College of Engineering

Department of Architectural Engineering

HOUSING OCCUPANTS' MOTIVATIONAL DRIVERS FOR ENERGY-SAVINGS IN THE UNITED ARAB EMIRATES: AN EXPLORATORY STUDY

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This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Science in Architectural Engineering

Under the Supervision of Professor Kheira Anissa Tabet Aoul

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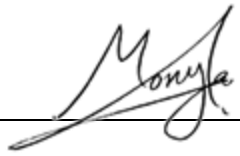
Declaration of Original Work

I, Monaya Muhammed Syam, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled "*Housing Occupants' Motivational Drivers for Energy-Savings in the United Arab Emirates: An Exploratory Study*", hereby, solemnly declare that this thesis is my own original research work that has been done and prepared by me under the supervision of Professor Kheira Anissa Tabet Aoul, in the College of Engineering at UAEU. This work has not previously been presented or published, or formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

Student's Signature:  Date: _____8/2/2021_____

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Abstract

The fast urbanization in the United Arab Emirates (UAE) accounts for 70% of energy consumption with the residential sector leading the way, urgently calling for mitigating strategies. Energy efficient housing under hot climate has been extensively researched in terms of design, building materials and systems. However, an energy performance gap subsides, a direct result of occupants' behavior, catalyzing focused research. Moreover, understanding the housing occupants' behavior, motivation and impetus to save energy proved to significantly increase energy savings. Exploring this topic in the UAE is vital given its distinctive specifics; fast-growing economy, harsh hot climate, and heterogeneous population. The latter presents major differences between local and expatriate residents, including energy tariffs, subsidies, home ownership, and cultural traits. Hence, this study aims to explore housing occupants' motivational drivers to save energy and compare the motivational drivers among local and expatriate groups.

This exploratory qualitative study used semi-structured interviews developed from informal conversational interviews and tested through a pilot study. 32 housing occupants (14 locals and 18 expatriates) living in Al Ain, UAE, were interviewed. The thematic analysis revealed that motivation is bound by two antagonistic elements: motivational drivers and obstacles. The literature compliant findings reveal that housing occupants' motivation to save energy is influenced by a combination of local policies, cognitive, emotional, contextual social and cultural factors. Home ownership, incentives, and energy costs were found to be the main motivational drivers for local occupants, whereas social influence, ambient culture and house size acted as obstacles. On the other hand, the increased energy cost, fines and the comparatively lower income levels of the expatriate occupants were found to entice energy-saving, while the lack of home ownership and the inexistence of individual space control discouraged energy saving-prone house renters. In addition to religious teachings and moral values, social media influencers emerged as prospectively having a significant effect.

The study offers insights to guide the development of effective energy-saving policies, strategies and awareness campaigns focused on residential occupants'

motivation, with a special attention to the subtleties, as revealed by this study, between the two groups composing the UAE's population.

Keywords: Housing Occupants, Motivational Drivers, Energy-saving, Obstacles, Behavior, Locals, Expatriates, Exploratory Qualitative Study, Semi-Structured Interviews, United Arab Emirates.

Title and Abstract (in Arabic)

الدوافع التحفيزية لسكان المنازل لتوفير الطاقة في الإمارات العربية المتحدة: دراسة استكشافية

الملخص

يستحوذ التحضر السريع في دولة الإمارات العربية المتحدة على 70٪ من استهلاك الطاقة مع تصدر القطاع السكاني مما يدعو إلى وضع استراتيجيات لمواجهة هذا الارتفاع بشكل عاجل. تم إجراء أبحاث مكثفة على مشاريع المساكن الموفِّرة للطاقة في ظل المناخ الحار من حيث التصميم و مواد البناء و أنظمتها. و مع ذلك، فإن فجوة أداء الطاقة تنحسر كنتيجة مباشرة لسلوك السكان مما يحفز إجراء المزيد من الأبحاث. كما ثبت أن فهم سلوك ودوافع السكان و حثهم على توفير الطاقة يزيد بشكل كبير من وفورات الطاقة. تعتبر دراسة هذا الموضوع في دولة الإمارات العربية المتحدة أمرا حيويا بسبب خصائصه الفريدة بما في ذلك الاقتصاد سريع النمو، والمناخ الحار القاسي وتنوع سكانها. توجد اختلافات كبيرة بين السكان المواطنين والوافدين من بينها أسعار الطاقة، الإعانات، ملكية المنزل و السمات الثقافية. بالتالي، تهدف هذه الدراسة إلى استكشاف الدوافع التحفيزية للسكان لتوفير الطاقة و مقارنة الدوافع التحفيزية بين المجموعتين المواطنة و الوافدة.

استخدمت هذه الدراسة النوعية الاستكشافية مقابلات شبه منظمة تم تطويرها من مقابلات محادثة غير رسمية و اختبارها من خلال دراسة تجريبية. تم إجراء المقابلات مع 32 ساكناً (14 مواطناً و 18 وافداً) يعيشون في مدينة العين في الإمارات العربية المتحدة. كشف التحليل الموضوعي أن الدافع مرتبط بعنصرين متعارضين هما: الدوافع التحفيزية و العوائق. تكشف النتائج المتوافقة مع الأبحاث السابقة أن دافع السكان لتوفير الطاقة يتأثر بمجموعة من السياسات المحلية و العوامل المعرفية و العاطفية و الاجتماعية و الثقافية السياقية. وُجد أن ملكية المنزل و الحوافز و تكاليف الطاقة هي الدوافع الرئيسية للسكان المواطنين، في حين أن التأثير الاجتماعي و الثقافة المحيطة و حجم المنزل كانت من العوائق. من ناحية أخرى، وُجد أن زيادة تكلفة الطاقة و الغرامات و مستويات الدخل المنخفضة نسبياً للسكان الوافدين تدفعهم إلى توفير الطاقة، في حين أن الافتقار إلى ملكية المنزل و عدم وجود تحكم فردي في المساحة أدى إلى تثبيط توفير الطاقة

لدى مستأجري المنازل. بالإضافة إلى التعاليم الدينية و القيم الأخلاقية، ظهر المؤثرون على وسائل التواصل الاجتماعي ليكون لهم تأثير مستقبلي كبير.

تقدم الدراسة رؤى لتوجيه تطوير سياسات و استراتيجيات و حملات توعية فعالة لتوفير الطاقة تركز على دوافع ساكني المنازل، مع إيلاء اهتمام خاص للتفاصيل، كما وضحت هذه الدراسة، بين المجموعتين المكونتين لسكان دولة الإمارات العربية المتحدة.

مفاهيم البحث الرئيسية: سكان المنازل، دوافع تحفيزية، توفير الطاقة، العوائق، السلوك، المواطنين، الوافدين، دراسة نوعية استكشافية، مقابلات شبه منظمة، الإمارات العربية المتحدة.

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I would also like to thank my lovely parents who are my first support in life, my brothers and sister. I will be grateful for ever for your support. Finally, to all relatives and friends who, in one way or another, shared their support, thank you very much.

Dedication

To my beloved parents and family

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List of Abbreviations

AADC	Al Ain Distribution Company
ADDC	Abu Dhabi Distribution Company
AC	Air Conditioning
CO_2	Carbon Dioxide
DEWA	Dubai Electricity and Water Authority
ICI	Informal Conversational Interview
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
KWh	Kilowatt hour
SSI	Semi-Structured Interview
UAE	United Arab Emirates
UNECE	United Nations Economic Commission for Europe
WGBC	World Green Building Council

Chapter 1: Introduction

1.1 Overview

Energy-efficiency in the built environment in general, and in buildings in particular, has been a global concern over the last few decades, following the impacts of climate change due to the massive increase in CO_2 emissions, and the subsequent general environmental degradation coupled with decreasing natural resources (UNECE, 2016). The quest for energy conservation has been global and has steered intensive research on identifying the factors affecting building performance, on adopting optimal strategies to promote building energy efficiency and overcome the various environmental issues (IRENA, 2019a).

This quest called for an extensive review of design, construction and operation of buildings (Sadineni et al., 2011) and resulted first, in a return to the optimal passive design principles and strategies (Taleb, 2014). Second, it brought to light the critical need for an intensive development of new building materials and systems along with the accompanying automation and technology integration (UNECE, 2019). This research and development effort focused on the optimization of building resources performance which, in turn, would contribute to the global rise of the green building movement. Also, as a direct result of the findings, stringent building energy codes and standards, as well as green building rating systems were developed and instituted. Many countries have developed their own green building rating systems, to go beyond the building code requirements and improve the building performance specific to their particular context (WGBC, 2020). Nonetheless, they all agree on the same target which

is to minimize the consumption of the natural resources and control all types of waste (Doan et al., 2017).

Despite this remarkable momentum for the well-being of the planet and its inhabitants, often enough the predicted energy-savings fell short of reaching their target as wide discrepancies emerged between the expected and the actual building energy performance, a fact that has been referred to as the 'energy performance gap' (Delzendeh et al., 2017; Wilde & Jones, 2014), with the building occupants' behavior invoked as the main culprit (Delzendeh et al., 2017; Hong et al., 2017; Calì et al., 2016). As a direct consequence, research was extended to address building occupants and their behavior with the intention to understand, account for and ultimately reduce the energy performance gap.

Consequently, an entire body of research focused on a comprehensive understanding of the behavioral patterns and the extent to which behavior affects the consumption through integrating the human dimension in the building performance simulations (Gucyeter, 2018; Yan et al., 2017). Evidence on the potential high energy-savings as a result of occupants' behavioral changes was provided by several researchers, with the caution that it is a difficult target to achieve and maintain over a long term (Ben & Steemers, 2014; Abrahamse et al., 2005). Nonetheless, more recently and within the same research realm, the exploration of effective ways to potentially modify occupants' practices toward pro-environmental behavior has emerged as a much needed research focus (D'Oca et al., 2016; Cui et al., 2017; Xu et al., 2017). Researchers agreed on the evident benefits since studying the factors influencing occupants' motivation to save energy is vital to fully understand occupants' behavior, may guide behavioral changes and practices to enhance and

increase the overall energy-savings targets (Huebner et al., 2013). Motivation has been asserted to be an immediate predecessor of behavior and a key parameter for changing behavior (Gram-Hanssen, 2014; D'Oca et al., 2016). Findings from occupants' perspectives on behavioral stimulators of changes are believed to feed into the development of effective measures and practices for the purpose of reducing energy usage.

1.2 Problem Statement

Building occupants' practices, awareness and energy-related decisions are factors that have been found to affect energy usage in buildings (Santin, 2010; Hong & Lin, 2013). The way building occupants deal with energy in terms of spaces and building systems usage, as well as their selection of home products and appliances were found to have a high impact on the actual measured energy consumption (Al-Mumin et al., 2003; Fabi et al., 2017). In this scenario, the energy performance gap is mainly the result of an over-simplified consideration of occupants' behavior in building energy simulations using fixed unrealistic schedules (Fabi et al., 2013). This is done while the occupants' behavior is dynamic, which makes it difficult to define and quantify (Hong et al., 2017). The existing literature indicates that understanding the actual occupants' factor in buildings and what triggers them to save energy is critical for the attempt of achieving high savings (D'Oca et al., 2016). Occupants' behavior and motivation may be affected by a number of influential factors that have been addressed by several researchers. These factors include comfort and satisfaction (Larsen et al., 2010), occupants' characteristics (Mortensen et al., 2016), policies and regulations (Ameli & Brandt, 2015), level of awareness (Li et al., 2019), values and norms (Kollmuss & Agyeman, 2002) and socio-cultural factors (Nolan et al., 2008).

Along these considerations, the context or building occupants' living environment, has been identified as having a potentially high impact on occupants' behavior and energy-saving motivational drivers due to climate, policies, culture and society that characterize each context (Rabinovich et al., 2012; Ameli & Brandt, 2015).

The United Arab Emirates (UAE), the general context of this study, has high energy demands and is identified as one of the highest electricity consuming countries mainly because of its harsh hot climate, high level of urbanization, rapid economic and population growth (UAE State of Energy Report, 2019; Kazim, 2007). The UAE is also characterized by the large proportion of the expatriates. For instance, in the Emirate of Abu Dhabi, the specific context of this study, expatriates group constitutes around 81% of the emirate's population (Figure 1) (Statistical Yearbook of Abu Dhabi, 2019). For the purpose of this study, expatriates refer to the temporary residents of various nationalities while locals are the Emirati citizens.

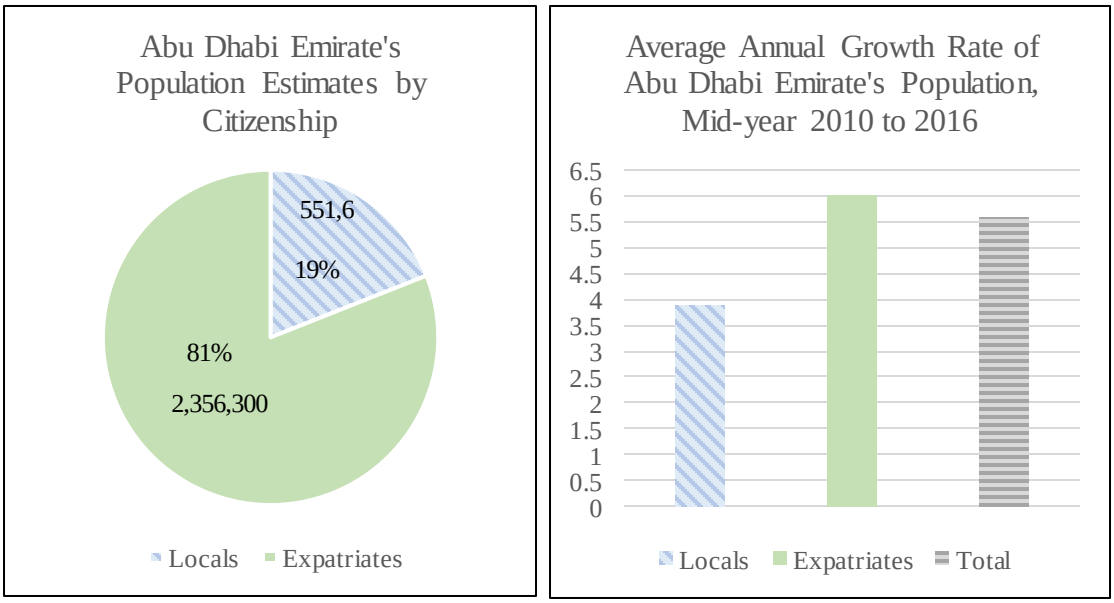


Figure 1: Abu Dhabi Emirate's Population Estimates in 2016 and Average Annual Growth Rate, Mid-year 2010-Mid-year 2016

They differ in several aspects, of which two may have a critical impact; home ownership and differential energy tariffs. Expatriates' residency in the UAE is tied to their employment contracts, investment in a business or owning a property with no possible permanent residency, which means the period of their stay in the country is neither specified nor guaranteed, while locals have permanent residency as Emirati citizens (The UAE's Government Portal, 2020b). Consequently, home ownership by expats is very limited. There are few differences in the ownership policy among the seven Emirates. However, all of them restrict to some extent, the expats' ownership of a property (The UAE's Government Portal, 2019). Another main difference between both groups which may also have a high impact resides in the differential energy tariffs. For Abu Dhabi Emirate's residents, the tariff applied on expatriates' utility bills is four times the tariff applied on locals' bills (ADDC, 2020). Also, the tariff applied in case if the usage exceeds the green band allowance differs among both groups as illustrated in the red band in Figure 2 (ADDC, 2020).

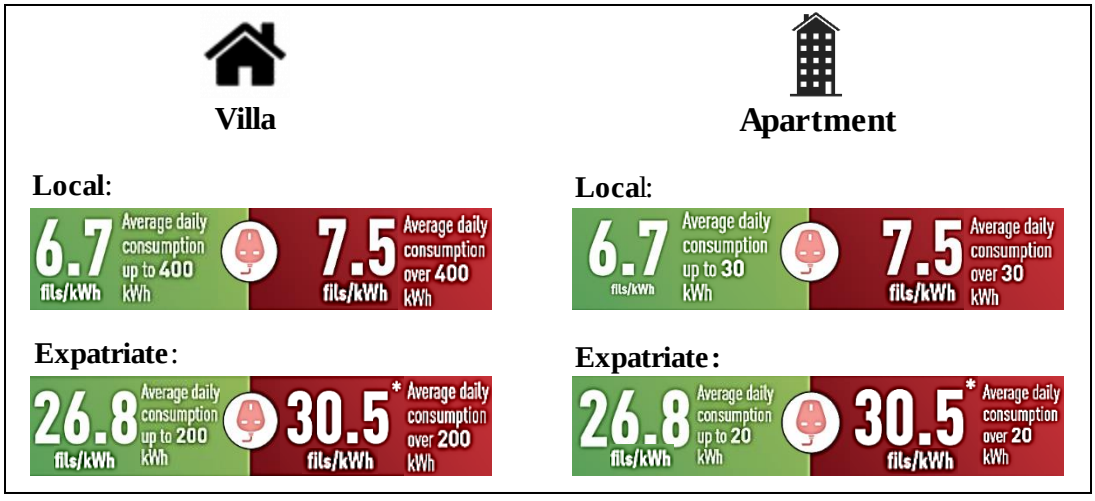


Figure 2: Tariff Applied on Electricity Bills for Locals and Expatriates in Different Dwelling Types

Additionally, a number of incentives are put in place to encourage occupants to save on utility bills and, in turn, save energy. Some of these incentives are strictly offered to locals, such as "Saving Energy and Water at Home Initiative", that were launched by the Abu Dhabi Department of Energy. As part of the initiative, the families of Emirati athletes compete for a prize by making their houses more energy and water efficient through abiding by energy conservation practices and sustainable behavior (Emirates News Agency, 2019). Another example is "Sustainable Energy at the Venues" that promotes installing solar photovoltaic panels (Emirates News Agency, 2019). The fact that 81% of the emirate's population is made of expatriates (Statistical Yearbook of Abu Dhabi, 2019) and is bound by the comparatively short-term stays in the country (The UAE's Government Portal, 2020b), limited home ownership (The UAE's Government Portal, 2019), and differential energy tariffs (ADDC, 2020) call for the full consideration of both groups in the target of energy efficiency as they both contribute in the total energy consumption in the country, but may differ in their motivation.

To curb down the high energy consumption rates, policymakers have taken serious actions such as developing a green building rating system. In 2010, as a key aspect of Abu Dhabi Vision 2030, Abu Dhabi Urban Planning Council launched Estidama, (the Arabic word for sustainability), a program that aims to enhance the development of sustainable and energy-efficient buildings (Awadh, 2017). In addition, in 2017, the UAE introduced the first unified energy strategy at the national level relying on supply and demand. The government-sponsored "Energy Strategy 2050" aims to increase the share of clean energy in the total energy use, reduce the carbon footprint as well as raise individuals' and corporates' consumption efficiency (The UAE's Government Portal, 2020a).

Despite the vision and great current interest, there is very limited work on building occupants' behavior towards energy usage and even less on their motivational drivers. Up-to-day, only one research-based study that explored energy conservation motivation of building occupants in the UAE is available. Still, this unique research was limited to a case study of a green university campus in Abu Dhabi where the sample was homogeneous, mostly students and between the ages of 22 to 27 years old (Azar & Ansari, 2017). However, this study has not been addressed in the dominant residential sector that makes up most of the city fabric.

1.3 Research Questions and Objectives

As discussed earlier, motivational drivers to save energy may be affected by a set of factors, of which home ownership, energy cost, incentives as well as other social and cultural factors may have an impact on the housing occupants' behavior and energy-saving motivation. This has not been studied in context. This research will attempt to fill such gap and will, therefore, be driven by a main research question:

"What are the energy-saving motivational drivers of housing occupants in the UAE's context?"

This main question can be further articulated into two specific sub-questions:

1. "What are the contextual-specific factors driving housing occupants' behavior and motivation for energy-saving in the UAE and how do they affect their practices and decisions?", and
2. "Are there any differences in the energy-saving motivational drivers between local and expatriate housing occupants in the UAE?"

These questions are assessed and addressed, through the following research objectives:

a. Validate the extracted factors from literature and investigate their applicability in the UAE's context,

b. Explore and identify the contextual-specific factors influencing housing occupants' behavior and motivation for energy-savings, if any,

c. Explore the differences in the energy-saving motivational drivers between local and expatriate housing occupants in the UAE, and

d. Identify the relationships to the possible measures and actions that would enhance energy efficiency in the residential sector in the UAE.

1.4 Structure of the Thesis

The thesis is organized into six Chapters. An overview of the research topic and an explanation of the study context as well as the research objectives are presented in Chapter 1. Chapter 2 presents a review of an extensive body of literature that looked into the factors with potential influence on occupants' behavior and motivation for energy-saving. Are also presented in the same Chapter the specifics of the context in order to first, build up the research gap and second, respond to the need to study this topic in the residential sector in the UAE's context. The exploratory nature of this study and its objective call for a phenomenological qualitative approach method are early developed in Chapter 3. Following, the selection of a semi-structured interview as a research method to collect in-depth data related to housing occupants' behavior, knowledge and opinions is demonstrated. In the same Chapter 3, the development of the semi-structured interviews through informal conversational type of interviews, the

pilot study as well as the data collection procedure of the main study with a sample of local and expatriate housing occupants are presented, along the results analysis using the thematic analysis approach. These results are interpreted and discussed in Chapter 4 to align the findings with the study objectives and the theoretical framework. Chapter 5 presents the final conclusions and study limitations along with suggestions for further research and investigation.

Chapter 2: Literature Review

2.1 Introduction

The extremely high and rapid energy consumption growth worldwide in general, and in the United Arab Emirates (UAE) in particular, calls for the urgent need to investigate the underlying factors and explore strategies to control the growing trend. In the UAE, the study context, the built environment accounts for the highest share of the total energy consumption. Numerous governmental strategies have been established to address this critical issue. While several factors are well recognized to affect energy usage in buildings, the building occupants' impact has still been comparatively less studied. Nevertheless, a building energy performance gap between the actual and intended energy consumption as a result of occupants' behavior is acknowledged by the authorities and scientists alike.

Studies found a number of direct and indirect influential factors driving building occupants' behavior and energy-saving motivation. The exploration and understanding of these factors may well guide the development of efficient strategies that would also affect building occupants' motivation to save energy. In this Chapter, potential factors impacting energy usage in buildings and the effect of occupants' behavior and practices will be presented in order to highlight the research gap. Also, previous studies on drivers motivating housing occupants to save energy will be reviewed to serve as a benchmark for research design. Lastly, the research gap and the need to study this topic in the context of the UAE will be presented.

2.2 Worldwide Energy Consumption

The International Energy Agency (IEA) in its latest report, with 2018 data but published in 2019, presented revealing figures on energy consumption trends. Statistics show that primary energy consumption is growing at a higher rate than population (IEA, 2019). In 2018, global energy consumption increased by almost twice the average rate of growth since 2010. More than half of the energy demand was for electricity that has risen dramatically. In 2018 and as a result of the high energy consumption, global energy-related CO_2 emissions grew 70% higher than the average increase since 2010 and hit a new record (IEA, 2019).

The U.S. Energy Information Administration (EIA), in its International Energy Outlook, also forecasts growing trends in world energy consumption. For instance, the global consumption is expected to rise by 15.3% between 2015 and 2030, reaching 28% in 2040 (International Energy Outlook, 2017). These facts and forecasts provide clear evidence of the critical need to explore and pursue further efficient strategies to reduce the global energy consumption. While the energy consumption is rapidly increasing worldwide, this issue is even more acute in the developing countries. Similar to many fast-growing nations, the UAE's context indicates an even more stringent need to address this issue.

2.3 Energy Consumption Status in the Study Context of the UAE

Similar to the global energy consumption trend, the UAE exhibits records of high energy consumption and growing demand. The energy consumption rates in the UAE has slowed down compared to the jumps in 2014 and 2015, but the energy demand has increased and continues to increase placing the country among the highest

electricity consumers per capita in the world (UAE State of Energy Report, 2019). The International Renewable Energy Agency's (IRENA) recent report (2019) that focuses on the Gulf region, shows that, in 2016 alone, the UAE accounted for the second highest share of the total energy consumption (23%) in the region among the Gulf Cooperation Council countries (Figure 3). Saudi Arabia accounts for half the total energy consumption in the gulf region, but with almost twenty-five times the size of the UAE and almost four times the population of the UAE (Population Reference Bureau, 2016). So, comparatively the share of the UAE at 23% is substantial (Figure 3). Furthermore, the report presents an expanded energy demand on a per-capita basis in the UAE. It has been at a level higher than many industrialized countries such as China, Japan, India and the United States (IRENA, 2019b). These reports corroborate the decades-long high and unsustainable consumption and serve as the basis for energy-saving effort at a national level.

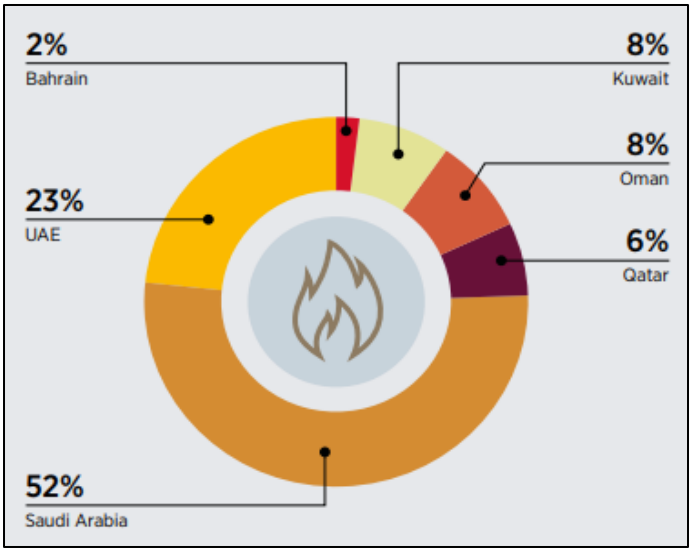


Figure 3: Total Energy Consumption in the Gulf Region by Country in 2016

2.3.1 Causes of UAE's Primary Energy Usage

There are three main parameters contributing to the UAE's high energy usage: population growth, economic growth and high urbanization (Kazim, 2007). UAE's population more than doubled in a single decade, from 4,106,427 in 2005 to approximately 9,400.000 in 2015 (Elessawy, 2017). According to the World Bank Statistics (2019), UAE's population in 2019 was 9,680,000 and it is expected to reach 10,600,000 in 2029. The main reasons for this rapid growth are economic migration, governmental measures of family aid, an advanced health care system and the naturalization wave that followed the establishment of the UAE in the seventies (Issa & Shuwaihi, 2011). The next influencial factor is the economic growth. According to the recent Annual Economic Report (2019) by the UAE's Ministry of Economy, the Gross Domestic Product (GDP), a measure to determine the economic status, of the UAE jumped from about 510.9 billion dirhams (139.1 billion US dollars) in 2006 to 1.521 trillion dirhams (414.1 trillion US dollars) in 2018. The combined population and economic growth resulted in an extremely fast urbanization, which have exponentially developed the residential sector in the country, resulting in a significantly high energy demand (Kazim, 2007). This is further exacerbated by the fact that until 2010, urban growth was not controlled by any comperehensive and strict building energy efficiency codes (Alobaidi et al., 2015). The city of Dubai is an appropriate model of the rapid urban growth in the UAE, as it had an annual urban growth rate of more than 10% between 1985 and 2015. This makes the city one of the fastest growing cities in the world. Figure 4 illustrates the urban growth in Dubai city from 1975 to 2015 (Elessawy, 2017).

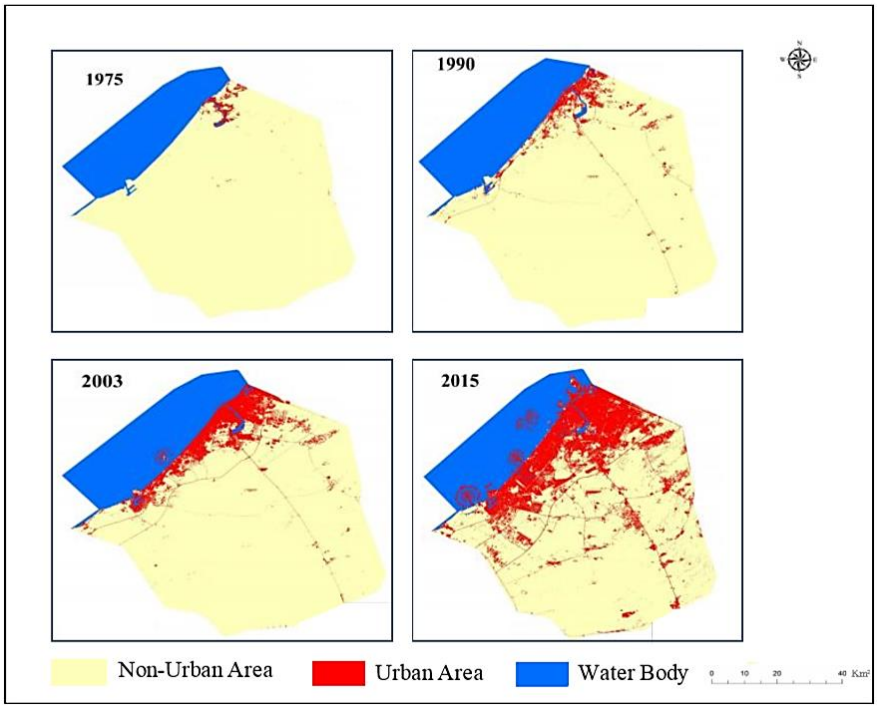


Figure 4: Urban Growth in Dubai City from 1975 to 2015

Smaller cities, such as Al Ain, the focal point of this study, witnessed similar growth patterns, where urban areas increased by almost 1,600% from 1972 to 2000 (Figure 5) (Issa & Shuwaihi, 2011).

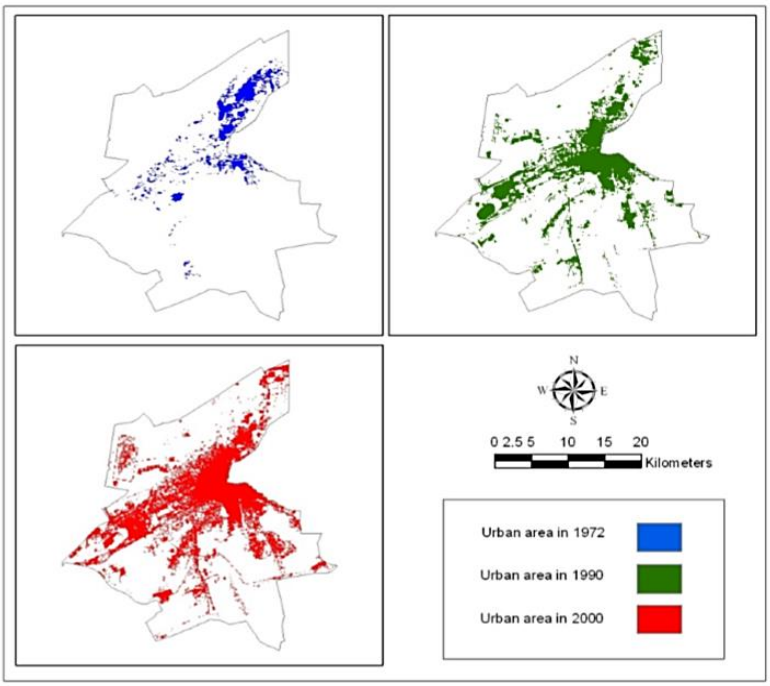


Figure 5: Urban Growth in Al Ain from 1972 to 2000

2.3.2 The Share of the Residential Sector in the Total Energy Consumption

In the characteristics growth scenario of the UAE, the residential sector leads in number of housing units and energy use. The residential sector is the second highest energy consuming sector with a share of 26.8% (Energy and Water Statistics, 2018). From 2006 to 2016, the percentage of annual electricity consumption growth in the residential sector in the UAE was at an average rate of 7%. This percentage was the third highest among the GCC after Qatar and Oman, outpacing developed countries and most regions anywhere in the world (Figure 6) (IRENA, 2019b).

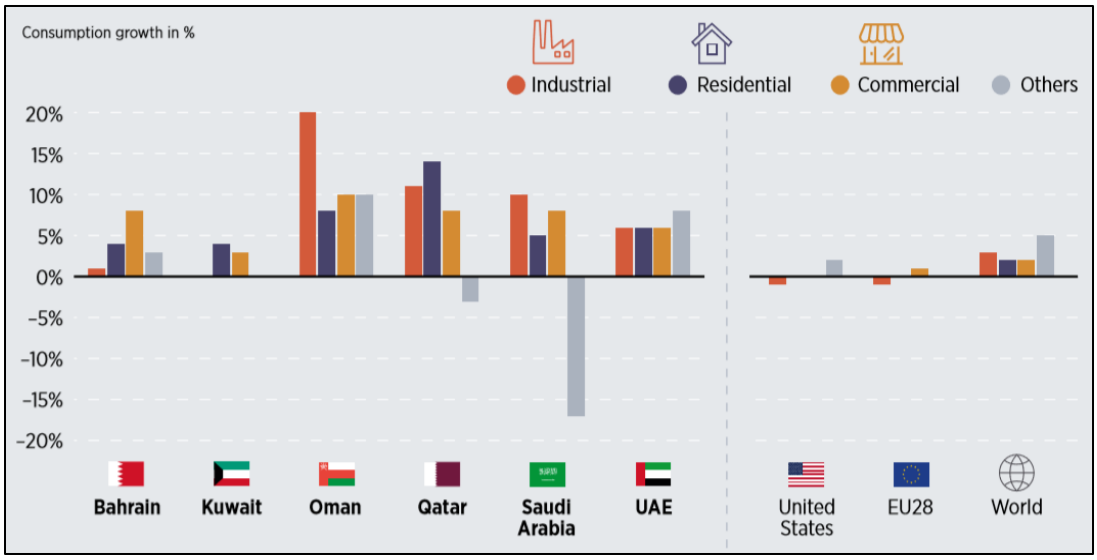


Figure 6: Annual Electricity Consumption Growth by Sector in the GCC and Selected Countries

The International Renewable Energy Agency's reports further stress that the energy demand is expected to increase (Masdar Institute/IRENA, 2015), and therefore, the urgent need to reduce the total energy consumption in the country, particularly in the residential sector. One positive result is that improving the energy efficiency in the residential sector is now a key priority in the national government program of energy conservation strategies and goals.

