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Research Articles

Investigating Consumer Awareness of Energy Efficiency in Saudi Arabia

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Abstract: Scholars have been interested in energy efficiency/conservation and consumer behaviour for over 35 years and research in this domain continues to grow. Energy efficiency and conservation are significant policy tools that can be introduced by governments to help save the environment. The kingdom of Saudi Arabia possesses a wealth of energy resources. The exploitation of these resources has allowed the country to keep domestic energy prices low, through a system of direct and indirect subsides. Saudi Arabia boasts the world's largest proven oil reserves and is the world's 200th largest producer and consumer of electricity. However, Saudi Arabia is threatened by unrestrained domestic fuel consumption, which has increased by more than 30% since 2000. This increased and inefficient consumption is causing environmental pollution and is leaving the country vulnerable to economic and social crises. This research study aims to address this issue in exploring the following questions: (1) What are the reasons behind the lack of energy efficiency practice in Saudi Arabia? (2) how can energy efficiency practice be improved amongst energy users in Saudi Arabia? and (3) what might the effects be of enhancing energy efficiency practice on energy security in Saudi Arabia? To answer the above questions, this study uses questionnaire surveys containing quantitative and qualitative questions. Results suggest that Saudi consumer behaviours, particularly energy consuming behaviours are influenced by social, cultural, educational and economic factors.

Keywords: Consumer Behaviour, Energy Efficiency, Saudi Arabia

Introduction

Although Saudi Arabia is one of the largest world oil and gas producers, it is also the largest oil consuming nation in the Middle East. The country consumed approximately 3 million barrels of oil per day (bbl/d) in 2012 (EIA, 2013). According to the latest Saudi energy efficiency report, "Saudi Arabia's primary energy consumption per capita is 3.6 times higher than the world average, at 6.7 toe in 2010" (SAEER, 2012).

Although some research has been conducted on energy efficiency in Saudi Arabia, some issues remain unclear. No research has investigated the reasons behind the lack of energy efficiency practice amongst Saudi Arabia's consumers. Furthermore, no research has been conducted on how consumer behaviour may be changed to reduce energy waste and increase efficiency.

This study presents a review of the literature on energy efficiency in Saudi Arabia, energy security and unhelpful energy behaviours. Recent reports highlight that Saudi Arabia's "electricity consumption has been growing rapidly since 1990 (+6.2 percent/year) and that surge was propelled by demand in the residential and service sector" (SAEER, 2012). This study focuses on the housing sector, with the aim of providing a better understanding of the reasons behind the lack of awareness on energy consumption in Saudi Arabia. This research explores what could be changed about Saudi consumer behaviour that may help increase energy efficiency, reduce energy consumption and cut on (CO2) emissions. It also explores the effects of enhancing energy efficiency practice on energy security in the country.

Methodology

This research used quantitative and qualitative approaches to address the research questions. In order to achieve a consumer behavioural modification, this research utilised random sampling techniques to distribute survey questionnaires to consumers in Saudi Arabia. The questionnaire contained both open-ended questions and questions with multiple-choice answers. Participants were guaranteed anonymity.

The survey was carried out online via SurveyMonkey. Data collection was conducted between April and June 2013 and 742 households responded in this period. Social status (education level and income) was measured in the survey. E-mail Interviews were also conducted with 6 energy experts from different energy sectors. SPSS was used for data analysis and Excel was used to create all figures.

Energy Efficiency

Policy makers consider energy efficiency and conservation immediate and urgent social objectives (Patterson, 1996). Previous research has highlighted evidence of the impact of public awareness on changing bad habits to positive habits (Kyung-Hee, 2007).

The current energy efficiency situation in Saudi Arabia remains problematic and largely neglected. An increasing energy demand and less efficiency in Saudi Arabia are driven by a number of factors, these are: Saudi Arabia's "energy-intensive industries, as well as energy-intensive lifestyle in buildings and transport, encouraged by low energy prices" (SAEER, 2012), the high rates of population growth and economic development and the lack of public awareness, which exacerbates overconsumption and waste (Pasten and Santamarina, 2012).

Currently, at around 2.8 million barrels a day, Saudi Arabia is consuming more energy than other countries. Electricity demand in the country is expected to grow from 40 GW to 120 GW between 2008 and 2010 (Dayal *et al*., 2011). Saudi Arabia's energy consumption is unsustainable and the country's annual consumption is growing at double the rate of GDP growth. Furthermore, the demand for its own oil and gas is growing at around 7% every year (Lahan and Stevens, 2011). Comparing Saudi Arabia with other countries with higher populations shows that Saudi Arabia uses more energy per capita than these countries (Fig. 1).

