURVEY)

Water and Related Energy in Residential Buildings
Conservation and Sustainability.

All information given will remain **CONFIDENTIAL** and used for this study only.
"THANK YOU FOR YOUR KINDLY PARTICIPATION AND CONTRIBUTION"

Prepared By
Salam M.S. Elzebdeh
Supervised By
Prof. Dr. Adnan Enshassi

(Mar. 2015).

Islamic **U**niversity of **G**aza
College of **E**ngineering
Civil **E**ngineering **D**epartment
Engineering **P**roject **M**anagement

Aims and Scope of this Survey:

This Survey aims to serve as a main tool of collecting data to verify the objectives for the reaserach titled **Water and Related Energy in Residential Buildings Conservation and Sustainability.** This questionaire is required to be filled with exact relevant facts as much as possible. All data included in this questionnaire will be used only for academic research and will be strictly confidential. After all questionnaires are collected and analyzed, interested participants of this study will be given feedback on the overall research results.

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Water and Related Energy in Residential Buildings

Conservation and Sustainability.

Part I : Personal information

1. Profession:

☐ Designer	☐ Supervisior
☐ Manager	☐ Other (specify)...............

2. Organization/ Authority:

☐ UNRWA	☐ CMWU
☐ Water Authority	☐ Municipality of ....
☐ Electricity Distribution Co.	☐ Other, ………................

3. Work Location :

☐ North area	☐ Gaza	☐ Middle area	☐ Khanyounis	☐ Rafah

4. Educational level of the respondent:

☐ Diploma	☐ BSc
☐ Master	☐ PHD

5. Experience in Water/or Energy field?

☐ less than 5 years	☐ less than 10 years
☐ less than 15 years	☐ 15 years and more

Part II : Drivers affecting household`s residents water and energy consumption at residential buildings.

To what extent do you agree with the following statements? Please check the no. reflecting your agreement to the following statements and how much do affect water and energy consumption?

1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree

No.	Item description	Degree of agreement				
		1	2	3	4	5
1.	Seasonal weather changes (climate) are direct drivers for water and energy consumption.	☐	☐	☐	☐	☐
2.	Tariff/ pricing system is one of the most determinants that positively affecting water and energy consumption.	☐	☐	☐	☐	☐
3.	Discount/ Incentives on water and energy saving technologies is one of the most determinants that positively affecting water and energy consumption.	☐	☐	☐	☐	☐
4.	The existnace of house water pumps leads to more consumption in water and energy.	☐	☐	☐	☐	☐
5.	Governmental water and energy restrictions and regulations directly affect the consumption rate.	☐	☐	☐	☐	☐
6.	Larger household size necessarly leads to more water and energy consumption.	☐	☐	☐	☐	☐
7.	Older houses consume less water and energy.	☐	☐	☐	☐	☐
8.	The existnace of water tanks conserve more water and energy.	☐	☐	☐	☐	☐
9.	knowledge of how to conserve water and energy is a direct dirver that positively affect the water and energy consumption	☐	☐	☐	☐	☐
10.	Behavioural control and attitude toward behavior are main determinants for water and energy consumption.	☐	☐	☐	☐	☐
11.	Institutional trust (i.e. trust in water provider) is a factor that positively affects the water and energy consumption.	☐	☐	☐	☐	☐
12.	Inter-personal trust (i.e. trust between populations at the same noughbourhood) is a determinant that positively affects the water and energy consumption.	☐	☐	☐	☐	☐
13.	Environmental values and conservation attitude are of the main drivers for water and energy consumption.	☐	☐	☐	☐	☐
14.	Social equity is an important factor that positively affects water and energy conservation.	☐	☐	☐	☐	☐
15.	Increase in household income leads to more water and energy consumption.	☐	☐	☐	☐	☐
16.	Decrease in family number leads to lower water and energy consumption.	☐	☐	☐	☐	☐
17.	Older house residents tend to consume less water and energy consumption.	☐	☐	☐	☐	☐
18.	Gender is an important factor for water and energy consumption.	☐	☐	☐	☐	☐
19.	Education level for householder residents is an effective driver for water and energy consumption.	☐	☐	☐	☐	☐

Part III : Strategies to imropve household water and energy conservation

To what extent do you agree with the following statements? Please check the no. reflecting your agreement to the following statements and how much do affect water and energy conservation?