2.3.3 Governmental Strategies and Policies to Reduce Energy Use

The UAE is a federal system of seven emirates, of which Abu Dhabi is the capital and largest emirate (Figure 7). It consists of three main regions, Abu Dhabi, the Eastern and Western regions with respectively the cities of Al Ain and Al Dhafrah as their siege (The UAE's Government Portal, 2020c). The emirate of Abu Dhabi has the highest percentage of locals among the seven emirates with around 19% of Abu Dhabi's total population (Statistical Yearbook of Abu Dhabi, 2019).

Figure 7: UAE Map Showing the Seven Emirates Including the Emirate of Abu Dhabi

Similar to the energy consumption status at the natioanl level, according to the UAE State of Energy Report (2019), the electricity peak demand is expected to increase by 80% from 14.2 Gigawatts (GW) to 26 GW by 2030 (Figure 8).

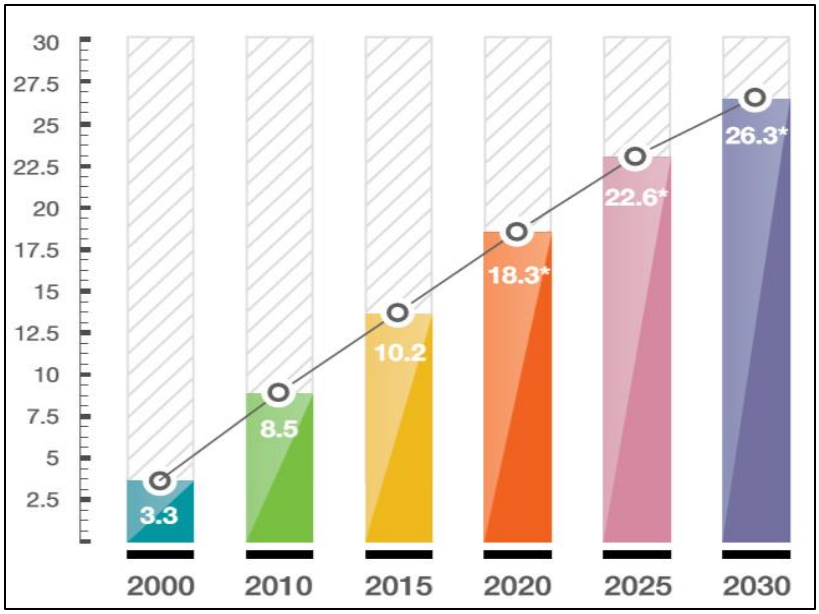


Figure 8: Forecast Growth in Electricity Peak Demand by 2030

In light of the unenviable situation of high energy current use and predicted demand, the UAE government developed numerous strategies and policies aiming to reduce the amount of energy consumed in all sectors; residential, commercial and industrial. Although each emirate has its own energy efficiency measures and strategies, they all aim to save the resources, minimize the negative enviroenmntal impacts and improve quality of life for people (Abu-Hijleh & Jaheen, 2019). There are different types of strategies and measures of different nature: codes and standards, increased energy cost and awareness initiatives.

In terms of improving building energy efficiency and retrofitting, programs setting minimum acceptable standards have been established. One of the important regulations is Dubai's Decree 66, issued in 2001, as the first regulation mandating the thermal insulation in the UAE. It aimed to improve the energy efficiency in buildings mainly by requiring the use of thermal insulation as well as setting minimum standards for the glazing (Abu-Hijleh & Jaheen, 2019). Sharjah Municipality, at the same time started enforcing similar requirements (Abu-Hijleh et al., 2016). In 2008 and as a key

aspect of Abu Dhabi Vision 2030, Abu Dhabi Urban Planning Council developed Estidama program which became mandatory in 2010 for all new buildings in the Emirate. This program is a building point-based code that aims to promote the development of sustainable, energy-efficient buildings in the Abu Dhabi Emirate (Alobaidi et al., 2015; Awadh, 2017).

In terms of the energy cost, starting from January 2017, the government increased the energy rate for all residents living in Abu Dhabi, albeit with a different share for locals and expatriates (Dajani, 2016). Prior to 2017, the electricity rate was insignificant for locals (5 fils/KWh) and of relatively economical for expats (21 fils/KWh) (ADDC, 2016). The governemnt subsidies were quite high, reaching almost 85% for locals (Hasan et al., 2019). The low prices of domestic energy compared with the levels of income in the country, played a significant role in prompting higher usage and rapidly increasing the overall country's energy consumption rate (Krane, 2015). After the increase in the energy price in 2017, local residents paid 1/4 the energy price for expats. The energy price has increased by 27.6% for expats (from 21 fils/KWh to 26.8 fils/KWh), and 34% for locals (from 5 fils/KWh to 6.7 fils/KWh) as indicated in Figure 9 (ADDC, 2016; ADDC, 2020). This initiative aims to attemp boosting sustainability and saving energy as well as encouraging occupants to use energy ideally (Dajani, 2016).

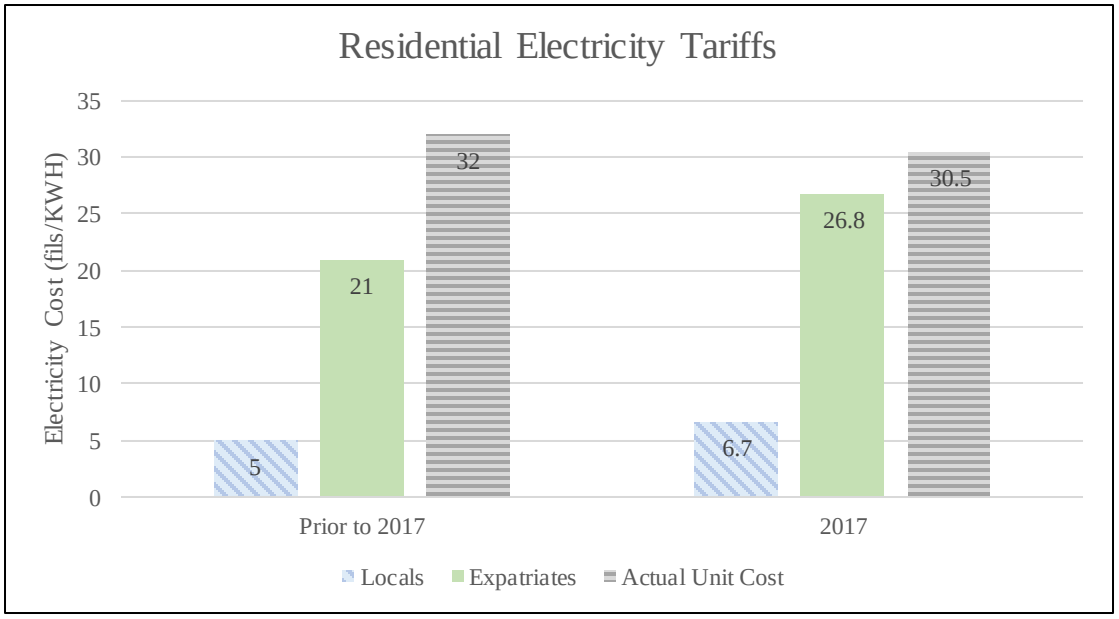
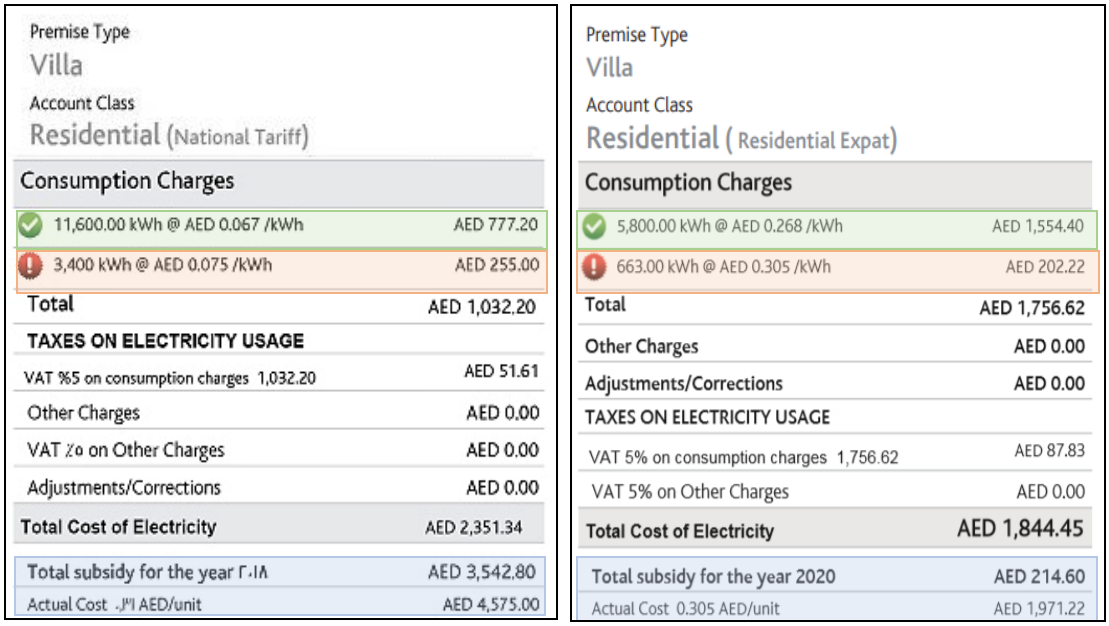


Figure 9: Electricity Tariffs for Local and Expatriate Residents Prior to and After 2017

Part of the mandatory increase in the energy price is on the consumption tarriff and other is added on the energy bill if the daily usage exceeds a governmemnt-specified limit (green band allowance). If exceeded, the energy rate will increase. Figure 10 compares two extracts from the electricity bills for a local and an expat residents. Although the extract that represents the expat's consumption was taken from the actual bill for September 2020 whereas the local's bill was taken from the ADDC website that represents a sample of a typical electricity bill for a local resident, but both bills present the consumption after the increase in the energy cost. The two extracts illustrate the difference in the green and red rates apllied for both groups. The tariff within the red band differs among locals and expats (7.5 fils/KWH and 30.5 fils/KWH, respectively). In case if expats who are referred to as "residential expats" in the utility bills exceed the green allowance, they pay 93.6% of the actual cost of electricity whereas locals pay only 23.7% of the actual cost in case of exceeding the recommnded level, showing the high subsidies for locals (ADDC, 2020).



Premise Type	Villa
Account Class	Residential (National Tariff)
Consumption Charges	
11,600.00 kWh @ AED 0.067 /kWh	AED 777.20
3,400 kWh @ AED 0.075 /kWh	AED 255.00
Total	AED 1,032.20
TAXES ON ELECTRICITY USAGE	
VAT %5 on consumption charges 1,032.20	AED 51.61
Other Charges	AED 0.00
VAT ٪٥ on Other Charges	AED 0.00
Adjustments/Corrections	AED 0.00
Total Cost of Electricity	AED 2,351.34
Total subsidy for the year ٢٠١٨	AED 3,542.80
Actual Cost .٫٣١ AED/unit	AED 4,575.00

Premise Type	Villa
Account Class	Residential (Residential Expat)
Consumption Charges	
5,800.00 kWh @ AED 0.268 /kWh	AED 1,554.40
663.00 kWh @ AED 0.305 /kWh	AED 202.22
Total	AED 1,756.62
Other Charges	AED 0.00
Adjustments/Corrections	AED 0.00
TAXES ON ELECTRICITY USAGE	
VAT 5% on consumption charges 1,756.62	AED 87.83
VAT 5% on Other Charges	AED 0.00
Total Cost of Electricity	AED 1,844.45
Total subsidy for the year 2020	AED 214.60
Actual Cost 0.305 AED/unit	AED 1,971.22

Figure 10: Extracts of a Monthly Electricity Bill for a Local and Expat Resident

There are two types of differenecs between the two groups; the applied tariffs as well as on the threshold of energy billed at a higher cost. The tariff increases beyond a threshold that is set differently for each group. For instance, residents living in villas, the green band as shown in Figure 11, indicates a threshold of 400KWH for locals while expats are limited to 200KWH, beyond which the tariff increases. Similarly, appartment residents, are respectively billed a higher unit cost beyond 30 KWH for locals, whereas expats threshold is limited to 20 KWH (Figure 11).

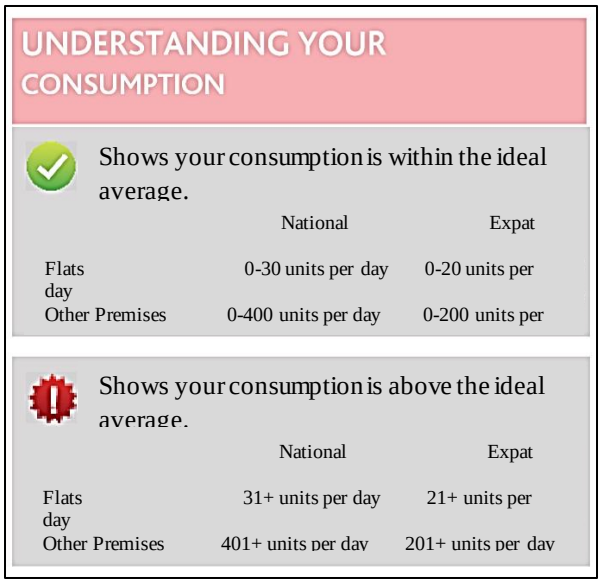


Figure 11: Extract of a Monthly Bill Showing the Difference in the Usage among Locals and Expats in Different Dwelling Types

Moreover, other local strategies for increasing potential energy-saving have been implemented with the aim to raise occupants' awareness. One of the most important local initiatives that yielded successful outcomes is the Powerwise trials that was initiated in Abu Dhabi in 2012. This pilot project aimed at assessing electricity consumers' behavior in respect to the information and electricity pricing. Through these trails, electricity was priced differently in the peak and off-peak hours of usage and participants received information about their historical and current usage in comparison with the performance chart of other particicpants. Also, they were provided with information on ways to reduce the consumption. The trails' results revealed that there was a significant reduction in the peak demand that reached up to almost 17% while 16.5% is due to the educational materials that raised participants' awareness (Alaileh et al., 2013). Another local strategy is the "Free Energy Audit Program" (Cerna, 2018). This program aims to raise the awareness among owners and boost the efficiency of buildings. Dubai Electricity and Water Authority (DEWA) has a team of specialists that makes field visits to buildings and carries out free energy

audits. Through these visits, the team audits the building efficiency and provides owners with information encouraging enough to entice them to make changes and install appropriate technologies to raise the efficiency, minimize the consumption and save at least 20% on utility bills (Cerna, 2018). Another example of a local initiative is "My Sustainable Living Program" that is offered for housing occupants in Dubai. It aims to enhance residents' electricity and water consumption through raising their awareness by installing a dashboard in their houses that allows them to monitor their consumption while comparing it with efficient similar homes (DEWA, 2020). Other incentives include "Saving Energy and Water at Home Initiative", that was launched by the Abu Dhabi Department of Energy. As part of the initiative, the families of Emirati athletes compete for a prize by making their houses more energy and water efficient through abiding by energy conservation practices and sustainable behavior (Emirates News Agency, 2019). Another example is "Sustainable Energy at the Venues" that promotes installing solar photovoltaic panels (Emirates News Agency, 2019). Another local initiative that is offered to encourage people save energy is providing them discounts on the bills when investing in efficient air conditioning (Sanderson, 2019). On another front, the "Young Future Energy Leaders", a program lunched by the Masdar Institute of Science and Technology (Aswad et al., 2013), aims to raise awareness among young professionals on sustainability through discussions and opportunities to develop solutions tackling climate change challenges (YFEL, 2013). Furthermore, the UAE started recently using social media platforms to provide people with guidance of energy-efficient practices. For instance, the Department of Energy in Abu Dhabi, through the department's account on Instagram, started sharing tips and examples of efficient practices (Department of Energy in Abu Dhabi, 2020). In September 2020, the department launched a competition "Save At Home" that calls

housing occupants to share their own experiences and tips in reducing the water and electricity consumption in their house. They offered a prize voucher of 1,500 AED (around 400 Dollars) to winners (Emirates News Agency, 2020).

These measures are well-embedded into UAE government vision and target of resources conservation. For instance, strategic goals to improve building energy efficiency and raise occupants' awareness have been established including Dubai Supreme Council of Energy's goals (DEWA, 2019), Abu Dhabi's Tarsheed Programme (Tarsheed, 2020) and the UAE Energy Strategy 2050 (The UAE's Government Portal, 2020a). Dubai Supreme Council of Energy has set the goal of reducing the energy and water demand in Dubai by 30 percent by 2030 through several ways including efficient cooling, new and existing buildings and smart homes (DEWA, 2019). In addition, in 2017 Abu Dhabi and Al Ain Distribution Companies (ADDC and AADC) launched "Tarsheed Programme". This strategic program provides a guidance to reduce by 20% the consumption per capita by 2030 through encouraging efficient use of energy by adopting conservation measures and educating the public on the high efficiency products and practices (Tarsheed, 2020). Furthermore, the UAE Energy Strategy 2050 was developed to increase the contribution of clean energy from 25% to 50% and reduce the carbon footprint by 70%, and as a result save 700 billion Dirham (190 billion US dollars) by 2050 (The UAE's Government Portal, 2020a). Of further direct relevance, is the UAE current focused goal, to raise housing occupants' awareness regarding efficient energy usage (Aswad et al., 2013; Karlsson et al., 2015).

Despite the now-established and implemented strategies discussed above, according to the IRENA reports and as presented in Section 2.3, the energy consumption in the UAE remains high with an expected increased demand in the

horizon (Masdar Institute/IRENA, 2015; IRENA, 2019b). Understanding the potential factors that influence energy consumption in buildings creates open venues for adequately addressing them. Hence, a critical review of the impacting factors is presented next.

2.4 Influential Factors Impacting Energy Usage in Residential Buildings

2.4.1 Controlled and Uncontrolled Influential Factors

Factors affecting energy cosumption in residential buildings have been extensively studied. A large part of the factors is controllable, whereas uncontrolled ones include climate (Baker & Standeven, 1994; Radhi, 2009), incorrect house location and orientation which restrain control (Abanda & Byers, 2016). Weather is found to be one of the main factors affecting energy consumption in buildings (Cena & Dear, 2001; Yousefi et al., 2017). As widely known, UAE's climate is characterized by extremely high temperatures, sometimes reaching 50˚C in summer.

On the other hand, building design, construction, mechanical systems quality are factors that can be controlled (Butterworths, 1983; Wei et al., 2014). The effect of design, materials and specifications have been addressed in an extensive body of literature and were found to have direct and indirect impacts on enegry consumption (Pacheco et al., 2012; Moga & Moga, 2015). Building materials are key determinants of the amount of energy needed to provide comfortable indoor environment for users (Pacheco et al., 2012). Improving the quality and efficiency of house components and systems can result in a significant reduction in energy consumption (Yun & Steemers, 2011). Different types of energy-efficient systems and sustainable materials as well as advanced smart technology that can play a significant role in energy-savings have been

addressed in a number of studies (Bhati et al., 2017; Anvari et al., 2015; Fabi et al., 2017). To enforce the implementation of these materials and systems, a large number of countries established their own efficiency codes and regulations (Iwaro & Mwasha, 2010; Bhati et al., 2017). These codes share the same target of saving natural resources and developing sustainable buildings as well as improving the energy efficiency of new and existing projects through energy efficient retrofitting. While these factors have been widely studied for different climates, including under extreme hot climate, a performance gap has been identified as the difference between the predicted energy at the design phase and the measured actual energy when the building is operational (Wilde & Jones, 2014). In this regard, the energy performance gap has been widely recognized as a result of occupants' behaviour and practices (Delzendeh et al., 2017; Calì et al., 2016; Wilde & Jones, 2014; Hong et al., 2017; Ahn et al., 2017).

2.4.2 Building Occupants' Behavior and Practices

It is important to reiterate that building occupants' behvaior is found to have an extremely high impact on energy consumption (Santin, 2010; Nguyen & Aiello, 2013; Hong & Lin, 2013). Energy simulation tools consider the physical elements of the buildings in addition to the climatic data, while the impact of occupants is either neglected or over-simplified by using fixed settings or schedules (Hong et al., 2017). This resulted in a wide performance gap that varied up to 300% in some scenarios (Delzendeh et al., 2017). The way the occupant lives in spaces and controls systems has a significant effect on the final energy consumption in the building (Fabi et al, 2017). Hong and Lin (2013), in their study of occupant behavior impact on energy use of offices, identified three categories of occupants behavior; the austerity type where users are proactive in saving energy, average type, and wasteful with no regard for

conservation. Hence, they recommended devising an effective way that would change occupant's behavior to the preferred austerity type.

The current usage pattern may undermine energy efficiency strategies related to the improvement of building design, materials and systems (Khosrowpour et al., 2018). Therefore, occupant's behavioral change is found to have energy-savings potential higher than that of technological solutions (Masoso & Grobler, 2010). Ben and Steemers (2014) revealed that the effect of positive behavioral change can reach a substantial 62-86% of the total potential savings in the energy used in the houses they tested. However, changing occupants' behavior is a difficult target to achieve (Stephenson et al., 2010; Abrahamse et al., 2005).

The emerging literature indicates that motivating occupants to save energy is a key solution to positively affect their behavior and increase the energy-savings (D'Oca et al., 2016; Cui et al., 2017; Xu et al., 2017; Li et al., 2019). Gaining knowledge about the motivators that would raise occupants' willingness to change behavior in terms of practices and interaction with building systems as well as their selection of products and appliances, will help provide indicators for policymakers to turn the knowledge into actions aiming at reducing the energy consumption (Huebner et al., 2013). Exploring the motivational drivers which entice occupants to save energy is of high relevance, and are explored next.

2.5 Occupants' Motivational Drivers to Save Energy

Exploring the drivers motivating housing occupants to save energy is a relatively recent interest in the broad energy conservation goal. Based on a comprehensive review of the emerging literature, the motivational drivers are factors found to be mainly related to comfort and satisfaction (Larsen et al., 2010), occupants'

characteristics (Mortensen et al., 2016), policies and regulations (Ameli & Brandt, 2015), occupants' awareness (Li et al., 2019), values and norms (Kollmuss & Agyeman, 2002) and socio-cultural factors (Nolan et al., 2008).

2.5.1 Comfort and Satisfaction

Building occupants use the spaces and interact with mechanical systems to achieve a comfortable indoor environment. Occupants' perception of comfort, satisfaction and expectations are one of the main factors directly affecting their behavior and willingness to change and save energy (Gupta & Chandiwala, 2010; Larsen et al., 2010). Occupants tend to stay within a level that they are comfortable and satisfied with. In case of discomfort, they take actions either through manipulating the systems, such as adjusting the Air Conditioning (AC) thermostat temperature or through behavioral actions such as adjusting clothing. Providing occupants with the choice to adjust the indoor environment and control systems and spaces is very important to ensure an adequate level of comfort the occupants (Hoes el al., 2009). Each person has a different comfort level due to physiological factors including gender and age (Parsons, 2002). Occupants' ability to control and interact with building systems directly affect their behavior and energy consumption (Santin, 2010). Therefore, if occupants are unable to control the systems according to their needs, the comfort conditions may be affected, resulting in an increase in the energy consumption and unwillingness to change behavior to save energy (Semprini et al., 2015).

2.5.2 Impact of Occupants' Characteristics on Behavior and Energy-Saving Motivation

Occupants' characteristics, including gender, age, income and presence of children in the house, may have influence their behavior and motivation (Indraganti et

al., 2015; Mortensen et al., 2016; Vringer, 2005; Kavousian et al., 2013). There are a number of studies that investigated a potential relation between occupants' age and behavior. For instance, occupants' age seems to correlate through the activities, perception of comfort and lifecycle stages (Cole & Neumayer, 2004; York, 2007; Hasanov et al., 2016). However, other conflicting results were obtained regarding the relation between age and energy-saving motivation. Some researchers argue that the older the occupant, the higher the energy-saving motivation. For example, Urban and Ščasný (2012) investigated residents' environmental concern and the effect on energy-saving and efficiency investments. They concluded that older people have higher concern about environmental issues, invest in efficiency and save more. Moula et al. (2013) drew a similar conclusion in their study of the level of social acceptability of renewable energy technologies in Finland and revealed that older people are more supportive for these technologies than younger ones. In contrast, the younger homeowners were found, in a study carried out by Mortensen et al. (2016) in Denmark, to be more interested in energy renovations. Furthermore, they added that the interest of occupants to save energy through performing renovations increases in a house with children, particularly in the ages between 9 and 13. In line with that, the presence of children was identified, in Fell and Chiu (2014) study, as a factor driving parents' motivation to reduce energy use as well as a direct factor impacting the consumption through their practices.

Gender was also found to have some level of indirect effect on behavior and energy-saving motivation. Although both genders, in several studies, reported similar concerns regarding environmental destruction (Fliegenschnee & Schelakovsky, 1998; Kavousian et al., 2013), few researchers claimed that women are more willing to change behavior and save energy than men (Grob, 1991; Lehmann, 1999). They linked

it to the fact that women are more emotionally engaged and tend to react more to environmental problems, and incidentally more prompt to change behavior. In total contrast, in their study with 314 households, Abrahamse and Steg (2009), found no significant relation between occupants' gender and energy consumption.

On another front, occupants' income was defined as having a differing, but significant impact on energy usage and savings. Conflicting results regarding the effect of occupants' income were obtained (Brounen et al., 2012; Urban & Ščasný, 2012; Trotta, 2018). Some researchers agree that the higher the income leads to more usage which affect their interest in energy-savings. For example, Vringer (2005) studied the significance of income based on 2,800 households in the Netherlands and found that a 1% increase in income results in a 0.63% increase in energy use. Similarly, Mortensen et al. (2016) concluded that residents with yearly low income have low interest in energy-savings compared with the ones having high income. Therefore, the high income which usually means a large house size may result high energy consumption, and in turn, high willingness to save, as explained by the previous studies. On the other hand, another group of researchers argue that the lower occupants' income, the higher the interest in energy-saving. For instance, Trotta (2018), through studying the factors influencing the energy-saving behavior and investments in British households, found that occupants that are living in a flat seem to be 21% more likely to save energy through daily practices than households in terraced and detached houses. This is because usually they have lower levels of income in addition to some other possible social reasons, but they are also less likely to invest in retrofit measures.

2.5.3 Policies and Regulations

There is a convergent body of literature that supports the intrinsic effect of energy cost on occupants' behavior and energy-saving motivation (Long, 1993; Park & Kim, 2012; Santin, 2010; Wei et al., 2014; Delzendeh et al., 2017; Tam & Le, 2018). The field study carried by Tanimoto and Hagishima (2005) on five family and three single dwellings in Japan identified that energy cost as one of the main factors affecting occupants' usage of appliances. They found that energy cost influences occupants' decision and action of turning on and off the air conditioner. Similarly, Huebner et al. (2013) reached similar findings when they studied the potential factors affecting occupants' energy-saving motivation in the UK using interviews, surveys and energy meter readings. They concluded that saving money was the greatest motivator for changing behavior. Beyond the foreseeable impact of energy cost, some researchers found that the energy cost is a crucial motivator mainly for occupants that pay the utility bills (Leth-Petersen & Togeby, 2001; Lindén et al., 2006; Wang et al., 2015). This is mainly because they are aware of their energy usage and expenditure on utility bills.

Azizi and Wilkinson (2015) argue that housing occupants tend to be prompted to reduce their energy usage when there is an increase in energy cost. Fiorillo and Sapio (2019) supported that argument by concluding that the lower energy cost leads to less energy-savings. Similarly, Long (1993) using an extended database of 6,346 households in western United States, estimated that each percentage point rise in the energy price, leads to a 0.21 percentage point increase in energy conservation investments. Besides the effect on investments, it also drives occupants' daily practices. Park and Kim (2012) reported that 58% of the 95 respondents to their questionnaire indicated the elevated energy cost as the main reason for avoiding the use of mechanical fans and accepting some level of discomfort.

In a more relevant context, Al-Mumin et al. (2003) observed through a survey of 30 university students that approximately represent the Kuwaiti society and simulation that residents tend to leave lights on when the room is not occupied. When matching the light schedules with their occupancy patterns and with AC thermostat set at 24˚C instead of 22˚C, they reported a significant reduction in the annual electricity consumption by 39%. Authors linked these results and behavior to the low electricity rates in Kuwait.

Locally, the UAE's government has followed the strategy of increasing energy price with the aim to guide people to a more efficient use of resources and to increase the energy-savings. In 2013, the energy demand increased, placing the UAE among the highest electricity consumers per capita in the world (UAE State of Energy Report, 2015). To boost the energy-saving in the country, in 2017, the energy price in the UAE was increased with a different share for locals and expatriates as previously mentioned in details in Section 2.3.3 (ADDC, 2016; ADDC, 2020).

Several energy-efficiency measures are available ranging from mandatory policies such as energy price to selective incentives. Many countries are offering different types of incentives with a target of encouraging occupants to save energy in their houses; including financial and non-financial incentives. Some of them aimed to positively alter occupants' practices while others encouraged the purchase or install energy-efficient products and appliances (National Action Plan for Energy Efficiency, 2010). Incentives that yielded successful energy-savings, such as discounts on purchasing efficient products and subsidized loans, have been covered throughout researches to provide insight into examples of effective policies and programs (Du Can et al., 2011; Bhati et al., 2017). In line with the objective, social marketing is an efficient alternative approach to marketing for sustainability and energy-efficient

usage (Peattie & Peattie, 2009). Marketing campaigns are vital for raising residents' awareness of the acute need to reduce consumption (Henryson et al., 2000; Stephenson et al., 2010). Kang et al. (2012) further supported that by comparing residents' behavior and knowledge of energy conservation before and after acquiring information from campaigns. The results revealed that residents' consciousness and behavior improved after being exposed to the campaigns.

Furthermore, home ownership was found to have a significant effect on the occupants' willingness to take the incentive and participate in the campaign, particularly the ones that call for home improvements (Leth-Petersen & Togeby, 2001; Liao & Chang, 2002; Sardianou, 2008; Andersen et al., 2009; Ameli & Brandt, 2015). Gillingham et al. (2012) revealed that houses occupied by owners are more likely to be insulated that the ones occupied by renters. Similarly, Davis (2010) found, using data from the residential energy consumption survey, that homeowners are more likely to own energy-efficient appliances than renters. This result was obtained while controlling some other factors including income, prices and demographics. Although home ownership may negatively affect occupants' behavior and decisions, Ameli and Brandt (2015) found, using a survey on household environmental behavior, that renters invest in energy-efficient appliances but with a short life cycle.

The effect of campaigns and incentives differ with the context due to intrinsic local specificities. The financial as well as the socio-cultural factors that may shape the social norms and occupants' values may impact their acceptance of the incentives and the effectiveness of the campaigns (National Action Plan for Energy Efficiency, 2010; Ameli & Brandt, 2015; Rockzsfforde, 2018). As part of the UAE's regulation, expats' ownership of a property is limited in the country. In the city of Abu Dhabi, there are different types of ownership for expats. Some impose a specific period of

ownership that varies from type to type, and in one type, the expat owners have the right to use the house that they own but with the inability to modify it. In addition, the expats are allowed to own a property in only nine designated investment areas in the city (The UAE's Government Portal, 2019). Besides the limited ownership, the expats' residency in the UAE is bound by employment, investment in a business or owning a property (The UAE's Government Portal, 2020b) which translates into the impossibilty to enjoy a permanent residency. These facts may impact housing occupants' acceptance of the incentives and willingness to modify behavior and save energy. The effect of the ownership policy on housing occupants' energy-saving motivation in the UAE is not covered in researches yet. This knowledge should help in guiding policymakers to develop targeted strategies to efficiently address all type of residents thus actively enagging all in the target to reduce energy consumption in the country.

2.5.4 Knowledge, Education and Awareness

The majority of the existing studies agree on the significant effect of occupants' level of awareness of the environmental issues on their willingness to save energy, but there is a debate on the extent of its impact. In the early 1970s, researchers started to develop models for analyzing the pro-environmental behavior of building users. The earliest and simplest US models explained the pro-environmental behavior by having the environmental knowledge which leads to pro-environmental actions. Based on these linear models, the more the environmental knowledge means higher environmental awareness and better behavior in terms of saving the environment (Burgess et al., 1998).

These models were criticized and dismissed by many researchers (Kempton et al., 1995; Kollmuss & Agyeman, 2002) on the grounds of the direct and certain assumption that environmental awareness leads to pro-environmental behavior. In Kempton et al. (1995) study, different groups in the United States, ranging from strong environmentalists to anti-environmentalists were surveyed. The shocking result showed that both groups have the same level of lack of knowledge. In support of that and in a more recent study, Mortensen et al. (2016) studied the key parameters determining homeowners' motivation for energy renovations in their houses in Denmark. Interestingly enough, they observed that craftsman has the highest level of interest in energy renovations compared with high school and further educated respondents. This indicates that occupants' level of education has limited influence, and does not directly affect occupants' willingness to save energy. Being educated is not enough to make significant change as compared to knowing how to act to lower energy consumption. Being aware of energy-saving practices is found to have a highly significant effect on occupants' energy-saving motivation (Steg, 2008; Steg et al., 2015; Li et al., 2019). Hines et al. (1987) conducted a meta-analysis review of 128 research studies that identified the most possible influential factors impacting occupants' behavior. They concluded that knowledge of energy-efficient practices and of issues is very critical, where occupants have to be aware of the impact of human practices on the environment, know the environmental problem to realize its actual effect and be aware of how to contribute in the attempt of solving it. These findings were further corroborated by a number of additional studies that looked into developing a framework of the potential barriers affecting pro-environmental behavior (Kollmuss & Agyeman, 2002) and the influence of environmental concern on households' motivation to purchase energy-efficient products in China (Li et al., 2019).

Similarly, Masoso and Grobler (2010) proved the effect of the lack of awareness and knowledge of efficient practices that usually lead to excessive energy consumption. They concluded that energy consumed (waste energy) during non-occupied hours (56%) is more than the occupied hours (44%) because of occupants' inefficient practices. In her study, Oktay (2012) supported these findings by concluding that what is needed for a sustainable lifestyle is knowledge of sustainable actions and alternatives for everyday practices. In unison, these studies indicated that environmental awareness is an influential factor, but it is not a prerequisite for energy-saving motivation and what is critical is the awareness of efficient practices.