The Benefits of Energy Efficiency

Energy efficiency helps to decrease energy consumption and reduces negative environmental impact (Alcott, 2005). Increasing energy efficiency leads to a number of national and international benefits. On a national level, economic growth comes first for Saudi Arabia. Studies show that improved energy efficiency can boost productivity, increasing growth and decreasing inflation (Assad, 2006). Also, increasing energy efficiency in Saudi Arabia can contribute to energy security goals by means of reducing both energy consumption and energy production. The transition to a new energy efficiency model in the country will also create new employment opportunities. On an international level, implementing energy efficiency measures bring about a number of benefits. One of these is cutting carbon dioxide emissions. Also, energy efficiency contributes significantly to Climate Change Mitigation, resource management and energy prices. Figure 3 shows the multiple benefits of energy efficiency measures.

Consumer Behaviour in Saudi Arabia

Energy consuming behaviors in Saudi Arabia are based on routine, "emulation" and negative habits (Assad, 2006). For example, inside and outside lights being left on when not needed is normal in a Saudi household; it is a Saudi habit to leave television on even when not being watched; most electrical appliances are left on standby without any regard for environmental impacts.

Furthermore, one of the main issues with Saudi culture is that good energy efficiency habits (such as turning off lights in unoccupied places and washing only full loads in dishwasher with avarice) are linked to old age and embarrassment (Al-Nuaim, 2012). As such, these behaviours are complex and hard to change.

It is worth pointing out that one of the problems often cited by Saudis engaging with this problem is the lack of understanding of the concept of sustainability. The word in Arabic (*istidaama*) has only been applied in this context in Saudi Arabia for the last few years. Since public education campaigns must be context- and culture-specific, a Saudi campaign would have to make the case that a new system of pricing would raise standards of living among the poor and create more jobs (Lahan and Stevens, 2011).

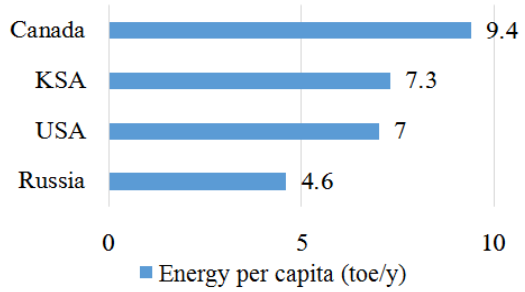

Fig. 1. Per capita energy consumption Source: BP (2011) UN population division data

Research Findings (Survey)

Energy Efficiency Awareness

A high percentage of participants (84%) knew what the term 'energy efficiency' meant. As such, it can be argued than energy efficiency non-compliance is not about a lack of awareness of what efficiency is.

When respondents were asked if they know how many Kilowatts they consume monthly, a high percentage of participants (85%) indicated that they did not know. Furthermore, when asked if they know what their electricity tariff is, 70% said no.

These results indicate that consumers' inability to understand their energy bills and their inability to understand the relationship between what they consume and what they are charged contributes to the lack of energy efficiency awareness.

Education Level

With regards to education level, when respondents were asked if they were aware of their current electricity consumption, only 10.53% of the respondent who attend high school knew about their monthly -kwh- consumption. 13.37% of the respondents who held an undergraduate degree knew about their -kwh- consumption. Finally, 24.17% of participants who held postgraduate degrees were aware of -kwh- consumption. It is evident that the lower the educational level, the lower the awareness about the energy details.

When respondents were asked if they would install renewable technologies in their home, 66.86% of the respondent who attend high school said yes. 67.48% of the respondents who held an undergraduate degree indicated that they would install it and 78.33% of the participants who held a postgraduate degree would also install it.

These findings are presented in Fig. 2. It was particularly interesting that a high number of participants with different education levels would like to install renewable technologies in their homes. However, it was found that participants with high education levels were more interested than others.

It is evident that the level of education in this study is associated with the level of energy efficiency awareness, with respondents with tertiary education reporting higher levels of engagement with energy information than others.

Income Level

Respondents were asked if they would install renewable technologies in their homes and responses were cross-referenced with income levels. Respondents with high income levels reported a higher rate of awareness of renewable technologies. Furthermore, there was a difference in levels of 'measured' -kwh- awareness with regard to the level of income. Respondents who earn above (SR15.000) were more aware of the -kwh- they use monthly (Fig. 3). This provides evidence that individuals who earn more are more likely to have increased awareness of energy efficiency measures.

A correlation between the level of income and the level of education among respondents emerged. The data shows that at the higher level of income, this correlation swings more towards higher level of education. The data suggests that higher socio economic status correlates positively with energy efficiency awareness. Educational level and monthly income level, unsurprisingly, appear to be most vividly related to energy efficiency awareness.