1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree

No.	**Item description**	**Degree of agreement**				
		1	2	3	4	5
1.	Metering: monitoring and controlling of water and energy household meters.	☐	☐	☐	☐	☐
2.	Working on water and energy efficiency/ saving devices (e.g., installing dual flush toilets or stopping use of house water lifting pumps.	☐	☐	☐	☐	☐
3.	Incentive/ disincentives mechanisims (e.g., rate structure and pricing, taxes regulations, rebates on water saving technologies, cancelling house lifting water pumps, etc.).	☐	☐	☐	☐	☐
4.	Funding: funding water and energy conservation programs (e.g., water and energy efficiency devices for households).	☐	☐	☐	☐	☐
5.	Monitoring and controlling of water and energy devices and systems.	☐	☐	☐	☐	☐
6.	Periodic maintenance for water and energy devices and systems.	☐	☐	☐	☐	☐
7.	Leakage control.	☐	☐	☐	☐	☐
8.	Consumers' enegagement in water and energy conservation planning and decision-making.	☐	☐	☐	☐	☐
9.	Educational and training programs for rising up the level of puplic awareness and the workers on the water and energy operational and maintenance field.	☐	☐	☐	☐	☐
10.	Information: Media and workshops for rising awareness level within the household residents of water and energy scarcity.	☐	☐	☐	☐	☐
11.	Institutional trust: Emphasize the trust between population and the energy and water supply sides.	☐	☐	☐	☐	☐
12.	Inter-personal trust: Emphasize trust between population at the same noughbourhood (i.e. between noughbours) of energy and water conservation. supply sides.	☐	☐	☐	☐	☐
13.	Social equity: equity in water and energy supply and distribution between noughbourhoods and between residents at the same noughbourhood.	☐	☐	☐	☐	☐
14.	Planning and implementation for polices toward energy and water conservation commitment.	☐	☐	☐	☐	☐
15.	Apply a demand side management for energy and water to monitor and control leaks, shortage and illegalities.	☐	☐	☐	☐	☐

Thanks for your time.

Appendix B : Questionnaire For UNRWA

Re-Housing projects, Househods` Residents

(English)

Engineering **P**roject **M**anagement
Civil **E**ngineering **D**epartment
Islamic **U**niversity of **G**aza
Master **D**issertation in **C**onstruction **M**anagement

(QUESTIONAIRE SURVEY)

Water and Related Energy in Residential Buildings
Conservation and Sustainability.

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Salam M.S. Elzebdeh
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(Mar. 2015).

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Water and Related Energy in Residential Buildings

Conservation and Sustainability.

Part I : Personal information (Socio-dempgraphic factors)

1. Age of the head of household (years):	☐< 20	☐ 20 to < 30	☐30 to < 40	☐40 to < 50	☐ > 50
2. Sex of Household Head:	☐Male		☐Female		
3. Marital status of Household Head:	☐Married	☐Single	☐ Widower	☐Divorced	
4. Head of household educational level:	☐High Dip.	☐Bachelor Deg.	☐ Master Deg	☐ High Cert.	☐Other: …..
5. Monthly incomefor family		☐<1000 NIS	☐1001-1500 NIS	☐1501-2000NIS	☐>2000NIS.
6. No. of home residents:	☐1-2	☐3-4	☐5-6	☐7 and more	
7. Area of the house	……… m^2				
8. Quantity of water consumed m^3/month		Average	………m^3/month		
9. Quantity of electricity consumed KWH/month		Average	……..KWH/month		

Part II : Household`s residents attitueds and behaviors toward water and energy conservation

To what extent do you agree with the following statements? Please check the no. reflecting your agreement to the following statements and which demonstrate the personal attitude and behavior toward water and related energy consumption and conservation.

1 *– Strongly disagree,* ***2*** *–Disagree,* ***3*** *– Neutral,* ***4*** *– Agree,* ***5*** *– Strongly agree*