Some researchers argue that there are two primary components effectively impacting human environmental awareness; cognition and emotions (Littledyke, 2008; Kollmuss & Agyeman, 2002). The cognition component is mainly related to the human perception of environmental problems. Few cognitive barriers limit the occupants' environmental awareness and energy-saving motivation, including slow environmental destruction where environmental change is very gradual (Preuss, 1991). In addition, most environmental problems are not tangible, such as the increase in the CO_2 emissions and the ozone hole (Preuss, 1991). Also, the environment is a complex system where it is difficult to understand the environmental problem and its causes (Preuss, 1991; Fliegenschnee & Schelakovsky, 1998).

The other primary component is the occupants' emotions. Littledyke (2008) stated that thoughts, emotions, and behavior are closely linked. In line with that, Kollmuss and Agyeman (2002), while developing their own pro-environmental behavior framework concluded that knowledge, together with values and emotions, are shaping the "pro-environmental consciousness" which may lead to energy-saving.

Also, Grob (1991), argued that the stronger a person's emotional reaction, the more likely that person will engage in pro-environmental behavior. As human emotions may have an impact, altruism and empathy were found to have a significant effect on occupants' motivation (Lehmann, 1999). For instance, people thinking and caring about others are more willing to sacrifice and reduce their consumption to help others. By contrast, the person with a robust sense of selfishness is less likely to be motivated to save energy (Lehmann, 1999). However, even if there is an emotional reaction toward the environmental problem, that does not mean the person will undoubtedly act pro-environmentally and have the interest to save energy (Chawla, 1999). Occupants' engagement in the problem rather than the quantity of information is critical in raising their awareness and modifying behavior (Fliegenschnee & Schelakovsky, 1998). Rajecki (1982) showed clearly in his study the difference between the effect of direct and indirect experience on behavioral change. He proved that experiencing the environmental problem as a "Direct experience" has a stronger influence than learning it in school; an "Indirect experience".

2.5.5 Values and Norms

Experiencing the environmental problem acts as an influencer on human values (Fietkau & Kessel, 1981). Evidence on the substantial effect of human values on occupants' behavior and individual sustainable choices is provided by several studies in which the impact was demonstrated to change due to different context-specific social and cultural conditions (Bamberg & Möser, 2007; Jain et al., 2013; Graffeo et al., 2015). One of the profoundly affecting human values on occupants' energy-saving motivation is having a sense of responsibility. Kollmuss and Agyeman (2002) indicated in their study that occupants with a high sense of responsibility are more

likely to hold an interest in saving energy and would behave pro-environmentally. Thus, taking the responsibility strengthens occupants' attention to their actions and choices, potentially leading to positive results (Gyberg & Palm, 2009). As humans' beliefs are derived from their own set of values, occupants who believe in their ability to make a significant change in the surroundings may result in a higher willingness to change behavior (Hines et al., 1987). This factor was described earlier by a psychologist as "Locus of Control" (Ajzen & Fishbein, 1980).

In fact, knowing the factors shaping occupants' values is a difficult task to achieve as different factors could influence each person's values. According to the previous studies, occupants' values and norms are mainly influenced by the society (Chan, 2001; Gadenne et al., 2011; Sidiras & Koukios, 2004). The reasons for environmentalists to select their major was explored in a study carried out in the United States that concluded the childhood experiences, experiences of pro-environmental destruction, values held by the family, organizations, role models, and education (Chawla, 1999).

2.5.6 Socio-Cultural Factors

Social and cultural traditions contribute in shaping occupants' values, beliefs and norms. Culture and social pressures may drive to unsustainable lifestyle and practices (Rajecki, 1982; Hines et al., 1987). Family, friends, and neighbors, can influence occupants' values and intentions which therefore affect their behavior (Nolan et al., 2008; Goldstein & Cialdini, 2009; Stephenson et al., 2010; Stephenson et al., 2015). The social norms may lead to habit-based practices where positively changing habits can lead to high energy savings (Polinder et al., 2013).

In this regard, putting knowledge into effect while providing occupants with information is important to boost their willingness to reduce the consumption (Henryson et al., 2000; Gyberg & Palm, 2009). For instance, social comparison, through informing occupants with their peers' practices, is an effective strategy for fostering sustainable behavior (Ferguson et al., 2011; Rabinovich et al., 2012). Researchers have documented observable changes in the energy use after using this strategy. For example, Peschiera et al. (2010), using monitoring tool in 83 rooms of a residential building, observed the influence of providing occupants with different information. They grouped occupants into three sets, the first group was provided with information regarding their electricity usage, the second set were provided additional data for the average occupant usage in the building, whereas the third group received the same information in addition to the usage of their peer network. They concluded that the third group was the only one that significantly reduced the consumption. Hence, the social comparison may lead to positive behavioral change and high energy-savings that may reach up to 55% if combined with eco-feedback (Jain et al., 2013). Besides telling people what others do, informing them who they are may also strengthen their sustainable beliefs and actions (Graffeo et al., 2015). Moreover, the type of information given to the occupants may further raise their interest in energy-saving. Obtaining a lower energy cost or / and contributing to a better environment were found to have significant effect on occupants' behavior. Therefore, providing people with ideological information where something has to be done to save the nature and the world in addition to health-related and supported with materialistic reasons focusing on what people can earn may enhance their desire to save (Gyberg & Palm, 2009).

Even though the impact of socio-cultural factors was documented by many scholars, the effect differs with the study context because of the norms, traditions and culture that distinguish each context (Rabinovich et al., 2012). With the high rate of immigration, the UAE's population consists of diverse nationalities, each with its own values and cultural background (Al-Awad & Elhiraika, 2003). This is in addition to the culture characterizing the UAE and the Gulf region countries. Therefore, it is critical to explore the effect of the socio-cultural factors on housing occupants' energy-saving motivation in the study context.

2.6 Energy-Saving and Housing Occupants' Motivational Drivers; Literature Gaps

2.6.1 Theoretical Framework Based on Literature Status

Evidence on the substantial effect of building occupants on energy-saving is well-established through the existing literature (Wei et al., 2014; Hong & Lin, 2013; Ben & Steemers, 2014). Motivating occupants to positively modify behavior and foster their interest in energy-saving can make a tremendous reduction in the energy consumption (D'Oca et al., 2016; Kemp-Hesterman et al., 2014). The literature agreed on a number of influential factors that were found to have a significant potential effect on occupants' behavior and willingness to save energy, as reviewed in this Chapter. These driving forces include comfort and satisfaction (Larsen et al., 2010), occupants' characteristics [age, gender and income] (Mortensen et al., 2016), policies and regulations [energy cost, incentives, house ownership and campaigns] (Ameli & Brandt, 2015), level of awareness (Li et al., 2019), values and norms (Kollmuss &

Agyeman, 2002) and socio-cultural factors (Nolan et al., 2008). Based on the extensive review, a theoretical framework is developed illustrating the research focus and the influential factors (Figure 12). These factors are interconnected, thus, it is difficult and infeasible to show the relation between all factors in a diagram. Therefore, the framework highlights only the main connections.

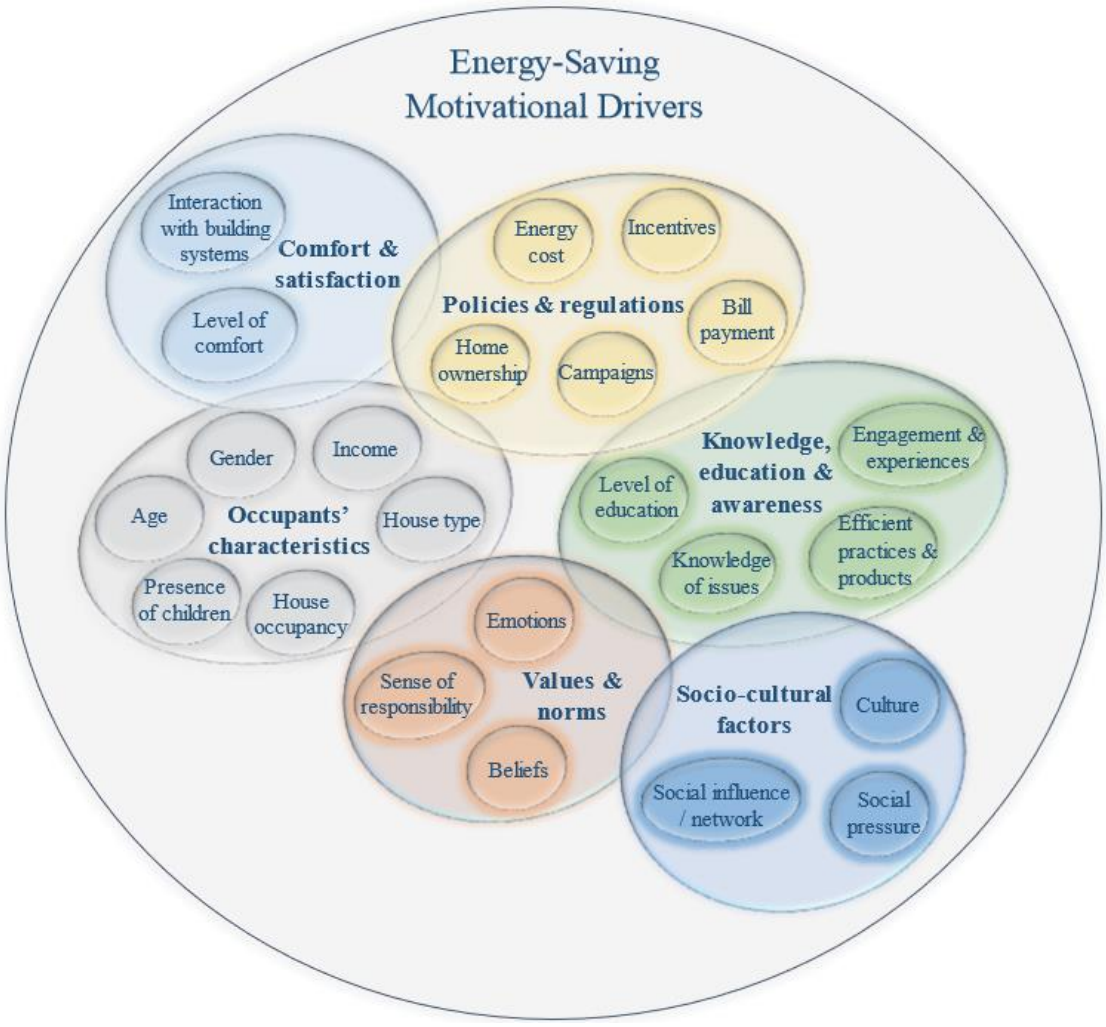


Figure 12: Theoretical Framework Based on Literature

Human behavior including sustainable practices is place-based (Grenni et al., 2020). Thus, occupants' motivational drivers and the impact of the influential factors

differ based on context due to differences in policies, values and norms (Rabinovich et al., 2012; Ameli & Brandt, 2015).

2.6.2 Contextual Specificities and Gaps

The contextual specificities that are unique to the UAE may dramatically influence housing occupants' behavior and motivation for energy-savings. While the impact of context has been highlighted in the literature, there are no studies on the residential sector in the UAE. The literature identified the impacting factors where the UAE differs in a number of them.

The composition of the UAE's population is different from many other countries as the expatriates constitute more than 80% of the total population. The locals and expatriates differ in the applied cost for energy (Section 2.3.3), home ownership (Section 2.5.3), length of stay in the country (Section 2.5.3) in addition to the culture (Section 2.5.6). Both groups are billed differently with a significant difference in the applied tariffs and the amount of usage. Also, expat's ownership of a property in the country is limited in the period of ownership and restricted to designated areas. Besides that, expats' length of stay in the country is not guaranteed as they lack the permanent residency. Another noteworthy factor is the socio-culture effect as the UAE's society is diverse consisting of a large proportion of expatriates in addition to the citizens of the Emirates. Hence, the impact of these factors must be investigated in the study context.

There is only one existing study that addressed energy conservation motivation of building occupants in the UAE. However, the study was carried out through a case study of a green university campus in Abu Dhabi where the sample was homogeneous [mostly students and between the age of 22 to 27 years old] (Azar & Ansari, 2017).

Yet, there is no study investigating occupants' interest in energy-savings in the dominant or conventional housing sector in the country.

Hence, this study aims to explore the factors driving occupants' motivation to save energy in their houses in the UAE as well as identify the differences in the motivational drivers among local and expatriate occupants, if any.

2.7 Conclusion

This Chapter has sought to provide a critical review of building occupants behavior and motivational drivers to save energy. The identified influential factors that were found mainly include comfort, occupants' characteristics, policies, awareness, values and socio-cultural factors. However, the analysis of the energy consumption status and trends in the UAE and the high impact of occupants' behavior on the discrepancy in building energy performance as well as the potential savings resulting from occupants' behavioral changes brought to light the significance of understanding the factors driving their practices and energy-saving interest. Housing occupants' motivational drivers to reduce the energy usage in the UAE were unveiled and a contextual gap in research was highlighted to express the novelty of this research. Hence, the aim of this study to explore the UAE contextual factors. In the next Chapter, the research rationale and the methodology is designed to explore this study and achieve the research objectives.

Chapter 3: Methodology

3.1 Introduction

The aim of this Chapter is to provide the rationale to answer the research question of defining the factors which affect occupants' behavior and motivation to save energy in their houses in the context of the UAE. The exploratory nature of this research calls for a qualitative study. The potential influential factors, derived from the existing body of literature and presented in the theoretical framework (Chapter 2, Figure 12), were used as a foundation for the research design. This Chapter presents first, the selection of the Semi-Structured Interview (SSI) as the most appropriate research method due to the nature of this study objective, type of data sought to be collected and the aim of the study. Then, it presents the design and development procedure of the semi-structured interviews to develop the final interview guide for the main study. Lastly, it presents the main study, descriptive results and thematic analysis of the interview data to generate the codes and themes where the interpretation of study results relied on later.

3.2 Research Design

Qualitative research strategies are largely addressed in the literature (Moustakas, 1994; Creswell, 2007). Strategies including ethnography, grounded theory, case studies, and phenomenology are selected based on the nature of the research problem and objectives (Moustakas, 1994; Creswell, 2007). In this research, participants' daily life practices and behavior are explored to develop an understanding, from their point of view, of their energy-saving motivational drivers. Therefore, phenomenological research approach is the most appropriate to achieve the

stated research objectives. The selection of a research approach depends on the type of data that needs to be collected to respond to the study objectives (Leedy & Ormrod, 2016). Recognizing the research problem and the aim of the study is the first step to correctly select the applicable approach (Creswell, 2007). In this regard, this study aims to investigate the following main research question:

- What are the energy-saving motivational drivers of housing occupants in the UAE's context?

This initial research question may well be articulated into two searchable sub-questions as follows:

- What are the contextual-specific factors driving housing occupants' behavior and motivation for energy-saving in the UAE and how do they affect their practices and decisions?
- Are there any differences in the energy-saving motivational drivers between local and expatriate housing occupants in the UAE?

These questions may well be assessed, as indicated in Chapter 1, through the following research objectives:

- Validate the extracted factors from literature and investigate their applicability in the UAE's context,
- Explore and identify the contextual-specific factors influencing housing occupants' behavior and motivation for energy-savings, if any,
- Explore the differences in the energy-saving motivational drivers between local and expatriate housing occupants in the UAE, and

- Identify the relationships to the possible measures and actions that would enhance energy efficiency in the residential sector in the UAE.

The objectives of this study are exploratory in nature; therefore, call for a qualitative approach (Leedy & Ormrod, 2016). The data intended to be collected in this study is related to participants' behavior, knowledge and opinions. Some of the data is intangible, related to opinions, beliefs, values and emotions. The qualitative approach is the effective approach in such studies. According to the research questions, this study aims to explore the energy-saving motivational drivers of housing occupants' in the UAE and explore how these factors affect their practices and decisions. This approach helps achieve the study target through examining the identified factors from the existing literature and extending the knowledge to address the unique context of the UAE. Also, it helps investigate the complex relationship between the influential factors (Mack et al., 2005).

In this research, there is high dependency on the theoretical framework developed based on the existing body of literature to develop a clear picture of the potential factors that may have significant effect on the study's objectives and provide opportunities to raise more issues and explore potential new and contextual factors. As identified in Chapter 2 (Section 2.6), there are very few local studies that approached the topic but are limited to a case study of a green university campus and thus cannot serve to answer the research question of this study. Hence, it legitimizes further exploration of this topic in the local context.

On the other hand, qualitative research approach also presents difficulties. It requires researcher's ability to collect detailed meaningful data while the data collection process itself is expected to be time-consuming as well. Finally, this

approach lacks the direct results that can be verified objectively (Choy, 2014). Notwithstanding the above difficulties, the applicability to effectively address the research problem and help achieve the research objectives remains the determining factor.

There are several research methods that can be used in a phenomenological-based research. The type of data produced in this study is textual. Information about the motivators for changing behavior and saving energy are intended to be collected in addition to developing an understanding of the direct and indirect relationship between factors that drive their own motivation. Therefore, interactive open-ended questions are used to collect in-depth data. As mentioned in Chapter 2, the local context is expected to have a significant effect on the study findings; therefore, the data collection method ought to be flexible enough to provide opportunities to explore new themes and allow participants to come up with unanticipated factors that can be explored further. Henceforth, the interview technique is the most applicable data collection tool for this study as it yields for the maximum possible level of details in an exploratory study, particularly face-to-face interviews.

While all interviews are used to collect information from participants, there are different interview types based on purpose, available information and depth level of data sought (Dicicco-Bloom & Crabtree, 2006). The extensive literature review, enabled identification of the potential factors that may affect housing occupants' energy-saving motivation. But, there is no previous study that addressed the research problem in the local housing sector of the UAE. Hence, interview questions would be formulated and structured to validate the effect of each extracted theme from literature and explore their applicability and effect in the local context while keeping

opportunities for other emerging questions. Consequently, a semi-structured interview is selected to gather a large amount of detailed data and give participants the freedom to express their opinions. This method has been effectively used in many previous studies with similar objectives (Crosbie & Baker, 2010; Gupta & Chandiwala, 2010).

The data collection process was conducted in three phases to ensure a proper design of semi-structured interviews and validate the results. Since there are no previous similar local studies in the housing sector, a preliminary phase needs to be used to distinguish themes that are applicable in the local context, and to then design and develop questions to be included in the main study. Therefore, informal conversational interview was selected and conducted in Phase I. This preliminary phase helps guide the semi-structured interview process. Based on the conversations' results, the interview guide was designed and questions were formulated. The interview procedure was tested to ensure its effectiveness. In Phase II, a pilot study was conducted to identify any shortcomings and issues with the process. Then, referring to the established guidelines and tests' results, the semi-structured interviews were designed and conducted in Phase III.

3.3 Selection of Study Participants

The literature provided an evidence of the performance gap between the predicted and actual consumed energy (Cali et al., 2016; Delzendeh et al., 2017). The wide gap between the construction and post occupancy phases is found to be linked to occupants' behavior (Cali et al., 2016). This proves that technological solutions used to reduce the energy consumption are insufficient without the energy-efficient behavior of occupants. Therefore, this research targets housing occupants to explore the drivers that would motivate them to save energy, thus, guide the development of

efficient strategies that will effectively reduce energy consumption in the residential sector in the UAE.

As addressed in the previous Chapter, 81% of Abu Dhabi emirate's population is made of expatriates and a very similar parallel applies to the country as a whole, thus this group has a significant effect on the country's total energy consumption. Furthermore, some factors may impact local and expat occupants differently. This is mainly because of the differences in the energy tariffs, home ownership, and other factors addressed in Chapter 2 (Section 2.6) Therefore, participants from both groups are selected.

Furthermore, the aim of the study determines which people to select as respondents from each group (Mack et al., 2005). According to the body of literature, some characteristics of housing occupants may have significant effect on the study findings. These characteristics are the occupant's age, gender, level of education, field of study, income, home ownership, length of stay in the house, and house type (Ameli & Brandt, 2015; Mortensen et al., 2016; Trotta, 2018). Therefore, criteria-based sampling method is used to select participants with these characteristics. Criterion sampling is the most applicable sampling strategy for this study which depends on preselected criteria to select participants that would most likely provide the most credible information (Creswell, 2007). However, the sample size depends on the results (Knox & Burkard, 2009). For the present study purposes, the number of participants is determined sufficient enough when additional interviews have similar responses and would not bring added-value to the process; or in other terms, reaching saturation.

3.4 Reliability and Validity

Reliability is a vital aspect to consider in any research to ensure a high level of credibility and trustworthiness (Patton, 2002). It refers to the ability of other researchers, or the same researcher, to repeat the study at another time and place while yielding the same results (Silverman, 2006). However, it is extremely difficult to achieve reliability in qualitative researches (Taylor & Bogdan, 1998), as the circumstances under which the interviews are conducted are likely to change over time and may irremediably affect the results. Also, repeating interviews in a different place may produce different results, because of the different contextual conditions. Measures to ensure reliability in a qualitative research as identified by Silverman (2006) are used in this study. For instance, this research described the data collection process clearly in details with all interview questions, tools and procedure used. In addition, all interviews were recorded, and evidenced through extensive quotes from the transcripts as displayed in the interpretation part (Chapter 4, Section 4.2). It is believed that these measures would enhance reliability and enable other researchers to repeat the study following the same procedure.

Validity is another important aspect that needs to be considered in any research to validate the selected method (Creswell & Miller, 2000). It is used to demonstrate that the study accurately measured what it intended to measure (Silverman, 2006). Patton (2002) advocates the use of triangulation of more than one data collection method to emphasize validity. In this research, triangulation was achieved through the use of two interview methods; one to one informal conversational and semi-structured interviews. This strategy ensured that the main data collection tool (semi-structured interviews) was properly designed to gather intended data that helped answer research

questions. Design and development of semi-structured interviews were based on the developed theoretical framework and the guidelines which resulted from the unstructured, informal type of conversations that is described in Section 3.6.1. Additionally, a pilot study was conducted to test the interview procedure and tools to eliminate bias from the data collection process and ensure efficiency in the interviews. In addition, participants were informed that they could review the transcript if they wished to. Furthermore, the validity of this research was achieved by comparing the findings among the participants as well as with the outcomes from the existing literature while aligning a number of the identified influential factors.

3.5 Research Ethics

Research ethics is a fundamental aspect in any research, as it establishes a basis for trust between the researcher and participants (Mack et al., 2005). In this study, research ethics was considered in all phases of data collection process. To carry out the study, an ethical approval was obtained from the Social Sciences Research Ethics Committee of the United Arab Emirates University. This was achieved through filing a research ethics review form with all research information including all questions and submitting it to the Ethics committee prior to starting the data collection process. Informed consent is a mechanism that can be used to ensure that people consciously and deliberately accept participating in the study (Mack et al., 2005). This mechanism was used in this research at each phase (informal conversations, pilot study and main study through semi-structured interviews) to inform participants with interview procedure and get their written approval as well as to provide participants a guarantee of confidentiality. A brief explanation of the purpose of the study without giving

details that may affect their responses to the interview questions in order to eliminate bias was attached to the procedure.

The native language of most of the participants was Arabic, some with no knowledge of the English language. Participants had the freedom to choose the language they feel comfortable with during interviews. For that reason, the consent form was written and prepared in both languages. Informed consent form in both languages is attached in Appendix A. Participants were also informed of their right to stop the interview at any time if they felt uncomfortable or had a question of their own. In addition, after the interview, participants' identities remained confidential and a fictive name was used to refer to the interviewee throughout all phases of this study, including coding the transcript and during the interpretation of findings. These techniques are considered safe ways to ensure protection of privacy and respect for people during the research and their participation in the study (Mack et al., 2005).

3.6 Semi-Structured Interview (SSI) Design

The semi-structured interview was designed and developed in two phases. These two phases of data collection were used for a number of reasons. Firstly, in the absence of existing local data, the use of questions derived from the related literature as the benchmark to guide qualitative question development was considered methodological inconsistent. Hence in Phase I, informal conversations were focused in the context, while also aiming to verify the driving factors that emerged from literature, but mostly to unveil the specific ones to the UAE's context in order to design and formulate adequate interview questions. In Phase II, the interview questions design, procedure and tools were tested first through a pilot study to ensure a proper design of the semi-structured interview was achieved. The next Section presents the

design, testing procedure and results of each step that culminated in the design of the main semi-structured interview.

3.6.1 Phase I: Informal Conversational Interviews (ICIs)

Informal conversational interview is a type of unstructured interviews where the researcher does not depend on any specific predetermined questions to guide the conversation. Alternatively, the researcher generates instantaneous questions during the interview based on the natural interaction with the participant (McNamara, 2009). As an important part of the overall data collection process, the unstructured interview or Informal Conversational Interviews are generally conducted as a first step to properly connect the targeted questions to the research objectives set for the local context. It helps explore and obtain the maximum possible preliminary data for further investigation while not limiting the questionnaire with a structured set guide, similar to structured interviews and surveys (Gray, 2009; Punch, 2014). Therefore, informal conversational interviews were conducted first to validate the themes extracted from the existing literature and presented in the theoretical framework (Chapter 2, Figure 12) and more importantly to explore the applicable and emerging themes specific to the UAE context. It should be noted that some researchers consider this type of interview as unstable because of the lack of consistency in interview questions (Creswell, 2007), while many others view it as beneficial because of its lack of structure allowing flexibility in the interview framework which may unveil unanticipated data (Gall et al., 2003; Creswell, 2007; Gray, 2009; Frey & Fontana, 1991).

3.6.1.1 Informal Conversational Interview Design

In this phase, there was not a set of planned questions to ask, but the researcher depended mainly on the themes presented in the theoretical framework that was developed based on the literature and found to have a significant impact on occupants' behavior and energy-saving motivation in other contexts to generate spontaneous questions driven by the conversation. Although, the researcher had to lean the interview towards the study focus and research problem to achieve the aim of the conversational interviews. The themes, derived from the existing body of literature, were grouped into six categories; comfort and satisfaction, user's characteristics, policies and regulations, education, knowledge and awareness, values and norms and socio-cultural factors, as defined in Chapter 2 (Section 2.5.1 to 2.5.6) and summarized in Figure 12. Although there were no predetermined questions but the conversation should be in a controlled process (Gray, 2009).

3.6.1.2 Participants

The sample was selected using "Criterion Sampling" strategy depending on predefined criteria as explained in Section 3.3. Since the target of this phase is to explore preliminary results, the conversational interviews were conducted with a small sample of 6 individuals. Participants were given the choice to select the place of the interview (participant's house or workplace) to ensure being in a comfortable environment for the participant to unrestrictedly share information and express opinions. Appointments to conduct the individual conversations were made ahead, either by a phone call, email or in person.

3.6.1.3 Procedure

Conversational interviews were conducted based on the guidelines and steps given by Eisner (1998), Shank (2002) and McNamara (2009). Before starting the interview, participants were informed briefly on the study purpose without providing extensive details to avoid influencing the conversation flow. Even though the conversations were conducted in informal flexible process, but still an informed consent mechanism was used in which participants were given enough time to read the consent form and sign it. The consent form was used to clarify the research objectives, interview procedure, the confidentiality of their personal data and a way to contact the researcher. Also, the consent form was used to obtain the participants' approval to audio-record the interview. Additionally, participants were informed of their right to stop the conversation when uncomfortable or requesting clarification on a question.

After ensuring that the tape recorder was working and verifying the informed consent orally, the conversation started by asking a general question related to the need to save energy in the house then to the discussion for further topics. As previously mentioned, there was not a set of planned questions to be asked in order to keep the conversation flexible and explore in-depth data. Questions were generated at the spur of the moment and asked differently depending on the conversation flow with one constant; all questions revolved around the themes in the theoretical framework. The main questions were about daily practices, knowledge and beliefs in addition to opinions in energy-saving strategies. It was important for the researcher to remain as neutral as possible while asking questions and listening to the participant's responses. This was designed to avoid giving any opinion or judgment on the participant's responses and to keep it open for any idea. After exploring participants' opinions and

behavior, the tape recorder was tuned off and the participant was thanked and appreciated for their participation and time.

3.6.1.4 Informal Conversational Interviews: Preliminary Findings

Informal conversational interviews were conducted with six residential occupants (locals and expats) living in the city of Al Ain (UAE). The selected participants were from different age groups, gender, level of education and living in different dwelling types. Participants' general information is shown in Table 1. Interview locations were established per the participants' preference. Participants 2, 3 and 5 were interviewed in their workplace, while participants 1, 4 and 6 in their place of residence. It should be noted that the listed names are fictive to preserve the participants' privacy and ensure the confidentiality of their identities.

Table 1: Participants General Information in the "Informal Conversational Interviews"

	Participant	**Level of Education**	**Gender**	**Age Group**	**Citizenship**	**Dwelling Type**
1	Salma	Bachelor Degree	Female	40-59	Expat	Apartment
2	Anas	Postgraduate	Male	21-39	Local	Villa
3	Rayan	Bachelor Degree	Male	21-39	Expat	Apartment
4	Lara	High School	Female	Less than 21	Expat	Apartment
5	Sandra	Postgraduate	Female	40-59	Expat	Villa
6	Saif	Primary	Male	+ 60	Local	Villa

The audio recordings were used to transcribe the interviews and derive the results that guided the development of semi-structured interview protocol and questions. Transcription was done manually by the researcher listening to the recording and converting the speech into text. The extracted themes from the informal conversations, aligned to the theoretical framework, thus validating the approach and this preliminary data guided the generation of semi-structured interview questions. One of the initial findings highlighted the local context has a significant effect on the study findings. The results exhibited signs of an evident difference in motivational drivers between local and expat participants. The financial characteristics seemed to affect both groups differently. All interviewees were aware of the increase in the energy cost; however, expats seemed to be more motivated to save on utility bills. Also, both groups' opinions appeared to be different in terms of house improvements to save energy whereas expatriates seemed to be unwilling to make changes in a house that they do not own, as opposed to the locals. In addition, one factor that was not considered in the theoretical framework appeared in the conversations with two expats. This factor refers to "Adaptation" where occupants being able to adapt to the place and issues in the house spaces and systems that affect their practices, in turn, affect their energy-saving motivation. This theme will be addressed in the main study for further exploration.

In brief, the Informal Conversational Interviews confirmed the relevance of many factors available in the literature and highlighted emerging contextual ones. These findings formed the basis of the Semi-Structured Interview.

3.6.2 Phase II: Pilot Study

Semi-structured interviews are usually conducted using an interview protocol. It is a tool used to act as a reference for the researcher to guide the interview. It helps ensure that all research areas are considered in the overall study (Dicicco-Bloom & Crabtree, 2006). It consists of a set of required interview questions all participants would be asked. The Interview protocol is usually first tested through a pilot study to ensure the effectiveness of interview questions, procedure and tools to be used in the study (Creswell, 2007). This phase helps determine any shortcomings and issues in the interview design and process and ensure a well-rounded collection of data (Galletta, 2013).

3.6.2.1 The Development of Interview Protocol and Questions

In semi-structured interviews, predetermined open-ended questions are used which focus the interview towards the study target, but still allow for a degree of flexibility for in-depth exploration (McNamara, 2009). Interview questions are not limited to the planned set, but rather some questions and prompts are generated during the interview based on the conversation flow to focus further and collect the maximum possible data. Forming semi-structured interview questions is not an easy task where the researcher has to avoid bias and be critical in the wording (Adams, 2015). Zeisel (1985) offered general rules and recommendations for writing and asking effective interview questions. According to his guidelines, an interview question should ask one thing at a time while avoiding complicated words with multiple meanings. Naturally, the wording of questions is a very important aspect as the participant must clearly understand the question to answer it properly (Zeisel, 1985). These are the main rules

that were followed in this research to generate well-formulated, precise and clear questions.

Accordingly, in this study, a predetermined set of open-ended questions was generated based on the identified themes in the theoretical framework in addition to the preliminary results of the informal conversations focusing on the differences among both groups in terms of financial factors and house ownership as well as the emerged theme "Adaptation". In the design of the interview questions, the identified factors were called themes and were grouped following the same categorization presented in the theoretical framework (Figure 12). Single or several questions were created to serve each applicable theme to further investigate its effect and explore contextual factors. Interview questions were developed with the main target of answering the research questions. Interview questions were composed of key and follow-up questions. Key questions were created to cover the main areas while follow-up questions were created to assist the in-depth exploration and indirectly highlight specific points to be discussed as needed. These types of questions would only be asked depending on the interviewee's response to a key question. Some key questions would be asked to shift to another area while the open-ended question and the in-depth exploration would be through the follow-up questions. Table 2 illustrates the development process of interview questions by formulating questions concerning each theme. As shown in the table, interview questions were formulated with respect to the main research questions, and organized by themes and categories. Most of the interview questions were open-ended to avoid restraining the interviewees' responses and to create an opportunity to explore unexpected topics.

Table 2: The Development of Interview Questions

Research Questions: Main question: What are the energy-saving motivational drivers of housing occupants in the UAE's context? Sub-question 1: What are the contextual-specific factors driving housing occupants' behavior and motivation for energy-saving in the UAE and how do they affect their practices and decisions? Sub-question 2: Are there any differences in the energy-saving motivational drivers between local and expatriate housing occupants in the UAE?		
Categories	Themes (From Theoretical Framework and ICIs)	Interview Questions
Policies and Regulations	Incentives	• Did you get any kind of incentives, whether financial or non-financial? (if asked for examples: offers on electricity bills, discounts on purchasing energy-efficient products). Follow up: - If yes, what are the incentives? - If yes, how did you know about these incentives? - If yes, do you think these incentives are effective? Why? - If no, are you interested in such incentives? Why?

Then, interview questions were rearranged and included in the interview protocol. Since all the predefined themes are related and connected in some way, some questions were repeated for more than one theme. Thus, the rearrangement of questions included filtering them and removing repeats. Next, an interview protocol was prepared to be tested through the pilot study. The designed interview protocol

consisted of the essential parts for the researcher to remember and consider during the interview for an optimal use of interview time. The four protocol sections are: opening statements, interview questions, researcher's notes and closing statements. As participants would have the option to select the language, either Arabic or English, to use in conducting the interview, interview protocol was developed and prepared in both languages.