No.	**Item description**	**Degree of agreement**				
		1	2	3	4	5
A.	**Water and energy personal attitudes**					
1.	I feel that Gaza Strip suffering water and energy shortage problem	☐	☐	☐	☐	☐
2.	I think that I am a part of water and energy shortage problem	☐	☐	☐	☐	☐
3.	I am convenced by the concept of water and energy conservation and sustainability at Gaza Strip.	☐	☐	☐	☐	☐
4.	I believe that more attention for water and energy conservation is needed.	☐	☐	☐	☐	☐
5.	I believe that changing attitudes and beliefs affects the water and energy conservation.	☐	☐	☐	☐	☐
6.	I believe that I can play additional positive role toward water energy conservation.	☐	☐	☐	☐	☐
7.	I feel that my nieghbours are not aware about water and energy conservation issue.	☐	☐	☐	☐	☐
8.	I believe of regular maintenance for water and energy appliances (ex. the roof water tank, water pump…).	☐	☐	☐	☐	☐
9.	I think that I can dipense of water pumps in your house.	☐	☐	☐	☐	☐
10.	I believe that I could make more efforts to conserve water and energy.	☐	☐	☐	☐	☐
11.	I believe that turning off my water pump when the roof tanks are full will conserve water and related energy.	☐	☐	☐	☐	☐
12.	I think that leakage in my home applencies or hoses during operating the water pump is an important cause of overconsumption.	☐	☐	☐	☐	☐
13.	I feel that it is important and visible that the water and energy concerning sides make strict laws to support water and energy conservation.	☐	☐	☐	☐	☐
14.	I believe that washing and cleaning the house while water pump is operating is a serious cause of overconsumption.	☐	☐	☐	☐	☐

No.	Item description	Degree of agreement				
		1	2	3	4	5
B.	**Water and energy personal behavior**					
1.	I directly change my behavior when I feel the action do conserve water and energy consumption.	☐	☐	☐	☐	☐
2.	I use the water pump at my home because of shortage.	☐	☐	☐	☐	☐
3.	I conserve water and energy where ever and all the time.	☐	☐	☐	☐	☐
4.	I dispnse of my water pump if I convenced that the design of the water network.	☐	☐	☐	☐	☐
5.	I advocate water and energy conservation everywhere and at any time.	☐	☐	☐	☐	☐
6.	I dispense of water pump at my house when I see the neigbours and people at the neighbourhood desipense of their water pumps.	☐	☐	☐	☐	☐
7.	I use the water pump at my home because all of the noughbourhood use water pumps at homes.	☐	☐	☐	☐	☐
8.	I dispnse of my water pump if I convenced that the water supply and operating system work efficiently.	☐	☐	☐	☐	☐
9.	I immediately repair any water and energy conservative appliences as leakge problems arise (ex. the roof water tank, water pump and pipes).	☐	☐	☐	☐	☐
10.	I do a regular maintenance for water and energy appliences as leakge problems arise (ex. the roof water tank, water pump and pipes.	☐	☐	☐	☐	☐
11.	I immediately turn off my water pump when the roof tanks are full.	☐	☐	☐	☐	☐
12.	I make sure that there is no leakage in my home applencies or hoses during operating the water pump.	☐	☐	☐	☐	☐
13.	I comply with the govermnetal restricting laws relavant to water and energy conservation at my home.	☐	☐	☐	☐	☐
14.	I used to wash the house by water hose while water pump is operating	☐	☐	☐	☐	☐

Thanks for your time

Appendix C : Questionnaire For UNRWA

Re-Housing projects, Househods` Residents

(Arabic)

برنامج إدارة المشاريع الهندسية

كلية الهندسة

قسم الهندسة المدنية

الجامعة الاسلامية غزة

(استبانة)

الاستدامة والحفاظ على المياه ومايتعلق بها من طاقة في المباني السكنية

وذلك جزء من البحث التكميلي لنيل درجة الماجستير في إدارة المشروعات الهندسية

كل المعلومات المطلوبة ستبقى سرية وسيتم استخدامها لهدف الدراسة فقط

شكرا لمشاركتكم ومساهمتكم فى انجاح هذا العمل

إعداد الباحث: م. سلام الزبدة

المشرف : أ.د. عدنان انشاصي

(مارس 2015)

الجامعة الاسلامية غزة
كلية الهندسة
قسم الهندسة المدنية
برنامج إدارة المشاريع الهندسية

الأخوة السكان في مشروع الإسكان السعودي الكرام/
السلام عليكم ورحمة الله وبركاته وبعد، ،،،

الموضوع/

استبانة في موضوع الاستدامة والحفاظ على المياه ومايتعلق بها من طاقة في المباني السكنية في قطاع غزة

هذه الإستبانة عبارة عن أحد الوسائل الهامة والغرض منها جمع البيانات التي تحقق أهداف هذا البحث والمعنون ب " **الاستدامة والحفاظ على المياه ومايتعلق بها من طاقة في المباني السكنية** ". ولتحقيق هذه الأهداف تم دعوة سيادتكم لتزويدنا بالبيانات المطلوبة لملئ هذه الاستبانة مع العلم أنه سيتم الاحتفاظ بأية معلومات تم جمعها من هذه الدراسة بسرية تامة لأغراض أكاديمية بحته.
مرفق لديكم الاستبانة ولكم جزيل الشكر اذا تفضلتم بتعبئته و شكرا لكم مقدما على مشاركتكم و وقتكم الثمين والمساهمة في انجاح هذا العمل البحثي.

تفضلوا بقبول فائق الاحترام،

الباحث : م. سلام الزبدة

الاستدامة والحفاظ على المياه ومايتعلق بها من طاقة في المباني السكنية

الجزء الأول : المعلومات الشخصية

1.عمر رب البيت بالسنوات : ☐ أقل من 20 ☐20- أقل من 30 ☐30- أقل من 50 ☐ 40- أقل من 50 ☐ 50 فأكثر

2.جنس رب البيت : ☐ ذكر ☐ انثى

3.الحالة الاجتماعية لرب البيت : ☐ متزوج ☐ أعزب ☐ أرمل ☐ مطلق

4.المؤهل التعليمي لرب البيت : ☐ دبلوم ☐ بكالوريوس ☐ دراسات عليا ☐ أخرى ....

5.الدخل الشهري للعائلة (شيكل) : 1000 ☐ > ☐ 1000- أقل من 1500 ☐ 1500- أقل من 2000 ☐ 2000 فأكثر

6.عدد سكان في البيت: ☐ 1-2 ☐ 3-4 ☐ 5-6 ☐ 7 فأكثر

7.مساحة البيت تقريبا: .... $م^2$

8. معدل الإستهلاك الشهري للمياه: .... $م^3$/الشهر

9. معدل الإستهلاك الشهري للكهرباء ....كيلووات/شهر

الجزء الثالث: توجهات وسلوك سكان المنازل في مشروع الإسكان تجاه الحفاظ على المياه والطاقة المصاحبة لها وديموتهما.

لأي درجة تتفق مع العبارات التالية؟ اختار الرقم الذى يعكس درجة موافقتك على العبارات المذكورة أدناه والتي توضح التوجه والسلوك الشخصي تجاه إستهلاك المياه والطاقة المصاحبة لها في المنازل والحفاظ عليها.

.1. لا أوافق بشدة .2 لا أوافق .3 معتدل .4 أوافق .5 أوافق بشدة

التسلسل	التوجه والسلوك الشخصي	درجة الموافقة 1. لا أوافق بشدة	2. لا أوافق	3. معتدل	4. أوافق	5. أوافق بشدة
أ.	**التوجه الشخصي تجاه المياه والطاقة المصاحبة لها في المنازل.**					
.1	لدي شعور تام بالمعاناة الناتجه تجاه مشكلة نقص المياه والطاقة في قطاع	☐	☐	☐	☐	☐
.2	أعتقد أنني أمثل جزء من مشكلة نقص المياه والطاقة في قطاع غزة.	☐	☐	☐	☐	☐
.3	أنا مقتنع بمفهوم الحفاظ على المياه والطاقة في قطاع غزة.	☐	☐	☐	☐	☐
.4	أعتقد بأن هناك حاجة ماسة تستدعي الانتباه للحفاظ على المياه والطاقة في قطاع غزة.	☐	☐	☐	☐	☐
.5	أعتقد أن تغيير القناعات والمفاهيم له أثر واضح على الحفاظ على المياه	☐	☐	☐	☐	☐
.6	أعتقد أن بامكاني لعب دورايجابي للحفاظ على المياه والطاقة في القطاع.	☐	☐	☐	☐	☐
.7	أشعر بأن جيراني غير حريصين على إستخدام المياه والطاقة بشكل مقنن.	☐	☐	☐	☐	☐
.8	أنا مقتنع بأهمية الصيانة الدورية لأجهزة المياه والطاقة المنزلية (كالخزانات العلوية و مضخة المياه المنزلية)خاصة في حال ظهور مشكلة كالتسريب	☐	☐	☐	☐	☐
.9	أعتقد أنه من الممكن الإستغناء عن مضخة مياه منزلية (ماتور مياه) في	☐	☐	☐	☐	☐
.10	من الممكن أن أبذل جهد إضافي للحفاظ على المياه والطاقة في القطاع.	☐	☐	☐	☐	☐
.11	أعتقد أن إغلاق مضخة المياه المنزلية (ماتور مياه) عند إمتلاء الخزان العلوي قد يساهم في دعم الحفاظ على المياه والطاقة في المنازل.	☐	☐	☐	☐	☐
.12	أعتقد أن أي تسريب في مواسير المياه والخزان العلوي أثناء تشغيل مضخة المياه المنزلية (ماتور مياه) سبب رئيسي في زيادة الإستهلاك .	☐	☐	☐	☐	☐
.13	أعتقد أنه من المهم والمجدي أن تقوم الجهات المسئولة عن المياه والطاقة بسن قوانين صارمة لدعم الحفاظ على المياه والطاقة في المنازل.	☐	☐	☐	☐	☐
.14	أعتقد أن عمليات الشطف و الغسيل والتنظيف خلال تشغيل مضخة المياه المنزلية (ماتور مياه) سبب حقيقي في زيادة الإستهلاك.	☐	☐	☐	☐	☐
الطاقة تعني الكهرباء						