3.6.2.2 Participants

Since the aim of the pilot study is to test the protocol, a relatively small sample of 6 people was selected to represent the participants of the main study. The selection was made using the criteria-based strategy following the same criteria for selecting the main study's participants. Appointments for individual in-person interviews were taken based on availability of participant and at his preferred location.

3.6.2.3 Procedure

The pilot study followed the same procedure as the ICI with the only difference being how the interview is conducted, which complied with the guidelines available from Zeisel (1985), Galletta (2013) and Adams (2015). Hence, after greetings, brief explanation of the study and approval to be interviewed and record, the Tascam DR-05 portable handheld audio recorder was turned on and the interview started by asking general questions easy and impersonal to answer. The first question was asking interviewee's period of living in the house. Starting the interview with asking for a fact was for the purpose of letting the participant adapt to the interview environment, feel comfortable and engage oneself with the conversation. Then, pre-determined questions were asked based on the conversation flow. The order of the questions varied

depending on the responses and interaction between the interviewee and researcher. The detail level of questions moved gradually from introductory general to the relevant critical questions of this study. Although, technical terminologies were not used in the questions, participants were informed to ask for any clarification. The purpose was to have clear, easy to understand questions without any risk of vagueness or confusion in terminology.

Using probes is an effective technique to clarify a point, gain detailed data, shift the topic or encourage interviewees to continue talking and expressing their opinions and experiences (Zeisel, 1985). This technique was used in the pilot study to enrich the interviews for these reasons. The open-ended nature of questions allowed for additional assistance questions to obtain in-depth information. Those questions are kind of reflecting probes in which the researcher reflects on the participants' answers by asking additional questions. An example would be the following dialog: *"Have you heard about any marketing campaigns that call for saving energy? If yes, how did you know about these campaigns? Did you follow any of these campaigns? If yes, how? If no, why?"* Follow-up questions were not limited to predetermined ones, whereas some questions were created spontaneously as needed. This is especially true when the interviewee touched on a new idea or interesting point that needed further exploration. Some probes such as *"Yes"*, *"Interesting"*, *"I see"* were used to show the interest in the interviewee's responses. Other probes such as attentive silence and nodding the head were used to give participants time to talk without interrupting them. During most of the interview time, the participant was talking and the researcher was listening without interrupting, unless there was a need to orientate the discussion towards the study focus if the participant deviated. In addition, there are some questions that were directly asked to participants to elaborate on their answers in case they mentioned

something that the researcher did not understand well or something interesting that required further explanation. Examples on these probes include *"Can you explain more?", "What do you mean?", "Can you give an example?"*

After asking all pre-determined questions and ending the interview with the closing statements, the audio recorder was tuned off and the participants were personally thanked and appreciated for their participation and time.

3.6.2.4 Results

Pilot test was carried out with six residential occupants (both locals and expats), living in Al Ain city (UAE) and from different age groups, gender and level of education. Table 3 presents participants' general information with fictive names. Interviews were conducted either in the participants' house or workplace, as per their preference, to provide them a comfortable environment. Interviews with four of the participants were conducted in their workplace (offices), while the others were conducted in their houses.

Table 3: Participants' General Information in the "Pilot Study"

Pilot	Participant	Level of Education	Gender	Age Group	Citizenship	Dwelling Type
1	Joud	Bachelor Degree	Female	40-59	Expat	Apartment
2	Yahya	High School	Male	Less than 21	Expat	Villa
3	Lana	Primary	Female	40-59	Expat	Apartment
4	Mona	Bachelor Degree	Female	21-39	Local	Villa
5	Khalid	Bachelor Degree	Male	21-39	Local	Villa
6	Sondos	Postgraduate	Female	40-59	Expat	Villa

Each test took approximately between 25 to 35 minutes. Test duration was found to be adequate which means it was not too short to collect in-depth data, nor too long where participants may lose interest and focus. The interviews were conducted as per the participant preference and were in English except for participants 2 (Yahya) and 3 (Lana). "Braina software" was selected to transcribe the interviews for its advertised versatility to accommodate colloquial speeches, including the local ones (Braina, 2020). It was supposed to help save transcription time and make the process easier to convert speech to text compared to manual methods. Therefore, a license was purchased and the tool was first tested in the pilot study to verify its effectiveness and potential use in the main interviews.

Lana (expat) the third interviewee in Table 3 raised a point that was not initially addressed in the protocol. She indicated her willingness to install energy-efficient products if the homeowner contributes with 50% of the initial cost of products, thus, both will get the benefits without one of them bearing the total cost. It was elected to ask all other participants for their opinion on the same. Since the pilot study is an interactive process, and in order to take advantage of the remaining pilot tests, the question was asked for the rest of the participants and added to the final interview protocol and named "Question 21" (Appendix B).

3.6.2.5 Pilot Study; Issues and Solutions

Besides the contribution of the pilot study to test the Semi-Structured Interview (SSI) protocol and questions, it also helped improve the researcher's interviewing skills. Further, it assisted in determining shortcomings and issues in the interview procedure and protocol that should be resolved prior to carrying the main study. Three

main issues were detected related to the collection of participants' general information, formulation of some questions and interview transcription software.

3.6.2.5.1 Collection of Participant's General Information

It was not practical to note down general information about participants and their residences while listening to their responses and keeping an eye contact with them. In the pilot study, general information was collected either directly by asking participants during the interview or, indirectly if they mentioned the information within their responses. Collecting all required data in that way was found to take some time during which interviewees might become uninterested. Also, directly asking participants about some information, such as their monthly income, may be vexing. Therefore, it was reverted to busing the tick box technique to collect information about participants' characteristics which should make the process easier and faster. A separate section with tick boxes was then added to the interview protocol to be filled by the participant before the starting interview and after signing the consent form. This added section was divided into two parts: interviewee's identification and residence identification. In the first part, information about participant's age, gender, citizenship, highest degree of education, field of study and income will be collected. These variables were determined based on the literature as having a potential effect on the study findings. Four age groups are considered; less than 21 years old for students, 21 to 39 for working population, 40 to 59 for those working people with high level of experience and over 60 years old for pensioners. Moreover, levels of income have been identified according to previous local study (Matherly et al., 2017). Figure 13 shows the interviewee identification part that has been added to the final interview protocol.

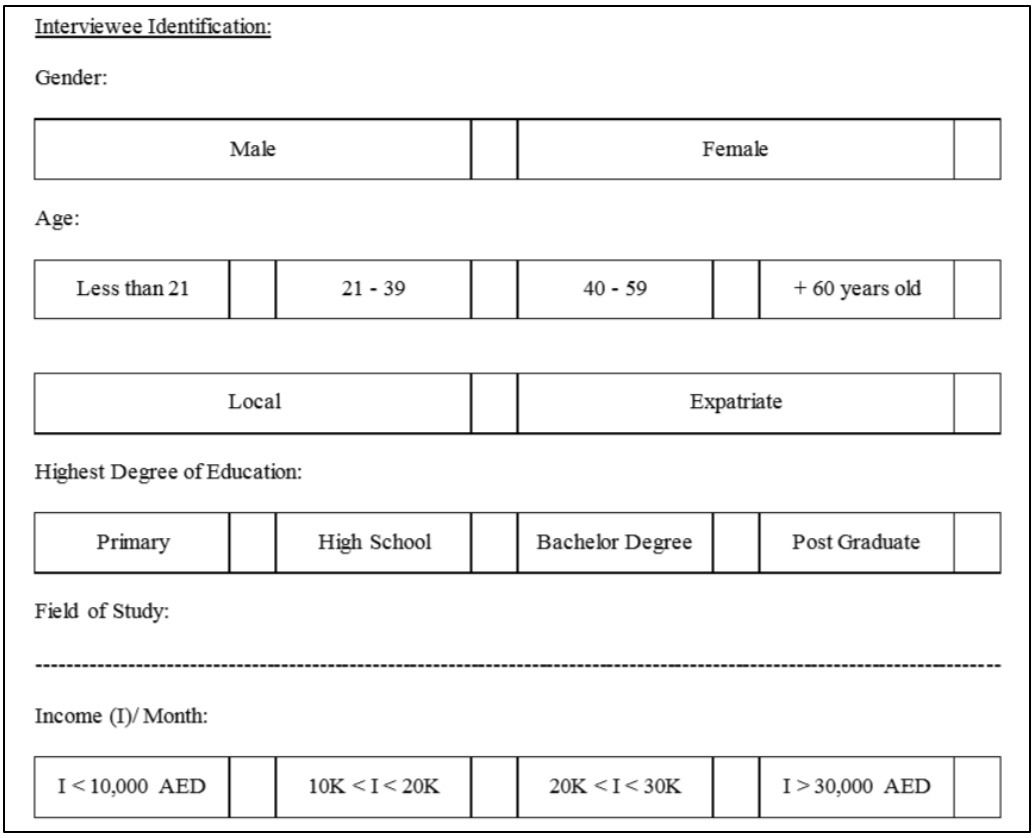


Figure 13: Interviewee's Identification Part in the Final Interview Protocol

In the second part, information about participant's residence was collected. This included house type, ownership and living period in the house. The subcategories that were considered in Mortensen et al (2016) study regarding the lived period of time in the house, were followed in this research. This factor was added considering the expats' temporary residency in the country. A specific distinction for houses built prior or post 2010 was added, as Estidama building code, promoting the development of energy-efficient buildings, was not mandated in Abu Dhabi until that year (Awadh, 2017). This means, houses that were constructed prior to 2010 did not follow the sustainability building code during the design and construction phases. The implementation of this code specified minimum requirements related to house design, minimum wall and roof insulation as well as components and systems which may well

have an impact on occupants' behavior and energy-saving motivation. Therefore, the year of house construction, whether prior to or after 2010, was considered in this study to explore if it had any possible impact. Similar to the considered identification of the participants, the house characteristics considered were in line with the potentially influencing factors identified in similar studies as presented in Chapter 2. Figure 14 illustrates the residence identification part that has been added to the final interview protocol.

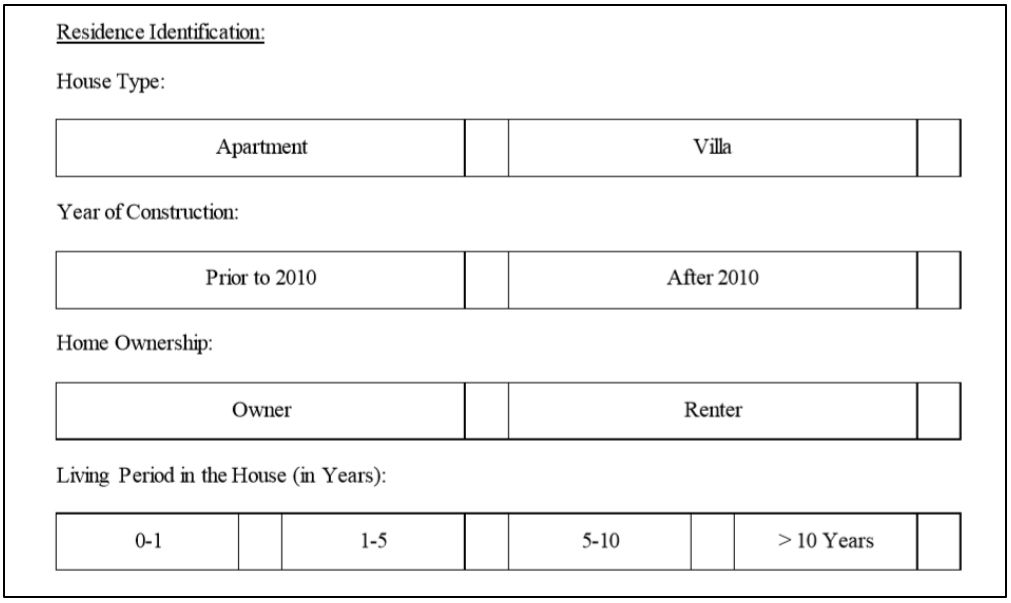


Figure 14: Residence Identification Part in the Final Interview Protocol

The added identification of both the interviewee and the house were tested with the last expat participant (Sondos). The test proved itself as an effective and practical technique, as well as an easy way to collect all required general information while saving the interview time for critical questions that needed exploration.

3.6.2.5.2 Questions Formulation

The pilot testing also highlighted recurrently that one of the questions "Question 5" was unclear to 4 of the 6 participants. The question formulated as *"How*

do you use the AC system in the house?" with an intent to document participants' practices, and then explore the reasons behind it, was differently perceived. Hence, participants asked if the intended meaning was the hours of usage, way of controlling the system or time during the day. For that reason, the question was reformulated into direct, clear questions asking about their usage of housing systems in terms of time of usage during the day, different seasons, as well as usage during non-occupancy hours.

Also, the formulation of some questions, prone to yes – no answers, had to be revisited such as was also "Question 11 and 13". Hence, these questions were re-formulated to open-ended ones to get detailed information and allow for the opportunity to explore unexpected topics that raises the value of the study. In question 11, rather than asking *"Do you keep water heaters turned on all the time or only when needed?"* the question became *"How water heaters are used? Who turns it on? When? Is that different for summer and winter? If so, why?"* Also, in question 13, rather than asking *"Do you consider the consumption of electricity when you purchase an electrical appliance such as fridge?"* the question became *"When purchasing appliances such as fridge or washing machine, what criteria or characteristics do you look for?"*.

Pilot study was conducted to test the interview protocol with two groups of participants; local and expat housing occupants. Results indicated that the whole process is the same and works well with both groups except for few differences in the interview questions. These differences are in the introductory question asking local interviewees about the living period in the house in addition to the pros and cons of living in their current residences. Expat interviewees were asked about their period of living in the house as well as in the UAE. Furthermore, another main difference was

asking the locals about their opinion in the changes in the payment system, increase in the energy billing rates, the governmental contribution, financial and nonfinancial incentives that are offered to encourage saving energy. The same questions were formulated differently for expats taking into consideration that they are renters, not homeowners. Considering these differences, two interview protocols were developed, one for local participants and the other for expats where the difference was only in few specific questions. Other than that, the procedure and the remaining questions are kept identical for both groups.

3.6.2.5.3 Transcription Process

After testing the procedure and recording the interviews, an issue was detected in the Braina software. It dictates only few words, not always the whole sentence even though the voice recording was very clear, which required the researcher to go back, listen to the recording and write the missing sections. This process required an additional time. Other efficient alternatives were searched but not found. Hence, the transcription process in the main study was done manually by the researcher.

3.6.3 Final Interview Protocol and Procedure

In summary, the issues encountered during the pilot study were addressed. This included streamlining the data collection of the participants and house characteristics. A short questionnaire was added with a tick box technique to be filled by the participant right before starting the interview. Also, the questions that were noticed to be even slightly unclear, and to accidentally guide the responses were re-formulated to more direct, easy to understand and open-ended questions such as in questions 5, 11 and 13 in the updated interview protocol. As discussed above, the differences between

local and expat occupants that may affect the study findings were considered in the interview questions; therefore, two interview protocols were developed with a slight difference in the questions while the procedure remains the same. The final interview protocol for each participants' group in both languages, English and Arabic, is attached in Appendix B. In addition, to resolve the transcription software issue, the transcription method of the interviews was changed, and the transcription was executed manually by the researcher.

3.7 Main Study Approach and Procedure

The main study took place in the city of Al Ain and was carried out from April to June 2019. Each interview took around 30 to 35 minutes including the time allocated for participants to fill the short identification form to collect the general information about them and their residence. The tools, participants' selection and data collection procedure followed the same steps as the pilot study with the updated interview protocol. Prior to the interviews, appointments for individual in-person interviews with both groups were scheduled according to the participants' availability where, sometimes interviews were conducted outside of business hours or on weekends. A number of interviews were rescheduled and few of them were totally canceled by the participants without rescheduling due to reasons not related to the study.

The signing of the consent form was the first step of the interview procedure to obtain participants' written approval for participation and recording of the interview. The short identification form was filled by the participants before starting the interview. The data collection procedure consisted of asking the crafted key and probing questions to collect in-depth data. Although all participants accepted to record the interview, notes were taken by the researcher regarding the interview duration,

place, any observations and short, instant comments when needed while the interview was in progress. These notes helped in keeping control over the interviews by checking the time and any observations to consider for the rest of interviews. In addition, the continuous transcription of the interviews without waiting until the completion of data collection process first emphasized the control over the process and second, helped identify any emerging concepts and factors worth exploring on subsequent participants. The interviews that were conducted in Arabic, as per the participants' preference, were transcribed first and then translated to English for the transcript to be used in the analysis.

Achieving saturation was the indication of the sufficiency of the number of interviews where the collected information became repetitive. Interviews with expat participants reached saturation before the locals which called for additional interviews of local participants until no different and no new insights were obtained.

3.8 Descriptive Results

In the main study, semi-structured interviews were conducted with a total of 32 participants. As addressed in Section 3.3, study participants were selected based on specific criteria that may have an effect on the study findings, including participant's age, gender, level of education, income, home ownership, period lived in the house, house type and year of construction. Since some of these factors are envisioned to have a potential impact, the study results can be easily connected to identify such factors and critically compare the study findings among both participants' groups to answer the research questions. Therefore, in this section, the results of the main study's participants' characteristics and their residences are described.

3.8.1 Participants' Characteristics

Interviews were conducted with 14 locals and 18 expats (44% and 56% of the study participants, respectively) until saturation was reached for each of the considered groups. 13 out of the 14 local participants owned the houses they live in, either personally or through a family member. Only one local participant was living in the house as a renter due to the long distance between the family house and the university. By contrast, all expat participants were renters in Al Ain (Figure 15).

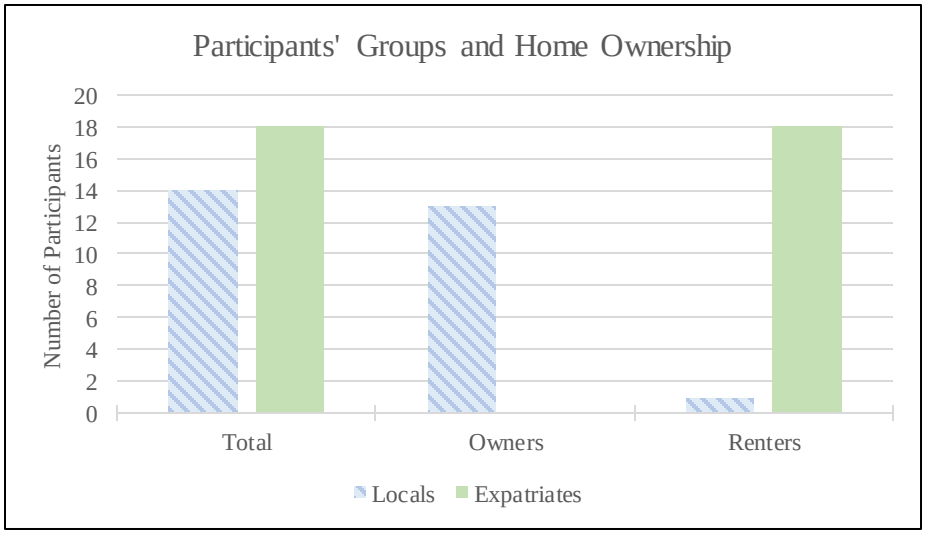


Figure 15: Participants' Groups and the Count of Home Owners and Renters in Each Group

The interviews were conducted with participants from both genders. There was an equal representation of males (9) and females (9) from the expats, as it was easy to access the expats community and had equal share of both genders, while for the locals, 9 were females, of an easier access to the female author, and 5 were males (Figure 16).

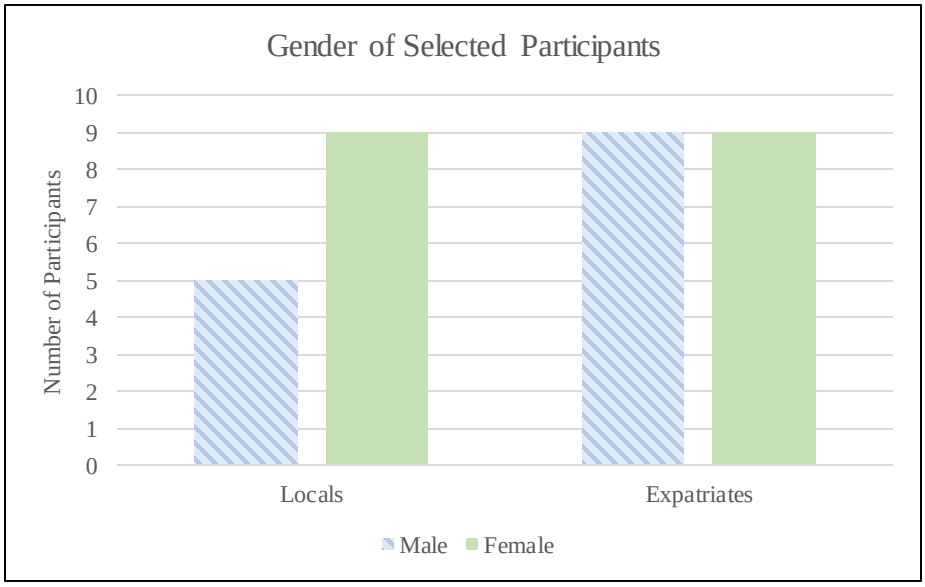


Figure 16: Gender of Study Participants

Overall, local and expat participants from different age groups were selected in order to ensure representativeness of occupants and to check the relationship between age and energy-saving motivation. The proportions of participants from each age group was as follows: 5 participants were less than 21 years old, 15 participants were between 21 and 39 years old, 8 participants were between 40 and 59 years old and 4 participants were 60 years or older (Figure 17). It should be noted that the latter age bracket was reluctant to be interviewed and candidates were difficult to find.

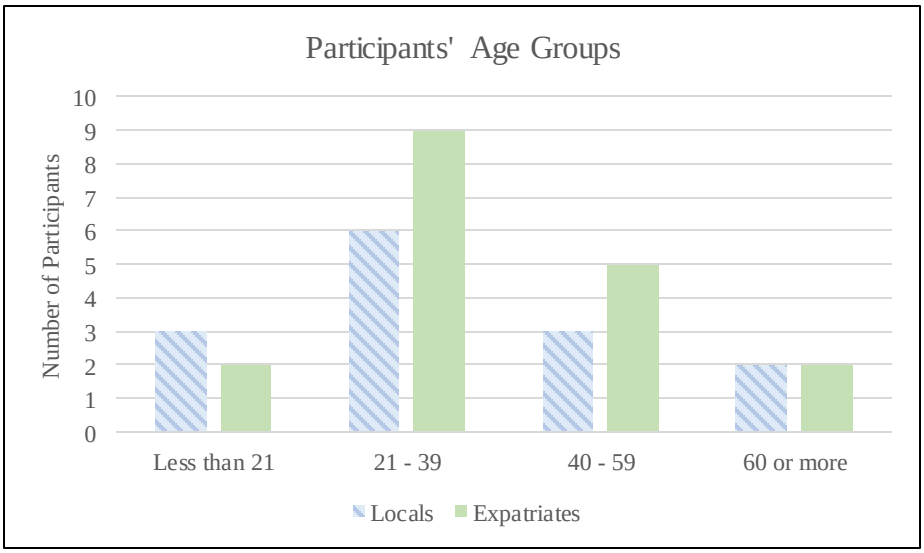


Figure 17: Age of Study Participants

The age category was not directly correlated with the level of education. Participants from both population groups with varying levels of education were selected to investigate the relation between educational level and energy-saving motivation. Three of the participants were unschooled or interrupted their education at primary or middle stages, whereas 6 participants had a high school degree. In addition, 23 participants pursued higher education where 16 out of the 23 participants had a bachelor degree and 7 participants claimed a post-graduate degree (Figure 18).

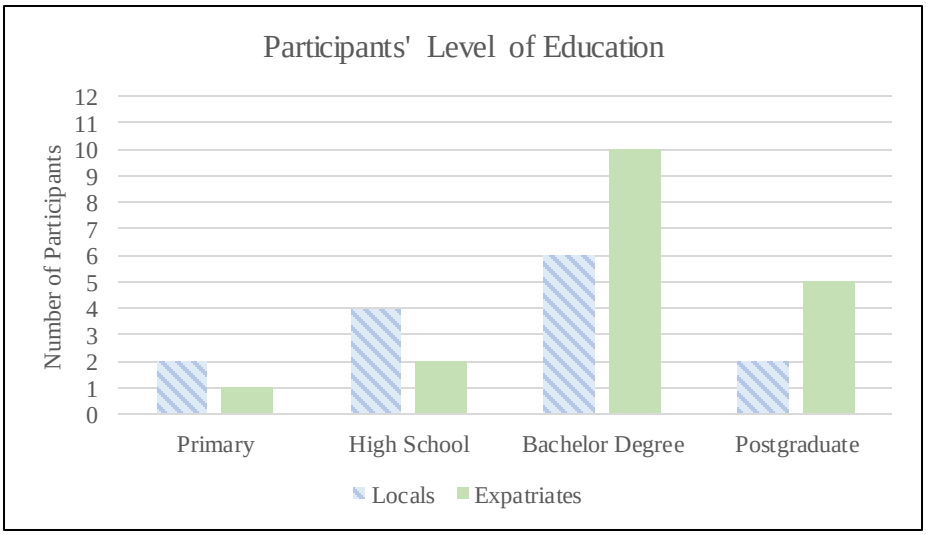


Figure 18: Study Participants' Level of Education

As the financial factors may have an impact on occupants' behavior and motivation, it was important to have representatives from both groups with varying income levels. Most of the participants who had an educational level lower or at high school level did not have a monthly income (6 participants). Also, 11 of the selected participants had a monthly income of less than 10,000 AED, 7 participants had an income between 10,000 and 20,000 AED, 5 participants had income between 20,000 and 30,000 AED, and 3 participants had a monthly income of more than 30,000 AED (Figure 19).

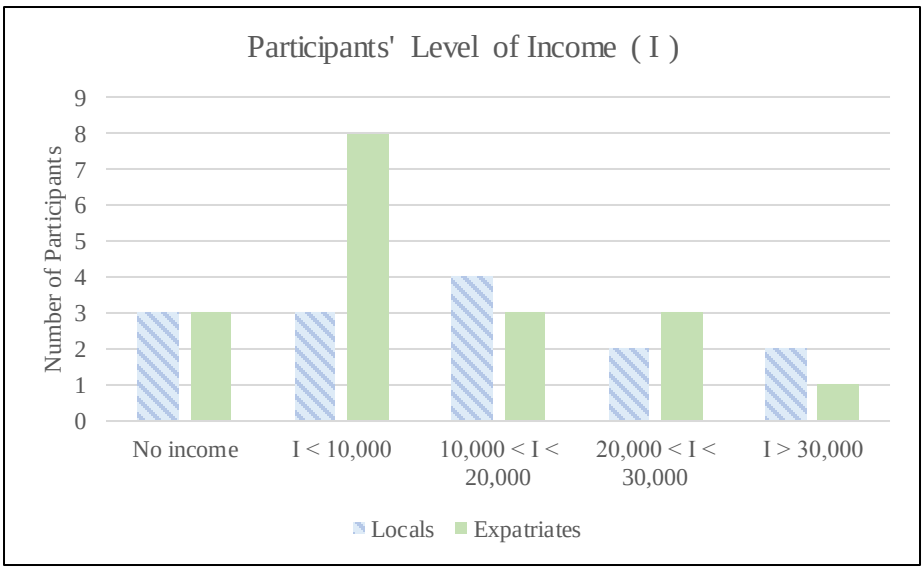


Figure 19: Local and Expatriate Participants' Level of Income

As previously mentioned in Chapter 2, the availability of children under the age of 13 and particularly between the ages of 9 and 13 in the house may influence how much energy occupants consume and their desire to save energy; therefore, this aspect was taken into consideration in this study. Both groups included an even distribution of children with 17 of the participants claiming children under the age of 13 living in the house, while 15 participants did not list any (Figure 20).

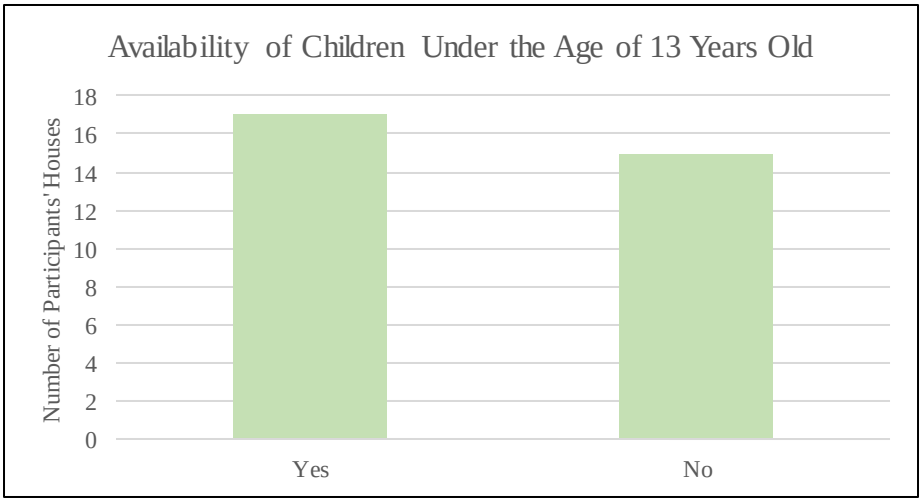


Figure 20: Count of Participants Having Children Under the Age of 13 Years old Living in their Houses

With the large number of expatriates in the UAE, it was easy to find and select participants with different periods of living in the country and residence. By contrast, it was not easy to interview local participants who lived in their houses for less than 5 years. Despite this difficulty, interviews with local and expat with different residency durations were considered. In terms of length of living in the house, participants who were interviewed were as follows: 2 participants lived in the same house for 1 year or less, 8 participants between 1 and 5 years, 10 participants between 5 to 10 years and 12 participants for more than 10 years (Figure 21).

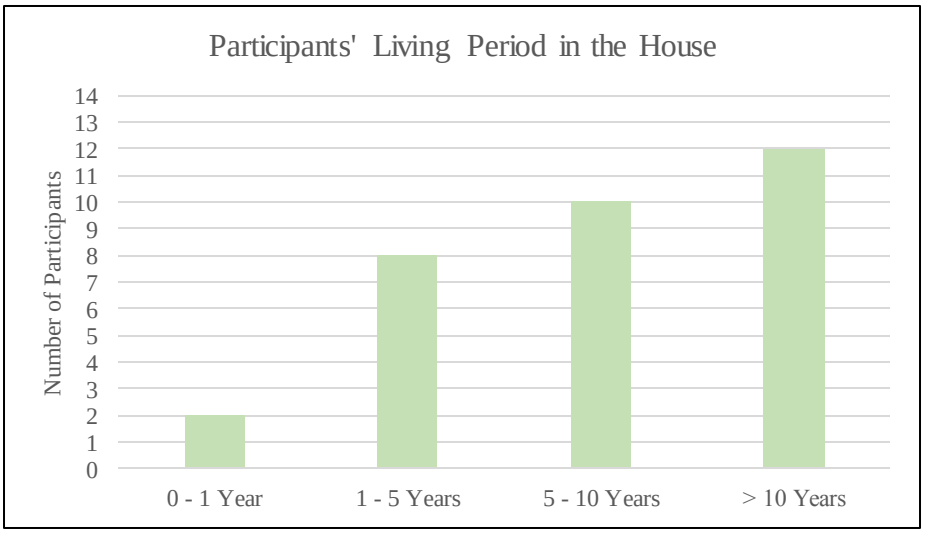


Figure 21: Participants' Living Period in the House

3.8.2 Residence Characteristics

The house type (i.e. a villa or an apartment), as identified in the literature, can have a significant effect on occupants' behavior and energy-saving motivation. In addition, energy tariffs in the UAE differ depending on the dwelling being a villa or an apartment (Chapter 2, Section 2.3.3, Figure 11). Therefore, the participants' housing type was considered for correlation to occupants' practices and interest in energy-saving. Most of the local participants were living in villas, while the expats'

housing varied between villas and apartments. Only two of the local participants were living temporarily in apartments because of studying in a university far from their family residence, whereas 10 expat participants were living in villas and 8 in apartments (Figure 22).

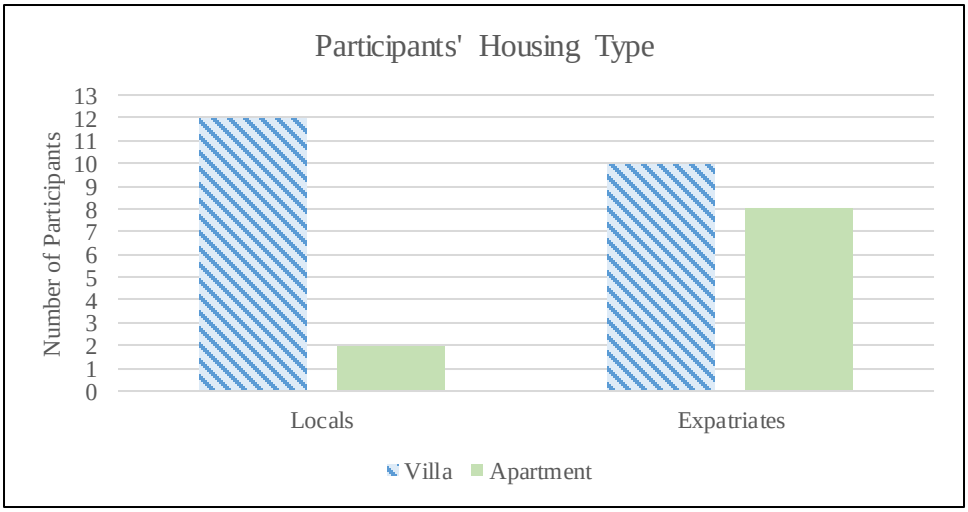


Figure 22: The Type of Participants' Houses

The date of construction of the house was also considered given its prospective critical impact, given the late implementation of the building energy codes. As highlighted in Chapter 2 (Section 2.3.3), Estidama, the sustainability framework, with its mandated green building code was not introduced until 2010. The houses were distinguished as prior and post 2010 with the focus to explore any impact on occupants' comfort, practices and willingness to reduce energy usage. Hence, 23 of the study participants were living in houses that were constructed prior to 2010 while 9 participants were living in relatively newly constructed houses built after 2010 (Figure 23). Table 4 summarizes the results of all study participants' characteristics and their residences.

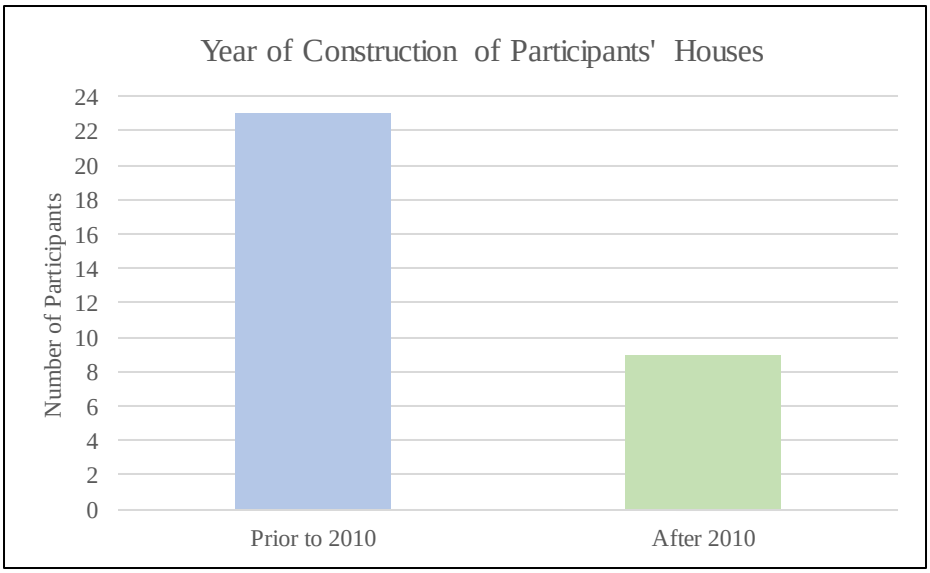


Figure 23: The Year of Construction of Participants' Houses

Table 4: Participants' General Information "Main Study Results"

Groups	Interviewees		Gender		Age				Highest Degree of Education				Level of Income					House Type		Year of Construction		House Ownership		Living Period in House				Availability of Children Under the Age of 13 Years old	
			Male	Female	< 21	21-39	40-59	> 60	Primary	High School	Bachelor Degree	Postgraduate	No Income	< 10 K	10 -20 K	20 -30 K	> 30 K	Apartment	Villa	Prior to 2010	After 2010	Owner	Renter	0-1	1-5	5-10	> 10	Yes	No
Locals	L_1	Mariam																											
	L_2	Ahmed																											
	L_3	Meera																											
	L_4	Reem																											
	L_5	Majid																											
	L_6	Noor																											
	L_7	Ali																											
	L_8	Omar																											
	L_9	Leena																											
	L_{10}	Fatima																											
	L_{11}	Safa																											
	L_{12}	Aseel																											
	L_{13}	Hamad																											
	L_{14}	Sara																											
Expatriates	E_1	Talia																											
	E_2	Rasha																											
	E_3	Yara																											
	E_4	Deena																											
	E_5	Adam																											
	E_6	Hasan																											
	E_7	Yazan																											
	E_8	Murad																											
	E_9	Mai																											
	E_{10}	Alma																											
	E_{11}	Layan																											
	E_{12}	Haroun																											
	E_{13}	Hanna																											
	E_{14}	Tamer																											
	E_{15}	Salim																											
	E_{16}	Nasser																											
	E_{17}	Yamen																											
	E_{18}	Laila																											

3.9 Thematic Analysis

3.9.1 The Approach

One of the critical phases in any qualitative study is the data analysis (Peräkylä & Ruusuvuori, 2008). Different approaches can be used to analyze qualitative data depending on the extent of the flexibility needed in the analysis (Gibbs, 2018). According to the research objectives, gathered data about occupants' behavior, opinions, and experiences is analyzed to identify the energy-saving motivational drivers of local and expatriate housing occupants in the UAE's context. To achieve this target, the analysis process should be recursive and flexible enough to conduct in-depth data analysis and to allow for any emerging, surprising or unexpected factors (Braun & Clarke, 2006; Creswell, 2007). Since this type of study was never undertaken for the conventional housing sector in the UAE, and there is a very limited contextual data about occupants' motivation to rely on while developing the study, an analysis approach allowing to "explore" new ideas and referring mainly to the research questions and prior studies in the literature to determine the analysis flow was used. Therefore, the deductive approach was selected where the researcher examines the existing knowledge in a context where it was not previously explored as well as extends the theory to explore the impact of the unique study context while relying on the grounded theory (Gabriel, 2013) as in the case of this research. As a result, the thematic analysis approach was selected to analyze the interview data as it is a flexible approach and suits the exploratory nature of studies concerning people's experiences and opinions (Clarke & Braun, 2013). Some authors identified the thematic analysis as a research methodology (Guest et al., 2012; Joffe, 2012), but many others considered it as a conventional analytic method (Boyatzis, 1998; Weston et al., 2001;

Clarke & Braun, 2013), as it is used in this research. In this approach, the data is compiled into groups of information that are known as themes; which help interpret the results and draw conclusions (Saldaña, 2016a). The thematic analysis primarily consists of familiarization with the data, theme building guide, and theme definition (Braun & Clarke, 2006). The thematic analysis depends mainly on the researcher's discernment and opinion on what is important in answering the research questions (Peterson, 2017). This process is very critical where the researcher has to be very careful in deciding what to code and which codes to use; otherwise, it will be highly subjective (Joffe & Yardley, 2004). This research attempts to apply the thematic analysis with a strong belief on the grounded theory provided by the specialized literature findings.

3.9.2 Application of Thematic Analysis Procedure

There is no one specific perfect way to analyze interview data (Weston et al., 2001). Thematic analysis can be done manually or with specialized electronic software (Joffe, 2012). The selection depends on the size of the study and the allocated time. Saldaña (2016a) states that data analysis software is an invaluable tool and beneficial for analyzing the qualitative data, particularly when a large amount of collected data is involved. However, these tools do not actually code the data, but rather organize and manage it for the researcher to code. Besides, with the researcher coding the data manually, usually the right codes are devised as the researcher is the person who conducted the interviews, owns the work, and has control over it (Saldaña, 2016a). In this study, the sample size (32 participants for SSI) is neither small nor large. Hence, the collected data for this research was coded and analyzed manually by the researcher.

3.9.2.1 Theme Building Guide

The theoretical framework developed based on the body of literature (Chapter 2, Figure 12) formed the foundation for the coding procedure of the interview data while keeping the process flexible for new emerging codes. Undertaking thematic analysis and the steps followed in this research were done relying on the guidance offered by Saldaña (2016b) and Clarke and Braun (2013). To ensure a successful thematic analysis, the process has to start with the researcher being very well familiar with the data collected. Listening to the audio recordings and reading the transcripts more than once would let the researcher immerse him/herself in the data. Through the thematic analysis process, the gathered data is examined and coded to identify the themes that feed into answering the research questions. Pre-coding procedure was used before starting the main coding process for the purpose of guiding the generation of the codes. In this preliminary analytical process, the relevant interview quotes in the transcripts were highlighted and the extracts that are very related and important for the data analysis were bolded. Figure 24 presents an example of pre-coded text taken from an interview transcript conducted with an expat interviewee.

Interviewee:

The house owner did not raise the rent from three years when we moved to this house…If I **own** the house that I am living in, I will **put money to solve the issue** of the AC system, so I feel **comfortable** and I **save on electricity bills** at the same time. But if I do not own it as in my current situation, **I will not pay a lot of money** to solve it and then **after few years I change the house**. If I put money on the house defects and issues, I have to do that because **I will stay in it** and it has to be **my own house**.

Figure 24: Example of Pre-coded Text Taken from the Interview Transcript

This preliminary phase facilitated the coding process by keeping the researcher's focus on the information relevant to the study while putting aside the unrelated data that may have been addressed by the participant, but deemed irrelevant to the study objectives. After that, the coding procedure was applied on all interview transcripts. In this process, interview data was reduced by referring to the data of relevance with meaningful phrases or words that simply represent the meaning of the data extracts. These words or short phrases are called codes. The process of generating the codes was based first, on the research questions where the decision was made according to what is intended to be explored and what should be answered at the end of the research and second, on the identified factors from literature. There are different ways to name the codes; either use the same term that the interviewee said "Vivo Code" or refer to the data extract with a word representing the main topic "Descriptive Code". In either case, the word should summarize and represent the idea of the quote. In this study, the codes were named using both ways. Indeed, identified relevant codes from the literature had an impact on the codes naming as the reviewed previous studies examined a similar topic in other contexts with different conditions.

To ensure the quality and effectiveness of the generated codes, the coding procedure of all transcripts was reviewed three times. In the first round, all the collected data was checked to ensure the coding of all relevant data. The second round was performed to review the codes and ensure selecting the most suitable codes to represent the ideas of the quotes. In this study, Bazeley (2007) was referred to, as he suggested, comparing the coded texts with each other to maximize the potential of identifying all ideas. Therefore, in the third round, the coded transcripts were compared, codes were filtered and duplicates of the same idea were removed. Table 5 illustrates an example of the coding process of a text from an interview transcript. As

shown in this table, each idea in the interviewee's quotes is signified by a phrase. To distinguish the codes and link them to the right quotes, each code is symbolized with a small number that is placed directly before the quote that represents it.

Table 5: Coding Procedure of Interview Transcript

Interviewee's Response (From the Transcript)	Codes
"[1] There is one controller for the AC system that is shared between my bedroom and my brother's bedroom. [2] My brother feels hot very quickly and I'm completely the opposite …"	[1] Occupants' Inability to Control Systems [2] Occupants' Comfort and Satisfaction

The same procedure was applied to all 32 transcripts. As a result, 29 codes were identified. Due to the large volume of interview transcripts and since the same procedure was followed with all the collected data, Table 6 presents all codes, along their meaning and examples of coded quotes from the interview transcripts for each of the identified codes.

Table 6: Emerging codes, Meaning and Examples from Interview Transcripts

Codes	Definition of Codes	Examples of Quotes from Interview Transcripts Fitting into the Code
Energy cost	Residential tariffs for electricity consumption in the UAE.	*"When the price increased, I feel it became really expensive…"* [Tamer, expat]
Incentives	Getting rewards, and/or benefits in exchange for a change in the house or behavior.	*"I did not know that there is such a program. But, I think it's interesting and useful and I would like to know more details."* [Sara, local]

Table 6: Emerging codes, Meaning and Examples from Interview Transcripts (Continued)

Codes	Definition of Codes	Examples of Quotes from Interview Transcripts Fitting into the Code
Fines	A financial penalty paid by the participant for purchasing inefficient products.	*"Fines could be an effective strategy as it will mandatory…"* [Hasan, local]
Home ownership	Owning the house that the participant lives in.	*"I will not change in a house that is not my own and I may leave it for any reason."* [Alma, expat]
Cost of products	The initial price to be paid when purchasing a product.	*"Any change in the house or purchasing any efficient product requires a lot of money as these products are expensive."* [Nasser, expat]
Occupant's income	Participants' monthly salary.	*"Most of the monthly income goes for the house rent and utility bills."* [Adam, expat]
House type	The type of house the participant lives in, either an apartment or villa.	*"The utility bills in our current house (villa) are more expensive than the previous one (Apartment)."*[Hanna, expat]
House design and construction	The design of house spaces, components and systems.	*"In one of the rooms, we turn on the AC although no one stays in it because it is a closed space. We use it as storage but we have to turn on the AC even for a short time."* [Laila, expat]
House age	The year of house construction where the participant lives in (prior to 2010/after 2010).	*"My father built a large house long time ago. The house became old … the AC in my bedroom is noisy and takes a long time to cool the room."* [Aseel, local]
Level of education	The highest education level attained by the participant.	*"I keep the AC on in the living room when we travel…"* [Yara, expat]

Table 6: Emerging codes, Meaning and Examples from Interview Transcripts (Continued)

Codes	Definition of Codes	Examples of Quotes from Interview Transcripts Fitting into the Code
Field of study	The study area/major of the participants which may affect their consciousness about the environmental issues and the negative effect of energy over-usage on the environment.	*"I know from my study how people through their actions can harm the environment."* [Fatima, local]
Lack of awareness of efficient practices	Participant's lack of knowledge on how to save energy and what are the efficient practices that will make significant reduction in energy consumption.	*"We had a problem in the guest room where sunrays directly enter the room and it was very hot most of the day. We did not want to close the curtains during the day for the light. So we turn on the AC in this room most of the day to stay cool."* [Reem, local]
Marketing campaigns	A series of campaigns to promote energy-efficient products and encourage efficient practices through TV, radio, street panels, etc.	*"I do not know about any campaigns except the ones that ask to reduce the usage to save on the bills but I do not exactly know how."* [Yazan, expat]
Social media	Raising occupants' awareness about the importance and how to save energy in their houses through influencers on social media platforms.	*"I suggest to use Instagram that can influence many people."* [Haroun, expat]
Occupants' comfort and satisfaction	The participant's level of comfort (thermal/visual) in which he/she feels satisfied with the indoor environment.	*"I feel hot very quickly; I cannot stay in the room without turning on the AC, particularly in summer."* [Hanna, expat]

Table 6: Emerging codes, Meaning and Examples from Interview Transcripts (Continued)

Codes	Definition of Codes	Examples of Quotes from Interview Transcripts Fitting into the Code
Climatic conditions	The conditions in which the UAE's weather is characterized by in terms of temperature, humidity, etc.	*"The weather in the UAE is very hot. In summer there is no way to stay in the room without turning on the AC, although I am a kind of person that feels cold quickly."* [Safa, local]
Occupants' inability to control systems	Participant's inability to control the temperature and light level in all house spaces separately.	*"There is one AC controller for the two rooms…this is not efficient at all because each one feels comfort at different temperature."* [Salim, expat]
Systems quality	The quality and effectiveness of house systems and fixtures.	*"The AC in the living room is very annoying, even sometimes we cannot hear the sound of the TV well."* [Haroun, expat]
Sense of responsibility	The participant takes the responsibility by observing his/her daily practices and trying to behave pro-environmentally as he/she feels responsible towards him/herself, other people and the environment.	*"The new generation is not responsible as they have to be, they do not care about reducing the usage…"* [Hasan, expat]
Locus of control	The participants' feeling that they can make a significant change on the situation and on others through their practices.	*"The issue is not limited to one house … My simple daily practices can make a huge effect on other people's lives."* [Rasha, expat]
Emotional involvement	The involvement of emotions and its effect on the participant's thoughts, values, and behavior.	*"I really feel sad for people that do not have water and electricity ... I do not know if we can help them by reducing the usage but I am trying."* [Adam, expat]

Table 6: Emerging codes, Meaning and Examples from Interview Transcripts (Continued)

Codes	Definition of Codes	Examples of Quotes from Interview Transcripts Fitting into the Code
Religion	The effect of religious teachings on the participant's values, beliefs and behavior.	*"Wasting electricity and water without the need for them does not comply with the teachings of the religion."* [Majid, local]
Social image	Caring about others' reactions and what they would think about their practices.	*"I will not replace the appliance with another one because it is cheap. Maybe it is good but what will people think if I replace the non-defective appliance with a cheaper one for no reason."* [Safa, local]
Social network	The influence of family, friends and people in the surrounding living environment on their behavior and willingness to save.	*"My relatives and friends are doing the same."* [Leena, local]
Culture	The beliefs, customs and traditions that may affect the participant's lifestyle, actions and willingness to change behavior and save energy which differ among countries and even differ among social groups and generations.	*"For years, we live together as a family in one house. So, even if I want to save, it is very difficult, we are many…"* [Ahmed, local]
House Size	The number and size of house spaces.	*"Each one of my sisters has a room and we all need to use the AC … now when I think about it, if we were staying together in the same room, we would use just one AC rather than staying in three rooms and using three ACs…"* [Mariam, local]

Table 6: Emerging codes, Meaning and Examples from Interview Transcripts (Continued)

Codes	Definition of Codes	Examples of Quotes from Interview Transcripts Fitting into the Code
House occupancy	The occupancy pattern and the number of occupants living in the house.	*"When we travel in the summer vacation for around one or two months, the bills became very minimal because we just leave the refrigerator on to save any food left that does not rot quickly…"* [Tamer, expat]
Habituation	A practice that the participant gets used to it and it became a habit where it is difficult to change.	*"… sometimes I feel guilty but I get used to do that."* [Yazan, expat]
Adaptation	Being able to adapt to the issues and defects of the house as well as adapt to the local policies and prices.	*"… I wish if I can control the AC as I want and as I need but I get used to it … we get used to pay this amount of money for the bills for this month."* [Layan, expat]

3.9.2.2 Defining Themes

Defining themes does not mean they are hidden within the data and will be discovered by the researcher; rather, they are identified by the researcher (Braun & Clarke, 2006). Themes are constructed by grouping and categorizing the generated codes. According to the guidelines and recommendations offered by Saldaña (2016b) for applying the thematic analysis, the constructed themes have to be clear, easy to understand, and explicitly present their intended meaning. After their identification through the coding procedure, the codes were grouped based on their central concept. To ensure all themes were coherent with their central concept and addressed the

research questions, the grouping of codes into themes was carried and reviewed several times. As a result, three main themes emerged out of the 29 codes and can be best labeled as: 1. Policies and Financial Factors, 2. Occupants' Level of Awareness, and 3. Values and Beliefs. The resulting themes from the thematic analysis were different to some extend from the identified themes in the theoretical framework developed from the literature (Figure 12). This is the result of the emerging codes that fit best into these three main themes based on the link between them and the hierarchy of importance of themes in the study context.

Even though codes were categorized to identify these themes, there were several inter-connections among some of them, where common codes were shared by two or all three main themes. Figure 25 presents the conceptual framework that resulted from the thematic analysis. This thematic scheme includes the codes extracted from the interview data and grouped under the three main themes along the shared ones across themes. The shared codes among the themes are shown in the intersection areas in the code to theme model (Figure 25).

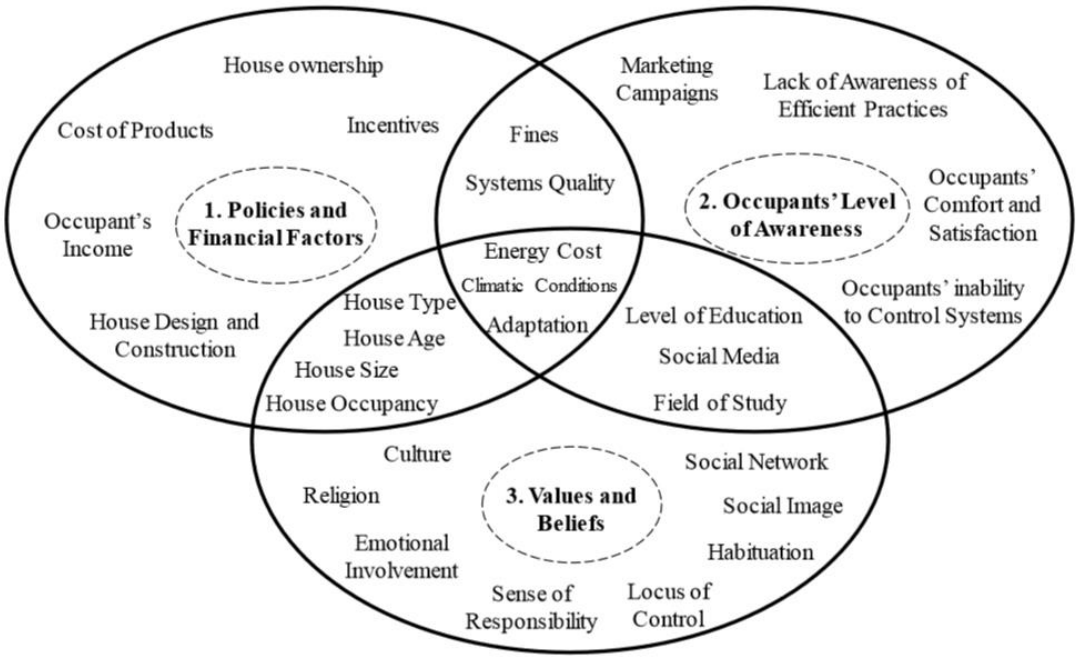


Figure 25: Conceptual Framework (Thematic Scheme Based on the Interview Data)

3.10 Conclusion

The research design rationale, the data collection procedure and the thematic analysis of the interview data along its procedure and results form the core of this Chapter. The data collection was done in three stages: informal conversational interviews, pilot tests and semi-structured interviews. Participants' selection adhered to specific criteria to include locals and expatriates from different age groups, gender, level of education, field of study, income and living in different house types. As a result, this enabled to validate the factors extracted from literature (theoretical framework) in the context of the UAE while specific contextual ones emerged. The thematic analysis of the interview data helped identify the codes and develop the themes. Three main themes emerged comprising 29 codes and would be best labeled as "policies and financial factors", "occupants' level of awareness", and "values and beliefs". The generated codes connect and interdependently interact in multiple ways

where some codes are shared among two or the three themes. The next Chapter presents, with these results in mind, the interpretation and discussion in relation to the research questions, together with the support of the background studies.

Chapter 4: Interpretation and Discussion

4.1 Introduction

This Chapter aims to comprehend the factors that drive local and expatriate housing occupants' practices and behavior in relation to their energy usage as well as unveil their potential motivational drivers to reduce such usage in the UAE. For this purpose, the Chapter in its first part, presents a critical interpretation of the study findings and discusses their meaning in view of the related literature. In its second part, it discusses the study's main findings with the target to answer the research questions, particularly on the factors that either motivate or prevent housing occupants from saving energy in the UAE in addition to contextually-specific factors. It also reviews the subtle differences in motivational drivers and obstacles as perceived by local and expatriate occupants. Finally, the Chapter concludes with a highlight on the contribution of this research to the general discourse on motivations for energy savings, through the validation of the common factors that align to the theoretical framework, while underlying the specific contextual ones.

4.2 Interpretation of Interview Results

The aim of this section is to interpret the study findings to understand the forces that shape occupants' behavior towards energy-saving, and provide a probable explanation behind the noted differences in motivational determinants between local and expatriate groups. This process was done based on the thematic analysis elaborated in Chapter 3 (Section 3.9). As a first general observation, the findings revealed that some influential factors seem to act as motivational drivers by having a positive impact on energy-saving motivation for one or both participant groups, whereas other factors

seem to act as obstacles for one or both participant groups, as discussed next. Although many of the generated codes (i.e. motivational drivers and obstacles) are interconnected they however, seemed to be best grouped into three main themes: "1. Policies and Financial Factors"; "2. Occupants' Level of Awareness"; and "3. Values and Beliefs" as already identified in Chapter 3 (Section 3.9.2.2). The next three sections present the interpretation of the findings according to these three emerged themes.

4.2.1 Theme 1: Policies and Financial Factors

The policies and financial factors appeared to be highly important for most of the participants from both groups, but somewhat in a differentiated manner. They highlighted the direct and indirect effects of the policies and regulations imposed in the study context in addition to the financial factors as they were addressed in many of the participants' responses. Figure 26 presents the codes emerged within this theme as per their weight and frequency of occurrence, while the frequency chart (Figure 27) illustrates the number of participants from both groups commented on each code.

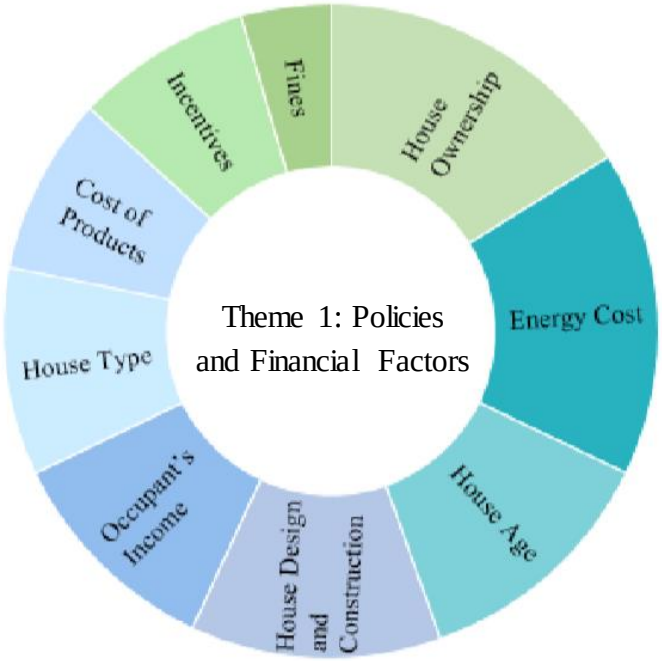


Figure 26: Codes within Theme 1; Policies and Financial Factors

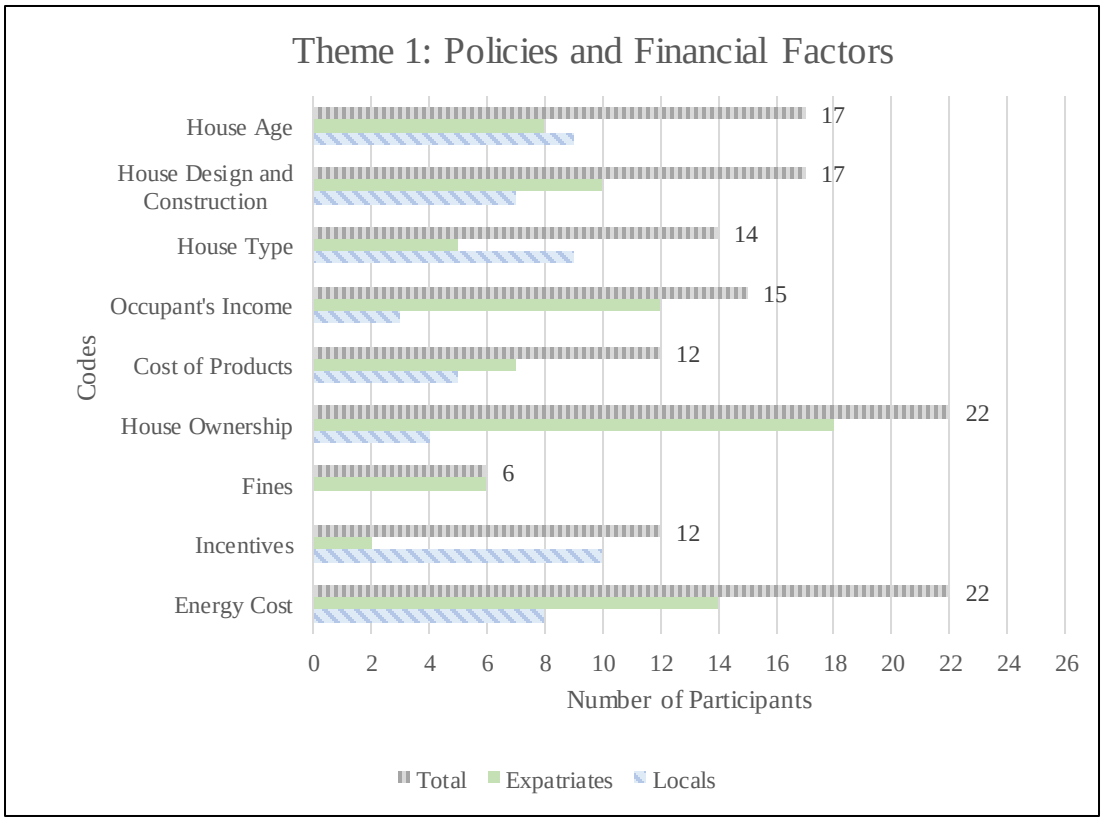


Figure 27: Number of Local and Expatriate Participants (out of 32) Commented on Each Code in Theme 1

Energy cost and house ownership were found to be the most important and impactful factors driving participants' behavior and motivation as their impact was expressed by most of the participants. Energy cost is the first most addressed factor by both participants' groups. Most of the expat participants (over two thirds) and slightly over half of the locals have expressed the high impact of the energy cost on determining their actions. However, both groups have different perspectives towards energy cost. All local interviewees who have addressed the energy price as a driver stressed the current compulsory payment of utility bills. In the past, electricity and water were offered for free to all locals, then, regulations have changed and forced local residents to pay at a still subsidized cost. Since 2017, the energy cost increased by 34% for locals, but this seems to have triggered an immediate awareness in energy cost and consequently usage as further highlighted by a local participant, Hamad:

"We were not caring much about how much we used, but now, we have to pay for the bills, we have to consider that. After the price has increased, it became kind of expensive." [Hamad, local]

Comparatively, most of the expat interviewees were aware of the significant increase in energy rates for all residents since its increase in 2017, as mentioned by Alma:

"We spend a lot of money on the bills. We are living in this house from 9 years…I do not remember my father was complaining about our usage or the bills, whether in this house or the previous one. But after the increase in the electricity and water price before 3 or 4 years, he started asking us to be careful about how much we use…He always says it became expensive and the bills are high. So, we as a family always try to make sure to turn off all electrical plugs, lights and the AC." [Alma, expat]

Similarly, several interviewees gave comparable practices used to reduce utility bills, such as turning off the AC when leaving the room. These reactions seem to provide an evidence of the impact and effectiveness of the increased cost policy on

occupants' energy-related behavior. While the energy cost motivates occupants to reduce the consumption, the extent of its impact seems to differ between the two groups, most probably due to the difference in the levels of income and the differentiated energy tariffs. An expat, Hanna confirmed this sentiment when she stated:

"I came to the UAE 12 years ago…My income is not very high but still good. But the problem is that the electricity and water bills eat up a lot of the income. I have to be careful in my consumption…" [Hanna, expat]

Generally, expats have a monthly income lower than that of the locals. In addition, independently of the amount of energy used, both groups are billed differently, where the tariff applied on expats' bills is almost four times higher than that of the locals. Therefore, high energy cost has a much higher incentive for expats to save money and energy than for the locals.

On the other hand, more insight into the interviewees' characteristics shows that the participants who raised the issue of energy cost are the ones responsible for paying the utility bills. This finding indicates that the occupants who do not pay their bills maybe totally lacking awareness of the incurred cost.

The significant effect of the energy cost does not mean that all interviewees accepted or were willing to accept the offered incentives towards saving on utility bills. Most of the participants from both groups were not aware of the existence of the incentives related to energy conservation behavior, efficient house renovations as well as the monetary incentives, such as the difference in the applied tariffs depending on the usage where occupants pay the tariff if the usage is below a certain level (green band allowance) and it increases if the usage exceeds the recommended level (within the red band allowance), as presented in Chapter 2 (Section 2.3.3). Additionally, other

incentives include discounts on bills when investing in efficient air conditioning. "Saving Energy and Water at Home" initiative and "Sustainable Energy at the Venues", presented in Section 2.3.3, were designed to provide simple and brief information about some of the available incentives to report their opinions. Regardless of their knowledge of the available financial and non-financial incentives, most of the local interviewees (approximately three quarters) seemed to be interested in the incentives and local programs aimed to reduce energy usage and incidentally utility bills. Particularly, they expressed a strong motivation into incentives for house renovations, improvements, and technological solutions if the payback period of investments is short. Incentives are perceived as unique opportunities for local residents to encourage energy-saving. By contrast, most of the expat interviewees commented negatively. For instance, an expat participant suggested that applying fines on purchasing inefficient products would be a more effective strategy than providing incentives to achieve significant reduction in energy consumption. The study noted a striking difference on this issue between local and expat interviewees' opinions. Some of the expat participants (around a third) agreed on the potential positive impact of applying fines, as they believe that this strategy would enforce energy-saving as consumers naturally tend to avoid paying fines by committing to the regulations. On the other hand, none of the local interviewees supported the idea of applying fines but rather highly supported the idea of incentives. The general locals' point of view is that providing incentives is an option which raises the willingness to save energy based on an actual desire rather than paying fines for non-conformance. In addition, local interviewees believe that the governmental incentives to improve home energy efficiency will have long-term benefits. The difference in both groups' opinions is mainly because home ownership for expats is very limited. Legally, expats' ownership

is both limited in time and restricted to certain areas of the country as presented in detail in Chapter 2 (Section 2.5.3). As a result, most expat residents are renters. Expats as renters, do not have the power to make a decision for major changes in the house. One of the expat interviewees mentioned:

"I'm not living in this house permanently. I will not make changes in a house that I may leave at any time. I prefer to move on to another house rather than spend a lot of money on changes in a house that I do not own." [Yazan, expat]

This opinion was further reinforced by another expat interviewee:

"I do not think I will make a remarkable change in the house one day. Even if I heard about a system that will make me save money, the authority that I can change in the house as a renter is very limited. Honestly, even if it was permissible, I do not think I will change." [Tamer, expat]

Home ownership was emphasized as an obstacle to perform house improvements in most interviews with expatriates. These findings indicate the home ownership as the most impactful obstacle for expat participants' motivation to invest in energy-efficiency solutions. Expat participants expressed unwillingness to make home improvements, such as replacing an inefficient system or purchasing an energy-saving appliance while restricted by a non-permanent residency. In fact, local regulations state that expats' residency in the country is directly linked to employment, investment in a business or owning a property with no possible permanent residency and, therefore, their stay in their homes may be unpredictable. In contrast, home ownership was identified by local participants as a high motivator to accept the offered incentives, make nominal changes and achieve savings over the long run, as stressed by a citizen, Sara:

"This is our house, any change or improvement we do in the house, at the end we will be the beneficiary so why not." [Sara, local]

This was in fact an expected outcome. Even though several local participants agreed to undertake the changes in their houses and the expats agreed on the minor basic changes, not all kinds of changes have been agreed upon. Approximately an equal number of participants from both groups addressed the comparatively high cost of the energy-efficient products. According to the expat interviewees' responses, only people with moderate to high income can afford the energy-efficient products and may prefer the option. Such difficulty was well expressed by Yamen:

"In my opinion, it is not an easy decision to purchase products that save energy. For example, I cannot always select the very good products that save energy over the other ones because they are much more expensive." [Yamen, expat]

Abundant in the same sense, another expat, Rasha shared her experience of purchasing an efficient product and observed:

"One day I heard about a washing machine that does not consume a lot of water and electricity…I went to the market to buy it; it's price was almost triple the price of the other products. I think these products are made only for rich people." [Rasha, expat]

According to the expats' responses, it appears that the long-term savings of the operational cost are not taken into consideration. This could be linked to the uncertainty in their length of stay and temporary residency.