التسلسل	التوجه والسلوك الشخصي	درجة الموافقة				
		1. لاأوافق بشدة	2.لا أوافق	3.معتدل	4. أوافق	5. أوافق بشدة
ب.	**السلوك الشخصي تجاه المياه والطاقة المصاحبة لها في المنازل.**					
.1	سأقوم مباشرة ودون تردد بأي عمل تجاه الحفاظ على المياه والطاقة عندما أشعر بأن هذا الفعل له أثر إيجابي.	☐	☐	☐	☐	☐
.2	أستخدم مضخة مياه منزلية (ماتور مياه) في البيت لأني أشعر بنقص المياه .	☐	☐	☐	☐	☐
.3	أحافظ على المياه والطاقة أينما كنت (في كل مكان أتواجد فيه) وفي كل وقت.	☐	☐	☐	☐	☐
.4	من الممكن أن أستغني عن مضخة المياه المنزلية (ماتور مياه) في حال إقتناعي أن تصميم شبكة المياه العامة يفي بحاجتي دون إستخدامها .	☐	☐	☐	☐	☐
.5	أدعم و أساهم في إقناع الجميع للحفاظ على المياه والطاقة في كل مكان وكل	☐	☐	☐	☐	☐
.6	أستغني عن استخدام مضخة مياه منزلية (ماتور مياه) في حال استغنى عنها جيراني في الحي.	☐	☐	☐	☐	☐
.7	أستخدم مضخة مياه منزلية (ماتور مياه) لأن جيراني في الحي يستخدمونها في منازلهم.	☐	☐	☐	☐	☐
.8	من الممكن أن أستغني عن مضخة المياه المنزلية (ماتور مياه) في حال إقتناعي أن شبكة المياه العامة تعمل بكفائة تفي بحاجتي دون إستخدامها .	☐	☐	☐	☐	☐
.9	أقوم مباشرة بصيانة أجهزة المياه والطاقة المنزلية (كالخزانات العلوية و مضخة المياه المنزلية)خاصة في حال ظهور أي مشكلة كالتسريب.	☐	☐	☐	☐	☐
.10	أقوم بالصيانة الدورية لأجهزة المياه والطاقة المنزلية (كالخزانات العلوية و مضخة المياه المنزلية ومواسير المياه).	☐	☐	☐	☐	☐
.11	يتم إطفاء مضخة المياه المنزلية (ماتور مياه) في حال امتلاء الخزان العلوي مباشرة.	☐	☐	☐	☐	☐
.12	أتأكد بشكل دائم أنه ليس لدي أي تسريب في مواسير المياه والخزان العلوي أثناء تشغيل مضخة المياه المنزلية (ماتور مياه) .	☐	☐	☐	☐	☐
.13	ألتزم بالقوانين الملزمة الصادرة عن الجهات المسئولة عن المياه والطاقة والخاصة بالحفاظ على المياه والطاقة.	☐	☐	☐	☐	☐
.14	أستغل فترة تشغيل مضخة المياه المنزلية (ماتور مياه) للقيام بأعمال الشطف و التنظيف في المنزل.	☐	☐	☐	☐	☐
الطاقة تعني الكهرباء						

شكرا لتعاونكم ووقتكم الثمين