Interestingly enough, the house type (i.e. a villa or an apartment) was reported as a factor with a possible effect on occupants' practices. Although the participants' official utility bills were not part of the data collection process, but roughly, participants who live in apartments have lower utility bills compared to the villas. Nonetheless, they expressed higher motivation in energy-savings. There are three main reasons that may explain the low cost and higher motivation of participants living in apartments. Firstly, the difference in the energy cost for different dwelling types, apartments and villas as presented in Chapter 2 (Section 2.3.3). In the UAE, the amount

of money spent on utility bills is not only determined based on the energy usage and local citizenship, but also based on the type of property the occupants live in. According to Abu Dhabi Distribution Company (ADDC), the green band allowance for energy usage differs among both housing types hence, affects the tariffs applied on utility bills (ADDC, 2020). Secondly, villas are usually more directly exposed to sun than apartments; therefore, the energy consumption is likely to be higher than in apartments. The large house area directly exposed to sun, particularly in a country where temperatures can reach up to 50˚C, is most likely a challenge for them to reduce the Air Conditioning load and increase savings which may explain the higher cost and less motivation of occupants living in villas.

Lastly, a correlation was found between occupant's income, house type and energy-saving motivation. By comparing the rental rates and participants' income, occupants who live in apartments usually have lower levels of income than those living in a villa which seems to be a reason for their willingness to positively change their behavior to save on utility bills. To confirm that, most of the participants with a monthly income of less than 10,000 AED have stated making changes to reduce utility bills such as turning on water heaters just one hour before the use and keep a high set temperature on AC. It should also be noted that this income bracket group appeared to be the foremost willing group to make further changes in energy usage habits. Conversely, participants that have a monthly income equal or more than 30,000 AED seemed to be the least interested group in behavioral changes and energy-saving measures. This difference is consistent with Trotta's (2018) study that showed that households living in a flat were 21% more likely to save energy than households in detached houses (single standing with no shared walls) and terraced houses (with a shared wall on both sides), because they usually have lower levels of income.

However, these findings are in contradiction with Mortensen et al. (2016) who argued that other reasons explain high-income residents' high interest in energy savings than others.

Furthermore, several participants raised issues related to the house design. The design of the interior layout, components and openings can play a significant role in reducing occupants' desire and ability to save energy. Negative comments on issues related to house design, interior layout and mechanical systems were addressed almost equally by local and expat participants. Mariam, a local interviewee, expressed some of the challenges:

"In one of the rooms, I turn on the AC even if it is not occupied to refresh the air because there is no window in that room. I know how much over-usage does harm the environment, sometimes I feel guilty for leaving the AC on when I am not in the room, but it's a very closed space. This room was not designed to be used daily but then I decided to make it an additional dressing room." [Mariam, local]

Similar issues were shared by a number of interviewees from both groups. For instance, an expat, Murad provided another example of inefficient design that affected his behavior:

"I am living in this house from years but I may change it next year. I hate the living room. There are two large windows from the floor to the ceiling. Even though, we have thick curtains in that room but it's still very hot. In summer, if the AC is turned off, it's like an oven." [Murad, expat]

However, almost half of all interviewees did not refer to any house design issues. A finding that emerged when the house age was considered, as all participants who addressed issues in the house design and spaces lived in houses that were constructed prior to 2010. A time before building energy efficiency codes like the Estidama program were established and enforced in the Emirate of Abu Dhabi (Awadh, 2017). Similar issues were not reported by participants living in relatively

newly constructed houses due to the implementation of the program and the new regulations that compel all parties in the construction process to abide by certain minimum requirements, such as minimum U-Value for building components of the insulation envelope and glazing requirements with regard to material, glazing ratio and glare.

The above section presented the emerging codes that are best related to policies and financial factors, while the next addresses the effect of occupants' level of knowledge and awareness of their practices and energy-saving interest.

4.2.2 Theme 2: Occupants' Level of Awareness

This theme demonstrates the effect of the environmental knowledge and awareness of efficient practices on occupants' daily behavior and willingness to act and save energy. This theme consists of nine codes that are presented in Figure 28 where the size of the sections represents the weight and frequency of occurrence.

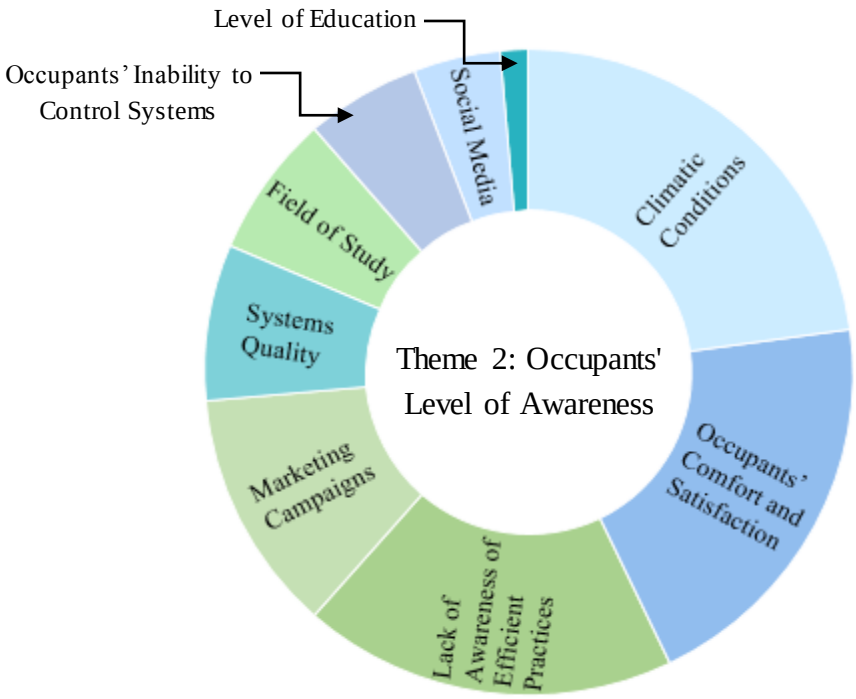


Figure 28: Codes within Theme 2; Occupants' Level of Awareness

Some factors related to this theme were addressed by almost all participants with a minimal difference in the number of participants from both groups as shown in the frequency chart (Figure 29) and as further discussed in this section.

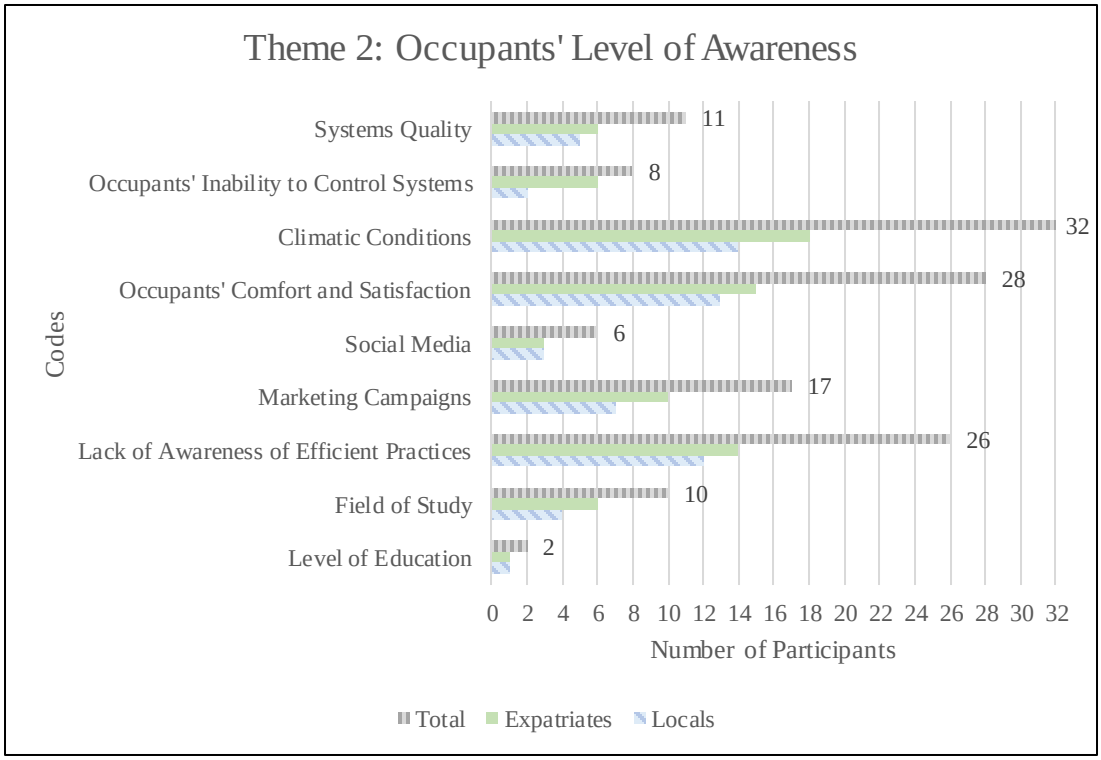


Figure 29: Number of Local and Expatriate Participants (out of 32) Commented on Each Code in Theme 2

The literature through several researches pointed to the potential of modifying occupants' behavior and increasing energy savings through raising their awareness about energy saving (Hines et al., 1987; Kollmuss & Agyeman, 2002; Masoso & Grobler, 2010). Education is one of the possible ways for occupants to acquire the necessary knowledge. While most of the participants (23 out of 32) have a university educational level of at least a bachelor's degree, only a few (10 participants) seemed to have an interest in energy-saving and concern of environmental impacts of high energy consumption. It should be noted that these participants had an educational background related to either energy efficiency and/or environmental sustainability.

This finding suggests that the education level may be limited or even irrelevant to raise environmental awareness unless it is in a related field of study. Even though, this may not necessarily translate into pro-environmentally actions or practices. For example, an expat Murad, who has a master's degree in environmental engineering, said:

"If I leave the room for just one hour, I keep the AC on…" [Murad, expat]

Although Murad's statement does not represent clear evidence as occupant's actual practices can be affected by several other influential factors such as climate, comfort and quality of systems, it provides, however, an indication that appropriate knowledge does not always lead to pro-environmental behavior when a critical factor may impact more. This was noted by reporting similar actions during the interview with this participant and others with a related field of study that revealed informed knowledge on the impact of high energy usage and its underlying negative impact on the environment.

Only few participants (6 out of 32) provided examples of environment-friendly actions and choices that they perform to increase the energy savings. For example, Mai, the only expat participant that shared a house improvement other than just changing the light bulbs, stated:

"When we moved to this house, the living room was very hot most of the time, I could feel the warm in the room, it was a problem in the summer. I remember my father added a very thin plastic layer on the window to control the heat and make the room cooler…Then, I do not remember we complained about it after this…" [Mai, expat]

On the other hand, several participants explicitly stated their knowledge of the issue, and their incapacity to solve it. This could be further explained because of the lack of awareness of energy-efficient practices. This obstacle was reported by most of the participants (more than three quarters). This result study indicates that knowing

WHAT the problem is and its causes may not be the right recipe for occupants to change behavior, but instead knowing How to behave appropriately to save energy could engender results. Besides lacking the information about possible solutions, some participants expressed misconceptions related to energy-efficient practices. A possible reason could be the inaccurate sources of information. The few participants who were aware of the efficient practices were asked about the means of getting the information about the efficiency of these practices. Campaigns and workshops related to their study and job were reported. Even so, this study noted a consensus among most of participants on the ineffectiveness of the available marketing campaigns.

"I do not know any of the campaigns. Actually, I have heard several times on the radio while I was driving about advertisements promoting something to reduce the consumption. I am not sure what type of product or action they were talking about. Honestly, I was not interested to know the details. It was kind of boring…" [Majid, local]

Several local and expat interviewees agreed on the "boring" advertisements, as literately described by "Majid". Many interviewees emphasized the unattractive awareness campaigns that do not provide details on what they may be looking for, which could be a reason for occupants' lack of awareness of the availability and the aim of these campaigns. Another possible reason could be the difficulty to obtain the detailed information. For instance, one of the expat interviewees, Laila stated:

"The consumption-related information is not clearly displayed on the product package when I usually purchase an electrical appliance." [Laila, expat]

Therefore, the difficulty in accessing the correct and right-on-target information may be one of the main obstacles that hinder occupants' motivation to acquire energy-saving knowledge. Moreover, one expat interviewee, Talia further expressed the shared incapacity to navigate the technical information:

"I don't understand the information written on the packages, it is very specialized that needs experts to understand it." [Talia, expat]

Displaying the information using technical terminologies that is not at everyone's reach, may make it difficult for unprepared occupants to acquire the needed knowledge and select the efficient products properly. Even if occupants have the intentions to save energy, it could be a time and effort consuming process to research alone the most energy efficient option. This process would likely reduce their desire for looking to the product's characteristics before purchasing it and may not consider the energy-saving as one of their criteria when looking for products.

Another possible obstacle for raising occupants' awareness is the limited visibility or outreach of the related marketing and/or awareness campaigns. This could mainly be due to the way the information is presented to residents. A very small group of three interviewees seemed to be satisfied enough with the posters and street panels, compared to a larger group of interviewees (around 14) who expressed dissatisfaction as they did not always notice the posters. Participants' opinions were obtained for suggestions to communicate the information that occupants need regarding simple and daily practices to help raise their awareness and, in turn, increase the energy savings. Social media platforms are one of the most effective ways to spread awareness and motivate people to save energy as a local, Ali stated:

"The traditional ways of delivering information to people is inefficient in this era. May be these ways were perfect in the past, but nowadays people and their interests changed. I suggest to engage Instagram influencers that can really have high influence on many people…Their effect can be easily seen, for example, when an influencer that has a huge number of fans promotes a product." [Ali, local]

The same participant when further asked about his understanding of "traditional ways", he responded: "Posters whether printed or digital". A small but

equal number (three participants) from each group suggested the usage of social media in different ways such as sharing useful and needed information through social media as well as Instagram influencers filming and sharing efficient practices that they do in their daily life to encourage others to do the same. The results demonstrated that social media could be an effective way due to their 24 hours/7 days' information loop in addition to the high effect of social media on influencing a large portion of people from different walks of life. Also, the engagement of social media influencers, through repeated involvement, may facilitate motivate, influence and maybe even persuade the public to positively alter behavior and apply the efficient practices.

The effect of occupants' awareness could be significant and ways to rise may be improved through campaigns, social media and the strategies already addressed in this section. However, it will be limited if an intrusive pro-environmental behavior leads to discomfort. It was evident that the quest to achieve a desired comfort (thermal and visual) highly and directly contributes into shaping occupants' behavior. Many of the participants' daily practices could be explained by simply responding to their body comfort. Thereby, the results clearly indicate the occupants' comfort as the foremost important factor among all other driving forces. An expat interviewee summarized the dichotomy between energy-saving and comfort as follows:

"Getting an adequate comfort level is a red line that cannot be crossed even for the sake of saving energy. I know how important it is to reduce the consumption as much as we can but I am a kind of person that feels hot very quickly. In summer, I really cannot stay a minute without turning on the AC." [Adam, expat]

Participants behave and interact with air conditioning systems to achieve an adequate comfort level which is a critical need, especially under the extremely hot climate of the UAE. Without exception, all interviewees pointed out the impact of the local climate which constrains any intent or effort to save energy. This is further

exasperated by the occupants' inability to control systems separately in each space as reported by some participants. Even though the local climate is harsh, solutions can be achieved by providing occupants the opportunity to interact and control systems as per their need, especially with the fact that each person has a different body comfort level. By doing so, occupants may achieve comfortable indoor conditions that suit the climate and their need as well as potentially reduce the excessive usage. The issue of the shared thermal controllers was raised by expat participants who constrain their control. For instance, Talia, already mentioned above gave an example that showed how the shared controller between different spaces can affect occupants' behavior and can be a source of energy waste:

"There is one controller for the AC system that is shared between my bedroom and my brother's bedroom. My brother feels hot very quickly and I'm completely the opposite. He keeps the AC turned on most of the time. So, I have to deal with the situation by adding more clothing layers as I cannot turn it off in my bedroom." [Talia, expat]

Controlling the indoor environment in each space avoids the excessive cooling and ensures an acceptable level of satisfaction for all users. The body comfort level for each occupant depends on several factors including age, health, and type of activity. These factors may explain the study finding that revealed the elderly participants' motivation for modifying practices is higher than the younger ones as well as their energy consumption which was found much less. Among the reasons invoked, is the limited use of appliances and electronic devices by the older generation. Also, it was reported that elderly participants set the AC thermostat as a temperature higher than that for younger ones. The obtained correlation between occupants' age and energy-saving motivation agrees with a number of studies. For instance, Urban and Ščasný (2012) found the older people save more energy as they invest more in efficiency and have higher concern of environmental issues. Similarly, Moula et al. (2013) concluded

that older people are more supportive for renewable energy technologies than younger ones. In contrast, Mortensen et al. (2016) reported a contradictory result as they found that younger homeowners are more interested in energy renovations. The contradiction in the results when exploring the effect of occupants' age could be related to the different objectives of these studies. As an illustration, studying the effect of the occupants' age on their willingness to save energy through adopting new technologies taking into consideration the income may lead to different findings when a study is carried with relation to the activities within the lifecycles. Furthermore, the obtained finding in this study regarding the effect of the occupants' age may be further explained due to the practices and beliefs derived from previous experiences as will be discussed next (Section 4.2.3).

Besides the inability to control systems, the impact of the climate is more exacerbated with the low quality of house systems. This issue was addressed almost equally by participants from both groups (5 locals and 6 expats) which caused them discomfort. Haroun provided an example:

"The AC in the living room is very annoying, even sometimes we cannot hear the sound of the TV well" [Haroun, expat]

Another example was provided by Aseel, a local participant:

"…the AC in my bedroom is noisy and takes a long time to cool down the room" [Aseel, local]

The low quality of systems and fixtures may not only affect the comfort and energy usage but also act as an obstacle for the motivation to modify behavior and save energy. A possible link can be formed between the issue of shared controller and low systems quality and house age as the participants who articulated these issues were living in relatively old constructions, before the compulsory building efficiency codes

were instituted. Therefore, the old houses may provide a low mechanical systems quality.

Finally, the third theme addresses the effect of values and beliefs on occupants' practices, energy-related decisions, and willingness to save energy as presented next.

4.2.3 Theme 3: Values and Beliefs

Despite the important effect of the policies and financial factors as well as the knowledge and level of awareness, the norms, occupants' values, and beliefs may also have a significant impact on shaping their behavior. There are 11 generated codes related to this theme which are presented in Figure 30 as per their weight and frequency of occurrence. There are a number of differences in the local and expat participants that have commented on the extracted codes related to this theme (Figure 31), as discussed throughout this section.

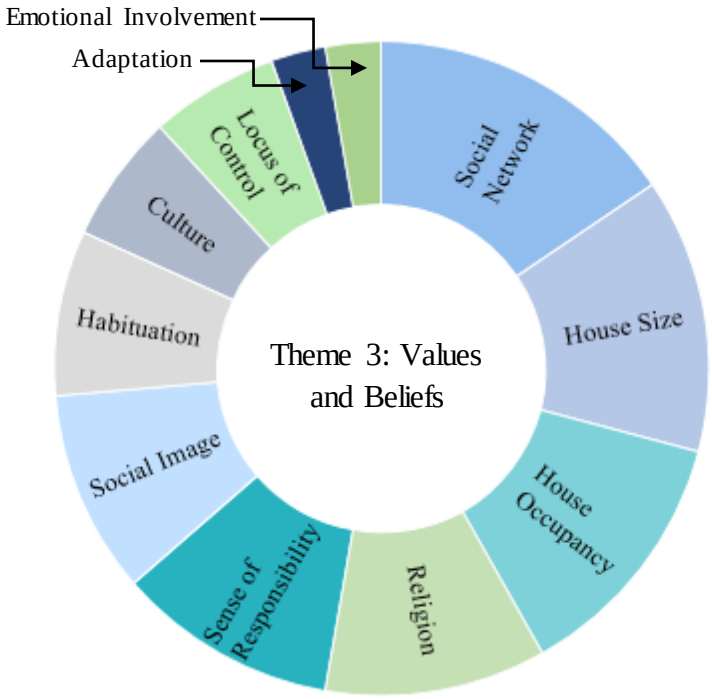


Figure 30: Codes within Theme 3; Values and Beliefs

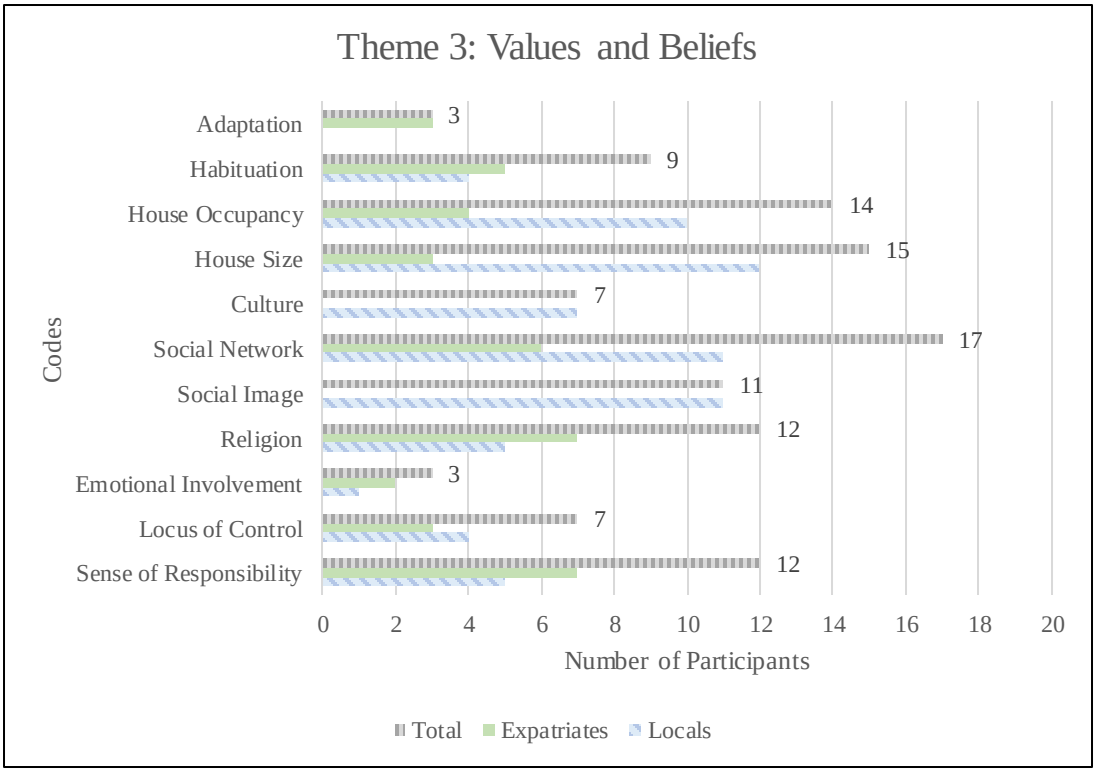


Figure 31: Number of Local and Expatriate Participants (out of 32) Commented on Each Code in Theme 3

The sense of responsibility for one's actions may influence occupants' behavior. Although it is very difficult to estimate the participants' responsibility through interviews, the participants who displayed a strong willingness to save energy in their places of residence, generally expressed a high sense of responsibility for their actions toward themselves and the families. The sense of responsibility may stem from a set of influential factors that contribute in encouraging occupants to reduce the consumption. Although it is difficult to limit this topic to specific factors, but based on the interviewees' responses, there are three possible factors that stimulated the participants' feeling of responsibility for their actions and decisions. Personal experiences, particularly previous experiences related to water and electricity

shortages, may shape occupants' values, beliefs, and condition their reactions. Hasan, an expat participant described the experience that made him act responsibly:

"When I was living in my home country, there were a lot of water problems. Water was available to everyone one day a week, and residents in each house must save water in order for it to remain available in the tank for the rest of the week…When I came to the UAE, I did not face any issue with water which I'm happy for that but I'm still responsible in my usage, the availability of water here never makes me consume more than what I need." [Hasan, expat]

Similarly, Tamer, an expat participant talked about a past experience related to electricity and water shortage which seemed to affect his view of their value and stated:

"The value of electricity and water is very great; it is essential for life. In my personal opinion, its true value is only felt by someone who has lost it or suffered with its shortage at some point." [Tamer, expat]

These representative quotes indicate that individuals with such experiences could be more responsible in their practices towards energy usage than those who did not. Another possible factor that may affect occupants' sense of responsibility is today's high living standards. Overall, despite the widespread development of education, elderly participants seemed to have higher sense of responsibility towards their actions than the younger ones and this may further explain the higher motivation of elderly that was discussed in the preceding section. A number of participants, particularly the elderly, indicated that the transformation in people's lifestyle reduced the new generations' responsibility. The rapid improvement in the country's economy (Annual Economic Report, 2019), which raises the living standards could be a reason that may affect occupants' behavior which results in the risk of growing energy consumption rates. One sixty-year old local elderly female interviewee stated:

"…Nowadays, the life is very easy compared to the past. Everyone in the new generation can get a lot of things easily and they do not even realize that…In my

opinion, I think that made me know the value of things and really appreciate their existence." [Noor, local]

The changes in the residents' lifestyle in terms of usage and high reliance on technology and electrical appliances may have well affected their perception of the value of electricity and water and their willingness to save these resources. After the shift in the country's economy and urbanization, electricity and water became largely readily available and at a low cost, grounding lifestyle in abundance. Despite the many positive aspects of this development, it may have a negative impact on occupants' perception of the importance of resources preservation. Thirdly, the upbringing environment plays role in shaping occupants' values which may drive their practices. Some participants explained their attitude and sense of responsibility by the role of parents in the children's education in environmental matters. For example,

"When I was young, my parents always asked me and my sisters to turn off the water heater when we do not need it and turn off all the lights when leaving the room and many other things. I grew up knowing that I have to do that and not doing it means I am doing something wrong." [Salim, expat]

Moreover, Deena mentioned her concern and her role as an expat mother in teaching her children on how to use systems properly without consuming energy more than needed. She stated:

"It is my responsibility. If I leave my kids to do whatever they want to do, it's not good for them so I need to raise their awareness and to make them understand that not everything comes very easily."

She also provided examples used to motivate her children to reduce the consumption:

"We have a policy in the house, if you are in the room you can open the AC but when you leave, you have to turn it off. Although managing kids is not easy…Sometimes we add penalties, they have to pay small amount of money if they leave the room without

turning it off…Also, there are constant reminders asking them to turn it off or reduce the usage."

She further added:

"We say Muhammed is the best…so his sisters get jealous and try to reduce the usage as well" [Deena, expat]

There is a strong indication of the relationship between the parents' influence and upbringing environment and its relationship with awareness and efficient practices. The potential positive effect of parents can be through embedding energy-saving related beliefs and thoughts in their children's minds which positively affect their current and future practices. This may further point out a potential relation between the presence of children in the house and energy-saving motivation. Although controlling children's practices is difficult, but their presence may motivate parents to teach and motivate them to behave properly which could be pro-environmentally as part of their responsibility as parents toward their children, as it was deduced from Deena's statements. In consistence, Mortensen et al. (2016) drew similar conclusion where they found that the energy renovations interest of families is the highest with children between 9 and 13 years old. In summary, these factors including the responsibility, parents' influence, past experiences and high living standards may not directly determine behavior but they may highly influence intentions that shape the behavior. The obtained relation with the sense of responsibility is in agreement with Kollmuss and Agyeman (2002) study that reported, while developing a framework of factors with potential impact on pro-environmental behavior, the responsibility and prioritizing the responsibilities may indirectly affect the behavior.

In addition, some participants who expressed a considerably high sense of responsibility towards their actions further indicated that their practices are not just

affecting them and their families in the house but also others. For example, Ahmed, a local stated:

"All our actions can make a difference in the world so I believe everyone has to engage to solve the problem." [Ahmed, local]

This indicates that occupants' motivation may probably come from the belief in their ability in making a change at least emotionally. Occupants' belief that they can influence the situation and their actions can make a significant change in other people's lives, the environment and the world, may be a strong trigger that motivates them to make a positive change in their behavior. This finding complies with the research carried out by Hines et al. (1987) that used the psychologist term to describe this phenomenon as "locus of control". Also, only one local and two expat participants pivoted some of their responses on emotions towards those who need energy for their daily needs but lack it. This implies that involving the emotions may also drive occupants to behave pro-environmentally in an attempt to help others. But the three participants emphasized that they have the desire to help others, if they do not compromise their comfort. Grob (1991) and Lehmann (1999) developed a relation between gender, emotions and energy saving. They indicated that women are more emotionally engaged which drives them to be more willing to change behavior and save energy than men. In contrary, this study did not show any evidence on a significant difference between both genders in terms of their energy-saving motivation. This finding agrees with Abrahamse and Steg (2009) who found no significant relation between occupants' gender and energy consumption. Ultimately, the high sense of responsibility, locus of control and emotions are interconnected factors that may have considerable impact on driving local and expat occupants' behavior and energy-saving interest.

Furthermore, some participants raised another driving factor which was not taken into consideration while exploring the study. Energy-saving is perceived by more than a third of the participants as an act prompted by religion. Religious teachings may have an effect on shaping occupants' values and beliefs. All religions encourage and call for the preservation of scarce resources and the environment. This may also be related to the moral values of people that may drive their decisions and actions. Therefore, taking these teachings and responsible social behavior as the basis for making decisions may lead occupants to use energy moderately and may positively affect their energy practices. This result predicts that occupants may get influenced by these values, which may advocate their inclusion in the awareness and energy-saving campaigns.

In addition to all of the above, normative social influence and culture can be considered as important factors and may have a powerful effect on the participants, particularly noted among the locals. Most of the local participants pointed out the impact of the society that may act, in some cases, as a barrier to behavioral changes. The surrounding people in the society may apply pressure on local participants which may lead to unsustainable practices. Many local participants expressed their interest in energy savings; however, thinking of how others might see and think about the changes whether in their behavior or replacing inefficient products may prevent them from acting to reduce the usage. For example, a local, Meera stated:

"I have to keep the AC turned on in the guest room until late evening in case any guests came to our house."

When she was asked about the reason, she added:

"What would my guests think if they came and the room is hot and uncomfortable? They may think that I am not welcoming them or I do not want them to feel comfortable in my house." [Meera, local]

Thinking about others' reactions vis-à-vis their behavioral changes, either in approval or criticism, may reduce their unwillingness to try and make a change. This result could be due to their desire to maintain a certain social image as it was indicated from the example of Meera's response. On the other hand, the results in this context indicated that social image does not seem to have any effect on expat participants. This may be valid, since expats are living outside their home country which means most of them have limited or no extended family and relatives in the host country. Therefore, the context may influence their practices as they may react differently in their home countries. Although no relation was detected between expat participants' energy-saving motivation and social image, nonetheless the social network, including friends and neighbors, may have a huge impact on both groups' motivation for behavioral changes, with a higher potential impact on locals. Social network may have a plausible effect on occupants' motivation depending mainly on others' behavior and accepted societal norms. Some local participants talked about their practices explaining that their relatives and friends are doing the same. Sara, a local, explained her approach:

"Usually, I ask my mom to turn on the AC in my bedroom one hour before returning home…I know my friends are doing the same." [Sara, local]

Similarly, another example, but from an expat this time, Yara explained her children's attitude as influenced by peers:

"My children keep the AC turned on most of the day and night. I think this is because they saw their friends doing that and they followed suit." [Yara, expat]

The two representative examples of interviewees' quotes show a potential negative effect of the social network on occupants' practices. In contrast, people may

also tend to positively change behavior if others behave pro-environmentally. For instance, Yamen, an expat who lives in an apartment in a multi-story building mentioned:

"We always turn off the lights of the outside stairs in front of our flat, everyone in the building do so…We were not doing that in the previous apartment as I think no one was caring about it." [Yamen, expat]

According to Yamen's response, they modified their behavior and started turning off the stairs' lights as it became a common practice among all those who lived in the building. This indicates that the social network may have a positive effect as well and may act as a trigger for occupants' to save energy by seeing what others do.

In addition to the extended social network and the presence of locals' families, as part of the UAE's culture, most of the local residents build their own houses where all family members live together. Usually, locals' residences consist of large spaces as the household may include several generations and alliances. Despite the many positive aspects of these traditions on social and family life, but the large spaces that are even larger than the needed for the number of occupants lead to high energy consumption which may hinder the energy-saving efforts. Most of the local participants (12 out of 14) indicated that the large house size is an obstacle for reducing the energy consumption as well as saving on utility bills. Ahmed, a local, emphasized the house size effect and suggested:

"I suggest to consider not only the house type but also the house size in determining the energy price as most of us own large houses." [Ahmed, local]

According to the excerpts presented earlier showing examples of participants leaving the AC and lights on while leaving the room, this may further stress on the high impact of the large house size and spaces that lead to high energy waste for the

local group. The extent of the impact of similar simple practices was proved by Al-Mumin et al. (2003) that showed a 39% reduction in the annual energy consumption that can be achieved just by turning off the lights when rooms are not occupied and setting the AC thermostat at 24˚C. Besides that, since the family lives, in most cases, in one large house, it is rare for it to be completely unoccupied. Therefore, energy is continuously used. This factor was raised by locals when they discussed their home occupancy and family gathering times. This may increase the difficulty of saving energy and result in a reduction in their motivation which makes house occupancy a factor with a potential high impact on their energy consumption. House occupancy factor does not seem to affect locals only; it may have a somehow subdued effect on the expats as well. The difference in the extent of the home occupancy effect could be measured because of the smaller number of occupants, in most cases, in the expat houses and the recurring non-occupancy for a period of time and during vacations during which the consumption is at its lowest level.

As presented earlier in this Chapter, socio-cultural factors may have a widespread effect on shaping occupants' actions. This condition may lead to behavioral conducts. Many participants mentioned some of their practices based on daily routine habits. These habits may have a positive or negative effect that influences occupants on the way they use and interact with home layout and mechanical systems. For example, "Nasser", who lives in an apartment, stated:

"In the morning, we always turn off the lights in the shared area between the three apartments even though we are not responsible about it and it is not included in our monthly bills…But we get used to do that every day since we lived in this house…Even our neighbors got used that we turn off the light every morning, so they don't turn it off." [Nasser, expat]

This representative quote presents an example of a habit that has a positive effect. However, most of the participants that pointed out the pattern indicated that it may apply a negative impact on their energy use. Habit-based practices can be considered as a serious impediment because changing habits is a difficult task. There may be a chance to change these habits if the misconceptions are corrected. Researchers have implied in their report "Annex 53" for the International Energy Agency (IEA) that changing occupants' habits, which are based on misconceptions, can lead to high positive effects on energy savings (Polinder et al., 2013).

Adaptation can be another side of the habit pattern that may hinder occupants' behavior and willingness to reduce the consumption. This issue was raised when expat interviewees were talking about their endurance with the low quality of fixtures and the shared controllers. Although these participants were totally dissatisfied, only three of them mentioned not shifting to another house with a better environment where the systems are of high quality and they can control each space separately. Being used to a place and able to adapt to the situation may influence the decision of the three participants. Layan, an expat, expressed this point of view by saying:

"I know it's a problem…I wish if I can control the AC as I want and as I need but I get used to it, now I can deal with that. I am living in this house from 18 years. I know many things changed and the cost increased but now we get used to pay this amount of money for the bills for this month." [Layan, expat]

Because of its low occurrence, this finding is acknowledged but may not be considered as a main obstacle with a high impact. What could be highly impactful barriers that must be taken into consideration to provide a comfortable indoor environment and avoid unnecessary increase in energy consumption are the occupants' inability to control systems and the low systems quality.

4.3 Discussion

The aim of this section is to align the study findings to answer the research questions in relationship with the literature background and the developed theoretical framework (Chapter 2, Figure 12). Thus, this section discusses the study findings to answer the following main and sub-questions:

> Main research question: What are the energy-saving motivational drivers of housing occupants in the UAE's context?
>
> Sub-question 1: What are the contextual-specific factors driving housing occupants' behavior and motivation for energy-saving in the UAE and how do they affect their practices and decisions? and
>
> Sub-question 2: Are there any differences in the energy-saving motivational drivers between local and expatriate housing occupants in the UAE?

To answer these questions, the purpose of the discussion is to highlight the factors that have crucial effect and validate the common ones that align with the factors in the theoretical framework developed based on the literature that shape and affect occupants' practices and willingness to reduce energy use likely independently from the specifics of a context. Also, the discussion aims to identify the factors that are context driven as well as the differences in the motivational drivers and obstacles among both participants' groups (i.e. locals and expats).

4.3.1 Consistent Factors Affecting Housing Occupants' Motivation for Energy-Saving

Building occupants' behavior and energy-saving motivation are intertwined in a complex web of interconnected factors. Analyzing the relationships between the

influential factors and occupants' motivation to reduce the usage is critical, first in understanding the actual occupants' behavior in buildings, and second in collecting indicators that may feed into the development of efficient strategies. The study findings indicate that generally housing occupants' motivation may be primarily grounded from their quest for comfort, financial factors, and lack of awareness in addition to the values. These indicators will be analyzed in this section.

Housing occupants' level of knowledge and awareness may well be one of the major factors driving their behavior in terms of practices and choices. Many of the occupants' efficient practices and decisions may be hindered due to their limited or lack of awareness of pro-environmental actions. It is generally accepted by many researchers that the lack of awareness may highly affect occupants' actual behavior (Hines et al., 1987; Steg, 2008; Steg et al., 2015; Li et al., 2019). They pointed out the importance of investigating effective ways to raise their awareness to achieve potential behavioral changes. However, this study did not establish a connection between education and level of awareness that may entice eco-practices.

The degree or the level of education seems to have a weak relation with occupants' awareness and practices. This was indicated by the interviewees who had a postgraduate educational level but overlooked the environmental issues and energy-efficient practices. This may be considered more effective if the study is in a related field that would provide occupants with environmental knowledge (Section 4.2.2). Although the environment-related information may raise the concern toward saving the environment, it does not, however, seem to systematically translate into pro-environmental behavior. It is acknowledged that there was a considerable debate on the effect of the environmental concern. The earliest US models (Chapter 2, Section

2.5.4) were based on a linear chain which stated that environmental knowledge leads to environmental awareness which automatically ensue pro-environmental behavior (Burgess et al., 1998). These study findings further stress the disagreement of these pioneer models that were criticized and rendered obsolete (Kollmuss & Agyeman, 2002). Even though environmental knowledge may have a limited effect but it may be enhanced by reinforcing the environmental education.

Despite the potential positive effect of the environmental awareness, it is not always enough to alter occupants' behavior. The lack of knowledge on "HOW" to save energy was identified in this study as one of the main possible reasons. This issue could be one of the main barriers for energy-saving and a main reason for the high energy consumption. This is in agreement with Masoso and Grobler (2010) where they found that energy consumed during non-occupancy (56%) is more than the occupied hours (44%) mainly due to occupants' inefficient practices such as leaving devices on when leaving the room. They concluded that there is a need for energy awareness campaigns as the energy consumption due to inefficient occupants' behavior seems to be very critical and impactful. Kang et al. (2012) confirmed the potential positive effect of campaigns as they established that residents' knowledge and behavior significantly improved after they were exposed to campaigns.

There have been numerous on-going attempts in the UAE to launch promotional campaigns on energy efficient products and practices (Aswad et al., 2013) but most of this study participants agreed on their apparent ineffectiveness. This could be due to the way the information was presented and occupants' ignorance of the availability and aim of these campaigns. Not only providing campaigns, but also putting information into effect is important to motivate people and achieve positive

results (Henryson et al., 2000; Gyberg & Palm, 2009). This finding suggests the use for more creative and impactful means and maybe slogans that may entice people change some of their practices than the presently ineffective ones. For example, improving the health and protecting the family may be more impactful than a bill reduction as Gyberg and Palm (2009) suggested that motivating people for behavioral changes can be achieved if the information appeals to health-related reasons and to save the next generation in addition to the materialistic benefits.

The lack of accessibility to information, as discovered in this study, may further limit the awareness among occupants. An example that was brought up by a participant is that it may be difficult for unprepared consumers to understand the technical and specialized terminologies documented on products' packages. A possible solution could be displaying the most important information that customers must know using accessible figures and charts highlighting the difference in the performance and consumption between products. This suggestion is in line with the recommendation provided by Bone and France (2001) on using the graphics on product packages that have a significant effect on the purchase intentions. Furthermore, hiring trained professional sellers to provide people with the sufficient information may raise their willingness to select the energy-efficient appliances.

In addition, few interviewees, mainly the young ones, came up with a suggestion to use social media platforms to promote the campaigns to provide the public at large with the on-target information. In the UAE, governmental organizations started recently using social media to promote efficient practices and services. For instance, the Department of Energy in Abu Dhabi, through the department's account on Instagram, started sharing tips and examples of efficient practices to provide people

with guidance (Department of Energy in Abu Dhabi, 2020). In September 2020, the department launched a competition "Save At Home" that calls housing occupants to share their own tips in reducing their water and electricity consumption (Figure 32). They offered a prize voucher of 1,500 AED (around 400 Dollars) to winners (Emirates News Agency, 2020). This highlights the value and effort the governmental organizations are putting in these actions for the target of raising the community's awareness. This competition is part of an awareness campaign "Use It Wisely" that was also launched on Instagram to raise people awareness on energy-efficient practices (Emirates News Agency, 2020). Today's generation reads and gets information from various digital media. Thus, this awareness campaign may meet its target whereas other initiatives may fall short in reaching audiences that do not use online media.

Figure 32: "Save At Home" Competition Announcement through a Post on Instagram

Interestingly enough, a number of interviewees implied that the main driver to behave pro-environmentally is their religious teachings. It is a religious duty and a moral value to preserve the environment and natural resources as well as not to be extravagant in usage in general of any resource. There are very few studies that have reported on this, but this result is in accordance with the findings reported by Toh et al. (2013), where they concluded that different religions affect students' perception similarly about protecting the natural resources when they studied the international students' attitude and behavior towards environment conservation in New Zealand. All religions share the same core values towards prohibiting waste, encouraging moderate

usage and saving natural resources. From a sociological perspective, consumer choices mirror their moral values and beliefs (Caruana, 2007). On another hand, a totally different conclusion was reached by Mazar and Zhong (2010) where they argued that behaving sustainably can negatively affect people's willingness to behave sustainably in future. The sentiment of having done their best to save the environment may induce some to consider themselves ethically superior, thus curtailing their future actions (Ferguson et al., 2011). However, none of the findings in this study hinted to a similar argument. This may draw a conclusion that morality and religious teachings may shape occupants' values and beliefs which may drive to efficient practices and choices, although this may need further exploration. This finding may suggest developing energy awareness campaigns that underlie a message that have a spiritual meaning and strong effect that may effectively motivate eco-friendly practices.

It should be stressed though that, regardless of the level of the awareness or any of the other identified parameters, physical comfort may be the first main factor determining occupants' actions in the study context and likely in any other context for that matter. With this observation in mind, it emerged that providing occupants with the ability to control building systems separately in each space enhances the indoor environment and maintains their individual comfort conditions. If occupants do not have the opportunity to do so, as reported by some study participants, it may directly affect their comfort (Hoes el al., 2009; Santin, 2010; Semprini et al., 2015). In addition to the enhancement of the comfort conditions, having the control most likely results in an overall reduction in the energy consumption (Semprini et al., 2015). Another incidental factor that may hinder occupants' comfort is the mechanical systems and appliances quality as well as the inefficient house design and construction quality. The study noted that if, of lower quality, it could be a strong barrier to any attempt by users

to save energy. This issue was evident with participants living in houses that were constructed prior to 2010 (Section 4.2.1). This may well be linked to the lack of building energy efficiency code prior to 2010, thus particularly exacerbating reactions in the pre-code houses (Chapter 2, Section 2.3.3). These findings shed the light on the high importance to resolve the issue. While changing behavior seems to be very difficult and may be impossible in case of uncomfortable indoor conditions, retrofitting to higher energy efficiency standards including systems' defects could be comparatively less difficult and yield more results. The systems and construction quality impact on the building efficiency is well documented in a number of studies (Yao, 2010; Yun & Steemers, 2011) and explored on case studies in the UAE context as well (Aoul et al., 2018; Khoukhi et al., 2020). In an attempt to mitigate this issue, these studies identified retrofitting opportunities and strategies whereas there is an urgent need for implementation to reduce the excessive consumption caused by the systems and building envelope defects. Establishing a regulation that enforces repairing the existing buildings may yield high savings as they constitute the dominant part of the built environment in the country. More so, just as it has been proven that sustainable houses do not have the optimal effect without energy-efficient occupants' behavior (Wilkinson et al., 2013), also the positive effect of pro-environmental behavior is limited if the house hinders the savings through its building design and construction. The next section will discuss in more details the impact of the contextual setting.

4.3.2 The Effect of the UAE's Context on Housing Occupants' Motivation for Energy-savings

Contextual specificities appeared to have a high potential impact on housing occupants' practices, decision-making, and willingness to save energy in the UAE.

The main impact of the local context seemed to be particularly related to the policies, financial and socio-cultural factors. Furthermore, an indication of the differences in the motivational drivers and barriers among both population groups in question was provided.

Home ownership could be the most critical determinant of energy saving motivation. Its impact was particularly determinant in the expat participants' responses (Section 4.2.1). The UAE's regulation limits expat residents' ownership of a property in the country, as previously documented in Chapter 2 (Section 2.5.1), which may hinder their sense of stability and belonging to the place, and therefore any investment in energy efficiency solutions. House ownership could be a main determinant of the type of behavioral change that occupants' may experience as well as the kind of incentives they may accept. As an illustration, expat participants, as renters, expressed a relatively high willingness in energy-efficient practices that do not require any house improvements. On the other hand, local participants, as homeowners, were willing to accept incentives that require energy-efficiency solutions in terms of house appliances and mechanical systems. Focusing on the same subject, and by using data from the residential energy consumption survey, Davis (2010) concluded that house ownership has a significant impact on appliance ownership patterns while controlling the other factors including income, demographics and energy prices. He affirmed that homeowners are more likely to own energy-efficient appliances than renters. A similar pattern of results was obtained by Gillingham et al. (2012) that confirmed the effect of ownership by reporting that houses occupied by owners are more likely to be insulated that the ones occupied by renters. In spite of the positive effect of the ownership on owners and comparatively negative on renters as further demonstrated by the last two studies, Ameli and Brandt (2015) found, using a survey on household environmental

behavior, that renters invest in energy-efficient appliances with a short life cycle. To some extent, Ameli and Brandt result is in accordance with this study's finding as it was evident that expats may only accept minor changes in the house such as using energy-efficient LEDs. Other than the minor changes, expats seemed to be willing to take incentives that ask for changes in behavioral actions but requiring low investment, while locals were more receptive to the idea. Although the explanation is not possible to be limited to one factor, but the uncertainty in expats' living period in the house most likely frustrates their willingness to invest in a temporary residence. Further, achieving a considerably high energy savings in the UAE would be difficult if some incentives are offered to locals only (Chapter 1, Section 1.2). Therefore, expats' engagement in the energy-efficiency strategies and incentives, with a special attention to the feasible measures that actually stimulate renters' acceptance may yield results. This is especially important as expats count for more than 80% of the total population and an assumed high share of the overall energy consumption.

The financial factors including occupants' income and energy cost, alongside home ownership, explain the kind of pro-environmental attitudes and actions that each group probably makes. The increased energy cost that was applied in the UAE in 2017 may result in raising residents' awareness of the energy use as well as motivating them to reduce consumption. Although both groups were thought motivated to save on utility bills, the study realized that locals appeared to be less stirred by the financial savings than expats. This could be because of the higher energy tariffs and relatively lower income for expats that may encourage them change behavior to save money on utility bills. The difference in the levels of income and the applied tariffs on utility bills between both groups seemed to play an important role in shaping their energy-saving motivation and likely determining their behavior. This result ties well with previous

studies implying that the lower cost leads to fewer saving (Fiorillo & Sapio, 2019; Park and Kim, 2012). For example, Azizi and Wilkinson (2015) argued that housing occupants tend to be prompted to reduce their energy usage when there is an increase in energy cost. This was acknowledged by several studies including Long's (1993), which estimated each percentage point rise in the energy cost, led to a 0.21 percentage point increase in conservation items. In agreement and in a context similar to the UAE, Al-Mumin et al. (2003) observed that Kuwaiti residents tend to leave lights on when the room is not occupied resulting in a high energy consumption, mainly because of the cheap electricity in Kuwait. In fact, the energy cost effect may be optimal only for expats who are responsible for paying the utility bills. In the UAE, some participants as home renters reported that the utility bills are included within their monthly house rent. This probably makes them less keen on energy usage as well as reduces their willingness to save energy as the amount allocated to the bills does not change with the months or the seasons. To attempt overcoming this obstacle, it is important for all residents to receive their monthly utility bills to be aware of the amount of energy they use which may motivate them to better control their energy usage.

Away from policies and regulations effect, socio-cultural factors that characterize the UAE's context played a significant role in forming the difference among local and expat housing occupants' energy-saving motivation. The culture and social climate in the study context convey, to some extent, how building occupants behave in everyday life. The socio-cultural effect is well documented in prior studies as it shapes occupants' values and intentions which, in turn, may affect their behavior and energy-saving interest (Nolan et al., 2008; Goldstein & Cialdini, 2009; Stephenson et al., 2010; Stephenson et al., 2015). This may lead to unsustainable practices (Rajecki, 1982; Hines et al., 1987). Local culture could be one of the primary

determinants of locals' house size, in addition to other factors including income and government subsidies. The large house sizes and occupancy schedules most likely result in high energy consumption but does not seem to motivate the occupants to save energy. This finding contradicts Mortensen et al. (2016) result that showed residents with high yearly income, owning usually large homes, have a strong willingness to save. The contradiction in both studies' findings could be due to the severe peer pressure that lessens local occupants' willingness to behave pro-environmentally. On the other hand, and comparing to locals, the occupancy pattern seemed to be an opportunity rather than a barrier for expats to minimize the energy use as most of them reported house vacancy for a period. Indeed, this is in case of proper usage of systems and appliances such as turning off lights and ACs as well as unplugging the electrical devices before leaving the house. Otherwise, they might not benefit from the non-occupancy hours to reach to high potential savings.

In addition to the challenge within the local occupants' houses, the society may perform pressure regarding behavioral changes. Peer influences from others' expectations and reactions toward the changes in behavior seemed to be a main barrier for local participants' motivation to modify practices. This seems to be triggered by a high peer-pressure to showcase and or preserve a certain social status. Although the social image factor may impact only locals, but social network, including friends and neighbors, appeared to contribute to shape both groups' intentions and behavior. This was evident when both groups described their practices as a norm in the local context. Some participants expressed their inefficient practices because of seeing others doing the same. It is possible to take advantage of the significant social influence in the given context to lessen such effect and lead to positive engagements. This may well be served by the UAE leaders who carry a high influence on locals. Eco-feedback studies that

provide occupants with information regarding their previous and current energy consumption, with normative comparison may achieve energy savings that reach up to 55% (Jain et al., 2013). A local study was initiated in Abu Dhabi through experiments to assess electricity consumers' behavior after applying two different tariffs depending on the peak periods as well as receiving information about their consumption against the other participants' usage, as presented in Chapter 2 (Section 2.3.3). A significant reduction in the electricity demand was achieved mainly due to raising participants' awareness through providing them with information. It is notable that social influence may differ with the contexts due to the norms and social climates (Rabinovich et al., 2012), but a similar conclusion was reached by Peschiera et al. (2010) when they found, through comparing three study groups, the only group that reduced their electricity consumption is the one that could view the usage of others living in the building. Telling people what others do could be effective, but who they are is also important to motivate them save energy (Graffeo et al., 2015). Therefore, a frequent communication with housing occupants within the same neighborhood, comparing behaviors and informing them about positive examples of pro-environmental practices may be an effective strategy to inspire and encourage them to reach the same.

4.4 Conclusion

In this Chapter, the study findings have been interpreted and discussed in an attempt to answer the research questions. The study findings highlighted that combination of energy cost, awareness and values acts as high motivational drivers and may lead to modified practices and behavioral changes. The effect of the comfort, awareness, mechanical systems' quality and house design and construction seemed to be consistent and independent from the study context. These findings were aligned

with the existing body of literature as having a similar impact on occupants' practices and interest in energy-saving. The effect of the UAE's context was identified where the policies and financial characteristics including the energy cost, house ownership and incentives in addition to the local culture and social climate appeared to significantly shape housing occupants' practices which may also underline the differences in the motivational drivers and barriers among interviewee groups, locals and expats. The next Chapter presents the general conclusions, study limitations as well as suggestions that may open the door for further research.

Chapter 5: Conclusion

5.1 Introduction

It is widely recognized that a change in a building occupants' behavior leads to improved energy-saving and contributes to the reduction of its energy performance gap. Equally recognized is the difficulty to control and change behavior without exploring in-depth the motivational drivers and obstacles which dictate occupants' motivation and then their actions. This exploratory study was carried out for this purpose in the housing sector in the context of the UAE, through a qualitative research using semi-structured interviews to collect pertaining data to local and expatriate occupants' practices and potential factors influencing their motivation to positively modify behavior. The data collection was carried out through three phases. In Phase I, Informal Conversational Interviews (ICIs) were conducted with six housing occupants to validate the identified themes from literature (Chapter 2, Figure 12), as well as explore the applicable and emerging factors specific to the UAE's context for further exploration. Relying on the theoretical framework and the preliminary results of the ICIs, the interview protocol was developed. In Phase II, the protocol was tested through a pilot study that was carried out with six participants. After identifying the shortcomings, solving the issues and ensuring a proper design of the protocol, it was used to collect the data until saturation which resulted on 32 participants through Semi-Structured Interviews (SSIs). The thematic analysis of the interview data indicated that housing occupants' motivation is driven by a framework of interrelated and connected factors that may shape the actual practices and decisions towards energy-saving.

This Chapter presents some general findings that contribute to the existing body of literature and some findings contextually grounded, through understanding the

possible reasons for the current behavioral pattern as well as interpreting a set of motivational drivers and emerged obstacles that may shape either way the occupants' behavior or practices. The study findings helped provide indicators which, in turn, may be translated into effective behavior change strategies. However, this study does not claim to be comprehensive, or indeed lead to eco-friendly practices, but recognizes the urgent need to resolve the issue at hand through further research that would consider this study's own limitations as well.

5.2 Research Limitations and Challenges

These study findings similar to any research are restrained by a number of limitations related to the research method and the study characteristics. First, collecting data using interviews may introduce some limitations. In-person, semi-structured interviews were an effective method to collect in-depth data and allow for probing questions; however, the interviewees' responses might have been influenced by the researcher's presence. In addition, part of the collected data was based on the interviewees' opinions with; therefore, no guarantee of non-biased and accurate answers. Another issue whenever dealing with the human character is the pretension of the interviewees to appear as an energy-conscious individual. To limit these constraints, all interviewees were assured of a complete anonymity throughout the research stages from data collection, analysis to results reporting. In addition, the researcher was keen to avoid any judgment or express personal opinion on any question or response. To add to their comfort level, participants were given the option to select the interview location, either at home or workplace.

Second, the collected data regarding occupants' usage of systems and spaces could not be effectively monitored. However, even though monitors were not used,

follow-up questions were asked as needed to obtain real life data that would minimize the risk of misinformation.

Third, although the study sample was heterogonous, it may not represent all the diverse expatriates' nationalities. The expats in the city of Al Ain may not be as diverse as in the larger metropolises like Dubai and Abu Dhabi; therefore, the diversity in the expats' communities, backgrounds, cultures and ethnicities may not be well represented in this study.

Finally, this study focused on single-family houses (villas/apartments) whereas other types such as workers' accommodations and shared homes were not considered. Even though, the small sampling limits its reach, this study identified indicators which could be turned into a potential material for future research to encompass population groups not presently included.

5.3 Main Findings of the Study

The exploration of occupants' motivation to save energy in their houses in the UAE resulted in several factors that may have predominant impacts on forming their behavior. These factors are mainly grounded in the local policies, financial characteristics, cognition, emotions, and contextual social and cultural determinants. Several factors appeared to have a similar effect in any context, aligning with the existing specialized literature. On the other hand, the impact of some factors seemed to differ by context resulting in differences in the motivational drivers and obstacles among the main considered population groups (i.e. locals and expatriates). The factors that most likely have a consistent effect are best labeled as; level of awareness, the quest of comfort, mechanical systems' quality and house characteristics (design and

construction), whereas the context-specific factors are related to the policies and financial aspects as well as local culture and social climate. Few other factors emerged as a separate entity but with a potential impact; morality and religious teachings, marketing through social media platforms and ability to adapt to a new environment. The following three sections summarize the study findings while answering the research questions.

5.3.1 Housing Occupants' Motivational Drivers and Obstacles for Energy-Saving

The thematic analysis of the interview transcripts indicated that housing occupants' motivation to reduce energy usage may be hindered by the quest of comfort, climate, house design and mechanical systems' quality, cost of efficient products, lack of awareness and habituation. While factors including values derived from past experiences, upbringing environment, emotions and sense of responsibility are driving forces that may raise their willingness to modify practices and behave pro-environmentally. The impact of these factors in the study context appeared to be in line with the outcomes of related studies. Therefore, they most likely have a significant effect on shaping occupants' behavior independently from the contextual conditions.

Ultimately, occupants' desire to achieve comfort (thermal and visual) appeared to be the foremost factor driving their usage and interaction with building systems. This is further exacerbated by the UAE's harsh and hot climate where temperature in summer can reach up to 50˚C. The inability to control systems separately in each room and the low quality of mechanical systems and layout design may not only lead to discomfort, but also most likely to unnecessary excessive energy consumption. Apart from the widespread effect on physical comfort, a number of interviewees pointed out the high cost of energy efficient products that seemed to hinder their willingness to

select them over the standard ones available in the market. Also, it was evident that the level of education may have a weak relation with the energy-saving motivation, unless the field of study was directly related to environmental subjects. However, and surprisingly enough, such environmental awareness did not seem to conclusively lead to efficient practices as some findings showed. The lack of sufficient and on-target information may be due to lack of accessibility as well as the ineffective current ways of presenting the information to the public. Finally, part of the participants' daily practices appeared to stem from long-established habits. Changing habits is a difficult task that seemed to prevent participants to modify behavior.

On the other hand, some participants indicated that their past experiences of electricity and water shortage as well as the significant role of parents and the upbringing environment contribute in shaping their values and beliefs and raising their sense of responsibility towards their actions, which in turn, may drive their practices and energy-related decisions. Furthermore, few participants pivoted some of their responses on emotions towards those that need electricity and water but lack it. This seemed to positively contribute in their willingness to alter behavior, particularly for participants with a belief that they have the ability to make a significant change on the situation.

5.3.2 The Contextual-Specific Factors Affecting Housing Occupants' Motivation for Energy-Saving

Contextual specificities appeared to have a high potential impact in shaping the practices and interest in energy-savings of both groups in question (i.e. locals and expats). Occupants' behavior in the UAE context may be governed by policies, financial and socio-cultural factors.

The increase in the energy cost for locals and expats since 2017, seemed to have triggered an immediate awareness in energy usage; however, locals appeared to be less stirred by the financial savings than expats because of the significant difference in the energy tariffs applied on the utility bills where the tariff applied on expats' bills is four times more than the tariff on that of the locals. In addition, the difference in income levels may also play role in shaping differently their willingness in the financial savings, as generally-speaking locals receive higher incomes than expats.

Further, the findings indicated a wide gap between both groups' interest in energy-efficient house improvements and renovations. Locals seemed to be more interested in incentives that call for house improvements and adopting energy-efficient products, whereas expats appeared to be more receptive for incentives calling for behavioral changes compared to house upgrades. This difference most likely lies with the expats' limited ownership in the country where there are restrictions in the ownership period and the geographic areas where home ownership is permitted. These factors combined with the expats' residency tied to limitative conditions with no potential for a permanent residency, could be critical determinants of the expats' energy-saving motivation.

In addition to these policies, the study realized that many participants who live in houses constructed prior to 2010, suffer from the relatively low quality of mechanical systems and house construction. The cut-off year of 2010 signifies the launch of a building energy efficiency code, Estidama, in the Emirate of Abu Dhabi.

Moreover, other factors that appeared to act as obstacles for reducing the energy use, particularly for locals, include the socio-cultural factors. As part of the Emirati culture, locals share large houses with their extended family. The large house

size, in some cases larger than the family needs, may act as an obstacle to reduce energy usage. This is further exacerbated by the occupancy pattern, where it seemed to be rare for the locals' homes to be completely unoccupied. Occupancy pattern appears to be much less impactful on expats due to the relatively smaller number of occupants, smaller house sizes and, in most cases, a higher possibility for non-occupancy for periods of time like extended travels to the home country.

Additionally, the social climate seemed to have a significant role in shaping both groups' practices through the social norms and network as some participants reported examples of inefficient everyday practices because of emulating others. On the other hand, the peer social pressure may be more impactful on locals. A reason that seemed to possibly lessen their motivation in modifications that would save energy is their desire to maintain a certain social image, whereas this factor appeared to have no apparent effect on expats. This could be due to the limited or no extended family and relatives in the country where they may behave differently in their home countries with the presence of family and extended social network.

5.3.3 Emerging Influential Factors

Few factors have been raised by the study participants during the interviews which were not taken into consideration while developing the study findings. These emerging factors are: morality and religious teachings, social media and adaptation.

Moral values and religious teachings appeared to act as instigators for eco-friendly actions as they encourage people to preserve the natural resources and protect the environment. From a different perspective, the use of social media platforms, influencers, was suggested by a number of participants as an effective mean for social

publicity of exemplary behavior to reach the public at large and raise their awareness on energy-efficient practices and products. Finally, the occupants' ability to adapt to the situation in terms of the place, energy price and house defects may affect their decision to take an action and save energy.

5.4 Thesis Contribution

It is believed that this study makes a significant contribution to the existing knowledge in the body of literature by extending the study to address the UAE's context and validating the effect of the already-known potential factors in a fast-growing, socially diverse and hot climatic context.

Furthermore, this study contributes to the global effort to better understanding of occupants' energy-related behavior at homes through providing a clear picture of the factors that may influence their motivation to reduce the energy use which, in turn, may drive their actual practices and decisions. Learning from building occupants contributes effectively to drive an agenda further through providing indicators to properly guide future actions, either at the national policy or individual levels. Using these indicators that were identified based on occupants' actual motivation, rather than assumptions, may help guide policymakers to emphasize the drivers and consider the obstacles to develop efficient strategies, measures, incentives and initiatives targeting both population entities. This is further useful in a country that considers energy-saving as one of the governmental priorities and has a strong interest in designing efficient policies to meet the ultimate national target to reduce reliance on non-renewable sources of energy.

5.5 Indications for Further Work

Due to its exploratory character, this study contributes to the knowledge, but does not claim comprehensiveness or the one ideal solution to positively change occupants' behavior, but rather opens venues for further exploration.

For instance, extending a similar study to a larger sample based on the identified criteria for selecting participants is important to collect an adequate amount of data for statistical analysis. Also, it may engender additional factors influencing housing occupants' behavior and interests to develop a comprehensive framework of all possible drivers and obstacles for energy-saving motivation in the context of the UAE.

The study findings indicated a high potential effect of social networking. A field study focusing and combining the social comparison with eco-feedback could be beneficial to investigate the effectiveness of this strategy in the local context. Thus, if the experiment leads to positive results, the technique can be adopted at the national level to raise occupants' awareness, then motivation to trigger behavior change.

Studies focusing on an in-depth comparison between the occupants' behavior and willingness to reduce the use among conventional and sustainable housing could similarly be beneficial.

Although the residential sector accounts for the second highest share of the total energy consumption in the country, the other building sectors have also a significant contribution as well. Building occupants' practices and motivation are expected to differ among the various building sectors. For example, the drivers that motivate housing occupants to save energy are most likely different from building

users in the workplace where the usage does not directly affect them. Therefore, it could be worth exploring the topic in the other building sectors in the same national context to design practical solutions that target the built environment in the city fabric.

Finally, a number of local initiatives have been identified throughout this research. The impact of some initiatives was studied in the form of small scale experiments or trials that provided only preliminary results whereas other initiatives were launched very recently, where their impact has not yet been studied. Therefore, it could be beneficial to investigate the impact of these initiatives and how these or similar initiatives can be further expanded, in light of this study's findings.

5.6 Conclusion Statement

The human factor in the built environment in general, and in residential buildings in particular, is critical and cannot be underestimated while attempting to reduce the building energy performance. This study provided insights into housing occupants' energy-related practices and factors shaping their behavior considering the two main population entities in the UAE's context. It highlighted the critical impacting factors while opening venues for contextual emerging considerations, of which some will need further investigation. However, it is hoped that this research contributes in developing a better understanding of housing occupants' behavior and feed in designing effective, on-target strategies based on their actual motivation under the contextual specificities.

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Appendices

Appendix A: Consent Form

Consent Form (English):

You have been invited to take part in a study to investigate the factors affecting housing occupants' behavior and drivers motivating them to save energy in the UAE. This study will be conducted by Eng. Monaya Syam in the Department of Architectural Engineering in the UAE University. Your views, opinions and experiences of daily practices in relation to the energy usage and motivation of energy saving in your house are highly appreciated, therefore, you are contacted for an interview that is sought to take between 20 to 40 minutes and it will be conducted either at your home or workplace, as per to your preference, for the purpose of providing comfortable place for you to conduct the interview.

At every stage, your identity will remain confidential. Your name and all identifying information will be removed from the written transcript. Eng. Monaya Syam will be the only person who will have access to this data. The data will be kept securely and destroyed when the study has ended, which will be a maximum of one year from completion of research. The data will be used for academic purposes only. A fictive name and a random number will be used to refer to your responses and general information. Copies of the completed reports and publications will be available on request. If you have any further question about the study, please feel free to contact Eng. Monaya Syam at 201350087@uaeu.ac.ae.

There are no risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time. Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken from UAEU require that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Please sign this form to certify that you approve the following:

- The interview will be recorded using an audio recorder, and a written transcript will be produced.
- You will be sent the transcript for your final check on request.
- The transcript of the interview will be analyzed by Eng. Monaya Syam as a research investigator
- Access to the interview transcript will be limited to Eng. Monaya Syam and the supervisor Prof. Kheira Anissa Tabet Aoul.
- You have the right to stop the interview at any time if you feel uncomfortable or if you have any question for clarification.
- The actual recording will be kept securely and destroyed when the study has ended.

- Any variation of the conditions above will only occur with your further explicit approval.

Please note that you also have the right to withdraw from the interview at any stage in the process without being penalized.

1. I confirm that I have read and understood the above information sheet and have had the opportunity to ask questions.

2. I understand that my participation is voluntary and that I am free to withdraw.

3. I understand that my data will be kept confidential and if published, the data will not be identifiable as mine.

I agree to take part in this study:

(Name and signature of participant)	(Date)
(Name and signature of the interviewer)	(Date)

Consent Form (Arabic):

لقد تمت دعوتك للمشاركة في دراسة للبحث في العوامل التي تؤثر على سلوك السكان و الحوافز التي تحثهم على توفير الطاقة في دولة الإمارات العربية المتحدة. ستجري هذه الدراسة المهندسة منية صيام من قسم الهندسة المعمارية في جامعة الإمارات. إن وجهات نظرك و خبراتك في الممارسات اليومية فيما يتعلق باستخدام الطاقة و التحفيز على توفير الطاقة في منزلك محل تقدير بالغ، لذا سيتم الاتصال بك لإجراء مقابلة تستغرق ما بين 20 إلى 40 دقيقة و سيتم إجراؤها سواء في منزلك أو مكان عملك، حسب ما تفضله لغرض توفير مكان مريح لك لإجراء المقابلة.

ستبقى هويتك سرية طوال مراحل البحث و سيتم إزالة اسمك و جميع المعلومات التعريفية خاصتك من نص المقابلة المكتوب، علماً بأن المهندسة منية صيام هي الشخص الوحيد الذي سيتمكن من الوصول إلى هذه البيانات. كما سيتم الاحتفاظ بالبيانات بشكل آمن و سيتم إتلافها عند انتهاء الدراسة بحد أقصى لعام واحد من الانتهاء من البحث. سيتم استخدام البيانات للأغراض الأكاديمية فقط و استخدام اسم وهمي و رقم عشوائي للإشارة إلى ردودك و معلومات عامة، و يمكنك الحصول على نسخ من التقارير و المنشورات المكتملة إذا رغبت بذلك. إذا كان لديك أي سؤال آخر حول الدراسة، فلا تتردد في التواصل مع المهندسة منية صيام عبر البريد الإلكتروني: 201350087@uaeu.ac.ae.

مشاركتك معنا خالية من أي مجازفة، كما يحق لك إيقاف المقابلة أو الانسحاب من البحث في أي وقت. نشكرك على موافقتك على إجراء المقابلة كجزء من مشروع البحث أعلاه. تتطلب الإجراءات الأخلاقية للبحث الأكاديمي الذي تجريه جامعة الإمارات العربية المتحدة موافقة صريحة ممن أجريت معهم المقابلات على إجراء المقابلة و على كيفية استخدام المعلومات الواردة في مقابلتهم. نموذج الموافقة هذا ضروري بالنسبة لنا للتأكد من أنك على إدراك تام من الغرض من مشاركتك و أنك توافق على شروط المشاركة. الرجاء التوقيع على هذا النموذج للتصديق على موافقتك على ما يلي:

- سيتم تسجيل المقابلة باستخدام جهاز تسجيل صوتي، وسيتم توفير نسخة مكتوبة.
- سيتم إرسال نسخة من النص المكتوب للتدقيق النهائي عند الطلب.
- سيتم تحليل نص المقابلة من قبل المهندسة منية صيام كباحثة.
- سيقتصر الوصول إلى نص المقابلة على المهندسة منية صيام والمشرفة الأستاذة خيرة أنيسة تابت أول.
- لك الحق في إيقاف المقابلة في أي وقت إذا شعرت بعدم الارتياح أو إذا كان لديك أي سؤال للتوضيح.
- سيتم الاحتفاظ بالتسجيل الفعلي بشكل آمن و يتم إتلافه عند انتهاء الدراسة.
- لن يحدث أي تغيير في الشروط المذكورة أعلاه إلا بموافقتك الصريحة الإضافية.

يرجى ملاحظة أنه يحق لك أيضاً الانسحاب من المقابلة في أي مرحلة دون أية شروط جزائية.

1. أؤكد أنني قد قرأت وفهمت ورقة المعلومات أعلاه و أتيحت لي الفرصة لطرح الأسئلة.
2. أتفهم أن مشاركتي طوعية و لدي خيار الانسحاب.
3. أتفهم أن بياناتي ستبقى سرية و لن يتم التعرف على البيانات الخاصة بي حال نشرها.

أوافق على المشاركة في هذه الدراسة:

(اسم و توقيع المشارك) (التاريخ)

(اسم و توقيع الباحث) (التاريخ)

Appendix B: (Interview Protocols)

Final Interview Protocol (Locals-English):

Heading and Opening Statements:

In this study, I am exploring occupants' usage of energy in their houses and the factors that affect their behavior and motivation to save energy. As a resident in the UAE's context, we value your opinions and information. The questions are divided into 3 main parts; introductory general questions, questions about your daily practices and usage of systems, and the last part is about your knowledge where the sequence of these parts is not fixed and may change during the interview.

Please read and sign the consent form before starting the interview to get your approval of recording and using your responses in this study. Note that your responses will only be used for the purpose of this study and the audio tape will be destroyed after transcribed. In addition, you may stop at any time if you feel uncomfortable or if you have any question.

Before starting the interview, can you please fill this short questionnaire to collect general information about yourself and your house.

Date: ---------- Address: ----------

General (Background) Questions:

Interviewee Identification:

Gender:

Male		Female	

Age:

Less than 21		21 – 39		40 – 59		+ 60 years old	

Local		Expatriate	

Highest Degree of Education:

Primary		High School		Bachelor Degree		Postgraduate	

Field of Study:

Income (I)/ Month:

I < 10,000 AED		10K < I < 20K		20K < I < 30K		I > 30,000 AED	

Residence Identification:

House Type:

Apartment		Villa	

Year of Construction:

Prior to 2010		After 2010	

House Ownership:

Owner		Renter	

Living Period in the House (in Years):

0-1		1-5		5-10		> 10 Years	

The Key and follow-up Interview Questions:

Introductory Questions:

1. How long have you been living in this house?
   - What do you like about living this house?
   - What about the things that you do not like?

2. Can you describe a typical occupancy day in your house in the weekdays and weekends? Example (if needed), when it is fully occupied?
   - Is there a certain time where there is no one in the house, during the day, the week or the year?

3. Are there places where family gathers in a daily basis?
   - Do you feel some rooms are getting hot more than others?
   - If yes, which ones?
   - What do you do to feel comfort in these rooms?

Usage of Systems and Spaces/ Everyday Practices:

4. If he/she mentioned the AC, usually, for how long do you turn on the AC system?
   - Does the usage of the AC differ in summer and winter?

5. What about the usage when you are out of the house, do you prefer to keep the AC on?

- Why?

6. Are there children living in the house?
   - If yes, how old are they?
   - If yes, can you describe how do they use the AC, for how long do they turn it on? During the day or/and night?
   - What about when they leave the room, do they turn it off?

7. Who sets the AC temperature? (Examples if needed: House maid? You?)
   - At what temperature do you set the AC?
   - Why is the AC set at this temperature?

8. How do you control the AC system? If asked for examples: Is it controlled by remote control/sensors?
   - Have you heard about the sensors that control lights automatically where it turns off the light when there is no one in the room and it turns it on when someone enters the space?
   - What do you think about these sensors?
   - Would you like to have such sensor in your house? Why?

9. Usually, at what time do you open the curtains?
   - Do you open the curtains in all rooms?
   - What about the light bulbs?
   - Usually, when do you turn lights on?

10. How are water heaters used?
   - Who turns them on?
   - When?
   - Is that different for summer and winter?

11. Based on your opinion, what is the most electricity consuming device or system in your house?
   - Why do you think that?

12. When purchasing appliances such as fridge or washing machine, what criteria or characteristics do you look for?

<u>Awareness and Knowledge:</u>

13. Did you hear about the energy crises and its impact on the environment?
   - Do you think we really need to save energy?
   - If yes, based on your opinion, what can you do in your level to save energy at home?
   - If answered, from where did you get this information?
   - If no, Why?

14. Do you know if there was any change in the energy price in the last few years?
   - If yes, how did you know?

- If no, (inform him/her first) Do you think there is difference in your daily practices before and after the changes in the energy price?
- If yes, can you give an example?
- If no, what do you think the reason for the no difference?

15. Who pays the electricity and water bills?
- How do you receive the bills?
- Do you have idea about how much is your utility bill per month?
- Do the bills differ in summer and winter?
- If yes, around how much is the difference?
- If yes, in your opinion, what is the reason for this difference?
- What do you think can be done to keep the bill at its lowest?

16. Did you get any kind of incentives, whether financial or non-financial? (If asked for examples: offers on electricity bills, discounts on purchasing energy-efficient products)
- If yes, what are the incentives?
- If yes, how did you know about these incentives?
- If yes, do you think these incentives are effective? Why?
- If no, are you interested in such incentives? Why?

17. Have you heard about any marketing campaign that calls for saving energy?
- If yes, how did you know about these campaigns?
- If yes, did you follow any of these campaigns?
- If yes, how?
- If no, why?

18. One of the local programs is the free energy audit program; where professionals give people information about the possible changes they can do in the building to significantly reduce the energy use and bills. Would you like to participate in such programs and make changes in your house?
- Why?
- Change the light bulb? The window frame? AC units? (Examples of changes and improvements if needed)
- (Provide other examples of incentives and campaigns to know their opinion if needed)

19. Do you think it is useful to buy energy-efficient products and appliances?
- Would you buy these products and appliances?
- Why?

20. Assume the government contributes in a percentage of the initial cost for changing for example the AC units or install smart sensors in the house to reduce the energy usage, would you like to participate and do that change?
- Why?
- If No, what is the percentage of government's contribution that will make you satisfied to change?

21. Do you think you are consuming more than your neighbors or relatives?

- Why?

22. Would you like to add anything related to the electricity and water usage in your house?

Researcher's Notes:

Closing Statements:

As I said before starting the interview, your responses will be confidential and will be analyzed to serve this study. Thanks for giving your time and sharing this valuable information, I very much appreciate that. For your information, I can send you a copy of the transcript for a final check if you would like.

Final Interview Protocol (Locals-Arabic):

المقدمة:

أقوم من خلال هذا البحث بدراسة استخدام السكان للطاقة في منازلهم و العوامل التي تؤثر على سلوكهم و دوافعهم لتوفير الطاقة. بصفتنا مقيمين في دولة الإمارات العربية المتحدة، فإننا نقدر وجهات نظرك و معلوماتك.

تُقسّم الأسئلة إلى 3 أجزاء رئيسية: أسئلة عامة تمهيدية، و أسئلة حول ممارساتك اليومية و استخدامك للأنظمة، و الجزء الأخير يتعلق بمعرفتك حيث أن تسلسل هذه الأجزاء غير ثابت و قد يتغير أثناء المقابلة.

يرجى قراءة نموذج الموافقة و التوقيع عليه قبل بدء المقابلة للحصول على موافقتك على التسجيل و استخدام إجاباتك في هذه الدراسة. يرجى العلم أنه سيتم استخدام إجاباتك فقط لغرض هذه الدراسة و سيتم إتلاف الشريط الصوتي بعد تحويله لنص مكتوب. يمكنك أيضاً التوقف في أي وقت إذا شعرت بعدم الارتياح أو إذا كان لديك أي سؤال.

قبل بدء المقابلة ، يرجى منك ملء هذا الاستبيان القصير لجمع معلومات عامة عنك و عن منزلك.

التاريخ: ---------- العنوان: ----------

أسئلة عامة:

بيانات تحديد هوية الشخص الذي تتم مقابلته:

الجنس:

ذكر		أنثى	

العمر:

أقل عن 21 سنة		21 - 39		40 - 59		60 سنة فما فوق	

مواطن		وافد	

أعلى درجة تعليمية:

أقل من الثانوية العامة		ثانوية عامة		درجة بكالوريس		دراسات عليا	

مجال الدراسة:

الدخل (I) / الشهر:

درهم I < 10,000		10K < I < 20K		20K < I < 30K		درهم I > 30,000	

معلومات عن المنزل:

نوع المنزل:

	فيلا		شقة

سنة البناء:

	بعد عام 2010		قبل عام 2010

ملكيّة المنزل:

	مستأجر		مالك

فترة المعيشة في المنزل (بالسنوات):

	أكثر عن 10 سنوات		5-10		1-5		0-1

أسئلة المقابلة الأساسية والتابعة:

أسئلة تمهيدية:

1. منذ متى و أنت تعيش في هذا المنزل؟
   - ما الذي يعجبك في العيش في هذا المنزل؟
   - و ماذا عن الأشياء التي لا تحبها؟

2. هل يمكنك وصف طبيعة يوم عادي في منزلك في أيام الأسبوع و عطلات نهاية الأسبوع؟ مثال (إذا لزم الأمر)، متى يكون المنزل مزدحماً بالجميع؟
   - هل هناك وقت معين لا يوجد فيه أحد في المنزل نهاراً أو أسبوعياً أو في السنة؟

3. هل توجد أماكن تتجمع فيها الأسرة بشكل يومي؟
   - هل تشعر أن بعض الغرف تزداد سخونة أكثر من غيرها؟
   - إذا كانت الإجابة بنعم ، فما هي؟
   - ماذا تفعل لتشعر بالراحة في هذه الغرف؟

استخدام الأنظمة و المساحات / الممارسات اليومية:

4. إذا تم ذِكر مكيف الهواء، ما هي المدة التي عادة ما تقوم فيها بتشغيل نظام التكييف؟
   - هل يختلف استخدام المكيف في الصيف و الشتاء؟

5. ماذا عن الاستخدام عندما تكون خارج المنزل، هل تفضل تشغيل المكيف؟
   - لماذا؟

6. هل يوجد أطفال يعيشون في المنزل؟
   - إذا كانت الإجابة نعم، كم تبلغ أعمارهم؟
   - إذا كانت الإجابة بنعم، هل يمكنك وصف كيفية استخدامهم للمكيف و كم من الوقت يقومون بتشغيله؟ خلال النهار أو الليل؟
   - و ماذا عنهم عندما يغادرون الغرفة، هل يغلقونها؟

7. من يحدد درجة حرارة مكيف الهواء؟ (أمثلة إذا لزم الأمر: خادمة المنزل؟ أنت؟)
   - في أي درجة حرارة ضبطت المكيف؟
   - لماذا يتم ضبط المكيف على درجة الحرارة هذه؟

8. كيف تتحكم في نظام التكييف؟ إذا طُلب منك أمثلة: هل يتم التحكم فيه بواسطة جهاز التحكم عن بعد/أجهزة الاستشعار؟
   - هل سمعت عن المستشعرات التي تتحكم في الأضواء تلقائياً حيث تقوم بإطفاء الضوء عند عدم وجود أحد في الغرفة وتقوم بتشغيله عند دخول شخص ما؟
   - ما رأيك في أجهزة الاستشعار هذه؟
   - هل ترغب في الحصول على مثل هذا المستشعر في منزلك؟ لماذا؟

9. في أي وقت تفتح الستائر عادة؟
   - هل تفتحون الستائر في جميع الغرف؟
   - و ماذا عن المصابيح الكهربائية؟
   - متى تضيء الأنوار عادة؟

10. كيف يتم استخدام سخانات المياه؟
    - من يقوم بتشغيله؟
    - متى؟
    - هل هذا مختلف في الصيف و الشتاء؟
11. حسب رأيك، ما هو الجهاز أو النظام الأكثر استهلاكا للكهرباء في منزلك؟
    - لماذا تعتقد ذلك؟

12. عند شراء أجهزة مثل الثلاجة أو الغسالة، ما هي المعايير أو الخصائص التي تبحث عنها؟

الوعي و المعرفة:

13. هل سمعت عن أزمات الطاقة و تأثيرها على البيئة؟
    - هل تعتقد أننا بحاجة فعلاً لتوفير الطاقة؟
    - إذا كانت الإجابة بنعم، بناءً على رأيك، ما الذي يمكنك فعله لتوفير الطاقة في المنزل على المستوى الشخصي؟
    - في حالة الإجابة، من أين حصلت على هذه المعلومات؟
    - إذا كانت الإجابة لا، فلماذا؟

14. هل تعلم ما إذا كان هناك أي تغيير في سعر الطاقة في السنوات القليلة الماضية؟
    - إذا نعم، كيف عرفت؟
    - إذا كان الجواب لا، (أبلغه/ها أولاً) هل تعتقد أن هناك اختلافاً في ممارساتك اليومية قبل و بعد التغيرات في سعر الطاقة؟
    - إذا كانت الإجابة بنعم، فهل يمكنك إعطاء مثال؟
    - إذا كانت الإجابة لا، ما رأيك في سبب عدم الاختلاف؟

15. من يدفع فواتير الكهرباء و الماء؟
    - كيف تستلمون الفواتير؟
    - هل لديك فكرة عن قيمة فاتورة المرافق الشهرية الخاصة بك؟
    - هل تختلف الفواتير في الصيف و الشتاء؟
    - إذا كانت الإجابة بنعم، فما هو الفرق؟
    - إذا كانت الإجابة بنعم، في رأيك ما هو سبب هذا الاختلاف؟
    - ما الذي تعتقد أنه يمكن فعله لإبقاء قيمة الفاتورة عند أدنى مستوياتها؟

16. هل حصلت على أي نوع من الحوافز سواء كانت مالية أو غير مالية؟ (إذا طُلب منك أمثلة: عروض على فواتير الكهرباء، و خصومات على شراء المنتجات الموفرة للطاقة)
    - إذا نعم ، ما هي الحوافز؟
    - إذا كانت الإجابة بنعم، كيف عرفت عن هذه الحوافز؟
    - إذا كانت الإجابة بنعم، هل تعتقد أن هذه الحوافز فعالة؟ لماذا؟
    - إذا كانت الإجابة لا، فهل أنت مهتم بمثل هذه الحوافز؟ لماذا؟

17. هل سمعت عن أي حملة تسويقية تدعو إلى توفير الطاقة؟
    - إذا كانت الإجابة بنعم، كيف عرفت عن هذه الحملات؟
    - إذا كانت الإجابة بنعم، فهل تابعت أيا من هذه الحملات؟
    - إذا كانت الإجابة نعم، فكيف؟
    - إذا كانت الإجابة لا، فلماذا؟

18. برنامج تدقيق الطاقة المجاني هو أحد البرامج المحلية حيث يقدم المحترفون للناس معلومات حول التغييرات المحتملة التي يمكنهم إجراؤها في المبنى لتقليل استخدام الطاقة و الفواتير بشكل كبير. هل ترغب في المشاركة في مثل هذه البرامج وإجراء تغييرات في منزلك؟
    - لماذا؟
    - تغيير المصباح الكهربائي؟ إطار النافذة؟ وحدات التكييف؟ (أمثلة على التغييرات و التحسينات إذا لزم الأمر)
    - (قدم أمثلة أخرى من الحوافز والحملات لمعرفة رأيهم إذا لزم الأمر)

19. هل تعتقد أنه من المفيد شراء منتجات و أجهزة موفرة للطاقة؟
    - هل ستشتري هذه المنتجات و الأجهزة؟
    - لماذا؟

20. افترض أن الحكومة تساهم بنسبة مئوية من التكلفة الأولية لتغيير وحدات التكييف مثلاً أو تركيب أجهزة استشعار ذكية في المنزل لتقليل استخدام الطاقة، هل ترغب في المشاركة في هذا التغيير؟
    - لماذا؟
    - إذا كانت الإجابة لا، ما هي النسبة المئوية لمساهمة الحكومة التي تجعلك تشعر بالرضا عن التغيير؟

21. هل تعتقد أنك تستهلك أكثر من جيرانك أو أقاربك؟
    - لماذا؟
22. هل ترغب في إضافة أي شيء متعلق باستهلاك الكهرباء و المياه في منزلك؟

ملاحظات الباحث:

الفقرة الختامية:

كما قلت قبل بدء المقابلة ، ستكون إجاباتك سرية وسيتم تحليلها لاستخدامها في هذه الدراسة. شكراً لإعطائك من وقتك و مشاركة هذه المعلومات القيمة، أنا أقدر ذلك كثيرًا. يرجى العلم أنه يمكنني أن أرسل لك نسخة من النص للفحص النهائي إذا كنت ترغب في ذلك.

Final Interview Protocol (Expatriates-English):

Heading and Opening Statements:

In this study, I am exploring occupants' usage of energy in their houses and the factors that affect their behavior and motivation to save energy. As a resident in the UAE's context, we value your opinions and information. The questions are divided into 3 main parts; introductory general questions, questions about your daily practices and usage of systems, and the last part is about your knowledge where the sequence of these parts is not fixed and may change during the interview.

Please read and sign the consent form before starting the interview to get your approval of recording and using your responses in this study. Note that your responses will only be used for the purpose of this study and the audio tape will be destroyed after transcribed. In addition, you may stop at any time if you feel uncomfortable or if you have any question.

Before starting the interview, can you please fill this short questionnaire to collect general information about yourself and your house.

Date: ---------- Address: ----------

General (Background) Questions:

Interviewee Identification:

Gender:

Male		Female	

Age:

Less than 21		21 - 39		40 - 59		+ 60 years old	

Local		Expatriate	

Highest Degree of Education:

Primary		High School		Bachelor Degree		Postgraduate	

Field of Study:

Income (I)/ Month:

I < 10,000 AED		10K < I < 20K		20K < I < 30K		I > 30,000 AED	

Residence Identification:

House Type:

Apartment		Villa	

Year of Construction:

Prior to 2010		After 2010	

House Ownership:

Owner		Renter	

Living Period in the House (in Years):

0-1		1-5		5-10		> 10 Years	

The Key and follow-up Interview Questions:

Introductory Questions:

1. How long have you been living in the UAE?
   - What do you like about living in the UAE?
   - What about the things that you do not like?

2. How long have you been living in this house?
   - What do you like about living this house?
   - What about the things that you do not like?

3. Can you describe a typical occupancy day in your house in the weekdays and weekends? Example (if needed), when it is fully occupied?
   - Is there a certain time where there is no one in the house, during the day, the week or the year?

4. Are there places where family gathers in a daily basis?
   - Do you feel some rooms are getting hot more than others?
   - If yes, which ones?
   - What do you do to feel comfort in these rooms?

Usage of Systems and Spaces/ Everyday Practices:

5. If he/she mentioned the AC, usually, for how long do you turn on the AC system?
   - Does the usage of the AC differ in summer and winter?

6. What about the usage when you are out of the house, do you prefer to keep the AC on?
   - Why?

7. Are there children living in the house?
   - If yes, how old are they?
   - If yes, can you describe how do they use the AC, for how long do they turn it on? During the day or/and night?
   - What about when they leave the room, do they turn it off?

8. Who sets the AC temperature? (Examples if needed: House maid? You?)
   - At what temperature do you set the AC?
   - Why is the AC set at this temperature?

9. How do you control the AC system? If asked for examples: Is it controlled by remote control/sensors?
   - Have you heard about the sensors that control lights automatically where it turns off the light when there is no one in the room and it turns it on when someone enters the space?
   - What do you think about these sensors?
   - Would you like to have such sensor in your house? Why?
   - If mentioned ownership or length of stay: What if we assume that you are not going to move to another house for the coming 10 years for example, would you like to install this type of control?

10. Usually, at what time do you open the curtains?
   - Do you open the curtains in all rooms?
   - What about the light bulbs?
   - Usually, when do you turn lights on?

11. How are water heaters used?
   - Who turns them on?
   - When?
   - Is that different for summer and winter?

12. Based on your opinion, what is the most electricity consuming device or system in your house?
   - Why do you think that?

13. When purchasing appliances such as fridge or washing machine, what criteria or characteristics do you look for?

<u>Awareness and Knowledge:</u>

14. Did you hear about the energy crises and its impact on the environment?
   - Do you think we really need to save energy?
   - If yes, based on your opinion, what can you do in your level to save energy at home?

- If answered, from where did you get this information?
- If no, Why?

15. Who pays the electricity and water bills?
- How do you receive the bills?
- Do you have idea about how much is your utility bill per month?
- Do the bills differ in summer and winter?
- If yes, around how much is the difference?
- If yes, in your opinion, what is the reason for this difference?
- What do you think can be done to keep the bill at its lowest?

16. Did you get any kind of incentives, whether financial or non-financial? (if asked for examples: offers on electricity bills, discounts on purchasing energy-efficient products)
- If yes, what are the incentives?
- If yes, how did you know about these incentives?
- If yes, do you think these incentives are effective? Why?
- If no, are you interested in such incentives? Why?

17. Have you heard about any marketing campaign that calls for saving energy?
- If yes, how did you know about these campaigns?
- If yes, did you follow any of these campaigns?
- If yes, how?
- If no, why?

18. One of the local programs is the free energy audit program; where professionals give people information about the possible changes they can do in the building to significantly reduce the energy use and bills. Would you like to participate in such programs and make changes in your house?
- Why?
- Change the light bulb? The window frame? AC units? (Examples of changes and improvements if needed)
- (Provide other examples of incentives and campaigns to know their opinion if needed)

19. To keep your utility bill low for example similar to the winter bill, have you done anything in order to reduce energy or lower your bills?
- If yes, from where did you get this information? How did you know about it?
- If no, why you did not?

20. Do you think it is useful to buy energy-efficient products and appliances?
- Would you buy these products and appliances?
- Why?

21. Assume the homeowner contributes in a percentage of the initial cost for changing for example the AC units or install smart sensors in the house to reduce the energy usage, would you like to participate and do that change?
- Why?

- If No, what is the percentage of owner's contribution that will make you satisfied to change?

22. Do you think you are consuming more than your neighbors?
- Why?

23. Would you like to add anything related to the electricity and water usage in your house?

Researcher's Notes:

Closing Statements:

As I said before starting the interview, your responses will be confidential and will be analyzed to serve this study. Thanks for giving your time and sharing this valuable information, I very much appreciate that. For your information, I can send you a copy of the transcript for a final check if you would like.

Final Interview Protocol (Expatriates-Arabic):

المقدمة:

أقوم من خلال هذا البحث بدراسة استخدام السكان للطاقة في منازلهم و العوامل التي تؤثر على سلوكهم و دوافعهم لتوفير الطاقة. بصفتنا مقيمين في دولة الإمارات العربية المتحدة، فإننا نقدر وجهات نظرك و معلوماتك.

تُقسّم الأسئلة إلى 3 أجزاء رئيسية: أسئلة عامة تمهيدية، و أسئلة حول ممارساتك اليومية و استخدامك للأنظمة، و الجزء الأخير يتعلق بمعرفتك حيث أن تسلسل هذه الأجزاء غير ثابت و قد يتغير أثناء المقابلة.

يرجى قراءة نموذج الموافقة و التوقيع عليه قبل بدء المقابلة للحصول على موافقتك على التسجيل و استخدام إجاباتك في هذه الدراسة. يرجى العلم أنه سيتم استخدام إجاباتك فقط لغرض هذه الدراسة و سيتم إتلاف الشريط الصوتي بعد تحويله لنص مكتوب. يمكنك أيضاً التوقف في أي وقت إذا شعرت بعدم الارتياح أو إذا كان لديك أي سؤال.

قبل بدء المقابلة ، يرجى منك ملء هذا الاستبيان القصير لجمع معلومات عامة عنك و عن منزلك.

التاريخ: ---------- العنوان: ----------

أسئلة عامة:

بيانات تحديد هوية الشخص الذي تتم مقابلته:

الجنس:

ذكر		أنثى	

العمر:

أقل عن 21 سنة		21 - 39		40 - 59		60 سنة فما فوق	

مواطن		وافد	

أعلى درجة تعليمية:

أقل من الثانوية العامة		ثانوية عامة		درجة بكالوريس		دراسات عليا	

مجال الدراسة:

الدخل (I) / الشهر:

درهم I < 10,000		10K < I < 20K		20K < I < 30K		درهم I > 30,000	

معلومات عن المنزل:

نوع المنزل:

	فيلا		شقة

سنة البناء:

	بعد عام 2010		قبل عام 2010

ملكيّة المنزل:

	مستأجر		مالك

فترة المعيشة في المنزل (بالسنوات):

	أكثر عن 10 سنوات		5-10		1-5		0-1

أسئلة المقابلة الأساسية و التابعة:

أسئلة تمهيدية:

1. منذ متى و أنت تعيش في دولة الإمارات؟
   - ما الذي يعجبك في العيش فيها؟
   - و ماذا عن الأشياء التي لا تحبها؟

2. منذ متى و أنت تعيش في هذا المنزل؟
   - ما الذي يعجبك في العيش في هذا المنزل؟
   - و ماذا عن الأشياء التي لا تحبها؟

3. هل يمكنك وصف طبيعة يوم عادي في منزلك في أيام الأسبوع و عطلات نهاية الأسبوع؟ مثال (إذا لزم الأمر)، متى يكون المنزل مزدحماً بالجميع؟
   - هل هناك وقت معين لا يوجد فيه أحد في المنزل نهاراً أو أسبوعياً أو في السنة؟

4. هل توجد أماكن تتجمع فيها الأسرة بشكل يومي؟
   - هل تشعر أن بعض الغرف تزداد سخونة أكثر من غيرها؟
   - إذا كانت الإجابة بنعم ، فما هي؟
   - ماذا تفعل لتشعر بالراحة في هذه الغرف؟

استخدام الأنظمة و المساحات / الممارسات اليومية:

5. إذا تم ذِكر مكيف الهواء، ما هي المدة التي عادة ما تقوم فيها بتشغيل نظام التكييف؟
   - هل يختلف استخدام المكيف في الصيف و الشتاء؟

6. ماذا عن الاستخدام عندما تكون خارج المنزل، هل تفضل تشغيل المكيف؟
   - لماذا؟

7. هل يوجد أطفال يعيشون في المنزل؟
   - إذا كانت الإجابة نعم، كم تبلغ أعمارهم؟

- إذا كانت الإجابة بنعم، هل يمكنك وصف كيفية استخدامهم للمكيف و كم من الوقت يقومون بتشغيله؟ خلال النهار أو الليل؟
- و ماذا عنهم عندما يغادرون الغرفة، هل يغلقونها؟

8. من يحدد درجة حرارة مكيف الهواء؟ (أمثلة إذا لزم الأمر: خادمة المنزل؟ أنت؟)
   - في أي درجة حرارة ضبطت المكيف؟
   - لماذا يتم ضبط المكيف على درجة الحرارة هذه؟

9. كيف تتحكم في نظام التكييف؟ إذا طُلب منك أمثلة: هل يتم التحكم فيه بواسطة جهاز التحكم عن بعد/أجهزة الاستشعار؟
   - هل سمعت عن المستشعرات التي تتحكم في الأضواء تلقائياً حيث تقوم بإطفاء الضوء عند عدم وجود أحد في الغرفة وتقوم بتشغيله عند دخول شخص ما؟
   - ما رأيك في أجهزة الاستشعار هذه؟
   - هل ترغب في الحصول على مثل هذا المستشعر في منزلك؟ لماذا؟
   - إذا ذُكرت الملكية أو مدة الإقامة: ماذا لو افترضنا أنك لن تنتقل إلى منزل آخر خلال السنوات العشر القادمة على سبيل المثال، هل ترغب في تثبيت هذا النوع من التحكم؟

10. في أي وقت تفتح الستائر عادة؟
    - هل تفتحون الستائر في جميع الغرف؟
    - و ماذا عن المصابيح الكهربائية؟
    - متى تضيء الأنوار عادة؟

11. كيف يتم استخدام سخانات المياه؟
    - من يقوم بتشغيله؟
    - متى؟
    - هل هذا مختلف في الصيف و الشتاء؟

12. حسب رأيك، ما هو الجهاز أو النظام الأكثر استهلاكا للكهرباء في منزلك؟
    - لماذا تعتقد ذلك؟

13. عند شراء أجهزة مثل الثلاجة أو الغسالة، ما هي المعايير أو الخصائص التي تبحث عنها؟

الوعي و المعرفة:

14. هل سمعت عن أزمات الطاقة و تأثيرها على البيئة؟
    - هل تعتقد أننا بحاجة فعلاً لتوفير الطاقة؟
    - إذا كانت الإجابة بنعم، بناءً على رأيك، ما الذي يمكنك فعله لتوفير الطاقة في المنزل على المستوى الشخصي؟
    - في حالة الإجابة، من أين حصلت على هذه المعلومات؟
    - إذا كانت الإجابة لا، فلماذا؟

15. هل تعلم ما إذا كان هناك أي تغيير في سعر الطاقة في السنوات القليلة الماضية؟
    - إذا نعم، كيف عرفت؟
    - إذا كان الجواب لا، (أبلغه/ها أولاً) هل تعتقد أن هناك اختلافاً في ممارساتك اليومية قبل و بعد التغيرات في سعر الطاقة؟
    - إذا كانت الإجابة بنعم، فهل يمكنك إعطاء مثال؟
    - إذا كانت الإجابة لا، ما رأيك في سبب عدم الاختلاف؟

16. من يدفع فواتير الكهرباء و الماء؟
    - كيف تستلمون الفواتير؟

- هل لديك فكرة عن قيمة فاتورة المرافق الشهرية الخاصة بك؟
- هل تختلف الفواتير في الصيف و الشتاء؟
- إذا كانت الإجابة بنعم، فما هو الفرق؟
- إذا كانت الإجابة بنعم، في رأيك ما هو سبب هذا الاختلاف؟
- ما الذي تعتقد أنه يمكن فعله لإبقاء قيمة الفاتورة عند أدنى مستوياتها؟

17. هل حصلت على أي نوع من الحوافز سواء كانت مالية أو غير مالية؟ (إذا طُلب منك أمثلة: عروض على فواتير الكهرباء، و خصومات على شراء المنتجات الموفرة للطاقة)
    - إذا نعم ، ما هي الحوافز؟
    - إذا كانت الإجابة بنعم، كيف عرفت عن هذه الحوافز؟
    - إذا كانت الإجابة بنعم، هل تعتقد أن هذه الحوافز فعالة؟ لماذا؟
    - إذا كانت الإجابة لا، فهل أنت مهتم بمثل هذه الحوافز؟ لماذا؟

18. هل سمعت عن أي حملة تسويقية تدعو إلى توفير الطاقة؟
    - إذا كانت الإجابة بنعم، كيف عرفت عن هذه الحملات؟
    - إذا كانت الإجابة بنعم، فهل تابعت أيا من هذه الحملات؟
    - إذا كانت الإجابة نعم، فكيف؟
    - إذا كانت الإجابة لا، فلماذا؟

19. برنامج تدقيق الطاقة المجاني هو أحد البرامج المحلية حيث يقدم المحترفون للناس معلومات حول التغييرات المحتملة التي يمكنهم إجراؤها في المبنى لتقليل استخدام الطاقة و الفواتير بشكل كبير. هل ترغب في المشاركة في مثل هذه البرامج وإجراء تغييرات في منزلك؟
    - لماذا؟
    - تغيير المصباح الكهربائي؟ إطار النافذة؟ وحدات التكييف؟ (أمثلة على التغييرات و التحسينات إذا لزم الأمر)
    - (قدم أمثلة أخرى من الحوافز والحملات لمعرفة رأيهم إذا لزم الأمر)

20. هل تعتقد أنه من المفيد شراء منتجات و أجهزة موفرة للطاقة؟
    - هل ستشتري هذه المنتجات و الأجهزة؟
    - لماذا؟
21. افترض أن المالك يساهم بنسبة مئوية من التكلفة الأولية لتغيير وحدات التكييف مثلاً أو تركيب أجهزة استشعار ذكية في المنزل لتقليل استخدام الطاقة، هل ترغب في المشاركة في هذا التغيير؟
    - لماذا؟
    - إذا كانت الإجابة لا، ما هي النسبة المئوية لمساهمة المالك التي تجعلك تشعر بالرضا عن التغيير؟

22. هل تعتقد أنك تستهلك أكثر من جيرانك أو أقاربك؟
    - لماذا؟

23. هل ترغب في إضافة أي شيء متعلق باستهلاك الكهرباء و المياه في منزلك؟

ملاحظات الباحث:

الفقرة الختامية:

كما قلت قبل بدء المقابلة ، ستكون إجاباتك سرية وسيتم تحليلها لاستخدامها في هذه الدراسة. شكراً لإعطائك من وقتك و مشاركة هذه المعلومات القيمة، أنا أقدر ذلك كثيرًا. يرجى العلم أنه يمكنني أن أرسل لك نسخة من النص للفحص النهائي إذا كنت ترغب في ذلك.