Perhaps respondents in the low income category may not have the opportunity to educate themselves on energy efficiency awareness. This highlights implications in terms of providing educational programmes that address this gap in public knowledge.

Possible Measures for Increasing the Saudi Awareness of Energy Efficiency

In terms of the tools that the Saudi government should implement in order to aid public energy efficiency, 39.72% of the respondent indicated that social media would be an effective tool. In fact, social media could well be the most effective tool to be used to increase awareness of energy matters, as Saudi Arabia has the highest percentage of active Twitter users, with 51% (PeerReach, 2013). At the same time, 32.48% of the participants indicated that the government should improve education curricula in order to help raise public energy awareness. Not surprisingly, only 1.42%of respondents believed that the government is doing enough.

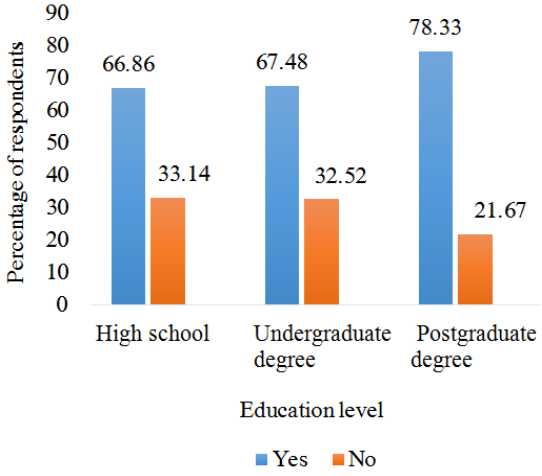

Fig. 2. Awareness of the renewable technologies/education level; source: Base of survey results

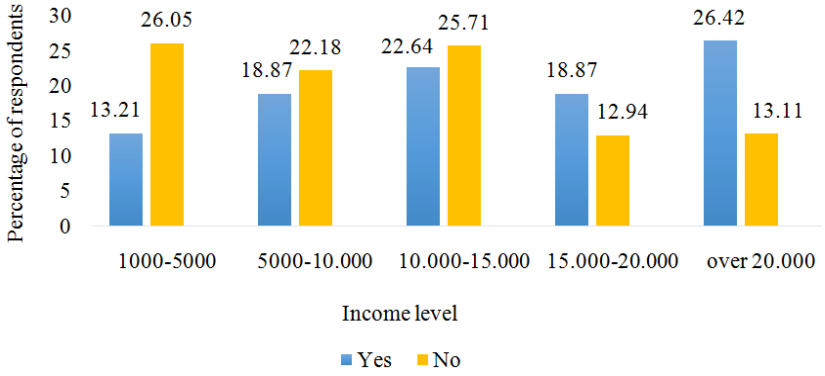

Fig. 3. Income level Vs Kwh-awareness Source: Base of survey results

Respondents were asked where they go to seek information about energy efficiency. A high percentage of participants (87.48%) noted self-research, 4.95% noted government agencies, 4.95% noted vendors and suppliers and only 2.61% noted utilities companies.

It is evident that Saudis have a number of options to seek information about their energy matters, but the majority of them seem not to be interested in obtaining energy information from official sources such as government agencies or energy companies.

Respondents were asked what would motivate them to use less energy. About 41.04% said that awareness about energy efficiency would encourage them to use less energy, 30.51% indicated that contributing to saving the environment would be a motivator and 25.03% of participants believed that energy costs and tariffs would drive them to use less energy (Fig. 4).

Public Opinion to Improve Energy Efficiency

The lack of awareness was reflected in respondents' answers when asked if they thought that Saudi Arabia's residents were aware of the issue of global energy and CO2 emission: 96.16% of respondents said no. However, when asked to consider ideas to improve energy efficiency, answers were really supportive and helpful. 12% of participants thought that renewable energy could be a good option to improve energy efficiency. One participant indicated:

> *"Saudi Arabia has a buried treasure-Solar Energy. The country receives some of the most intense sunlight in the world. Additionally, it has high oil revenue that could help them to establish a huge solar power plant in the world".*

In terms of public awareness of the environment and energy efficiency, 22% of respondents thought that increased public awareness might help reduce energy consumption, improve energy efficiency and in turn enhance energy security. One participant pointed out:

> *"Although energy is very cheap in Saudi Arabia, public should not consume more than what they need".*

Only (3%) of respondents thought that their electricity bill was cheap and that implementing new power tariffs would largely support energy saving in Saudi Arabia. One respondent indicated:

> *"Because the lack of understanding of the environmental issues amongst Saudi's culture, they are not taking it seriously and they usually make jokes of it. Therefore, increasing the electricity bill will definitely be more helpful".*

Based on a qualitative analysis of the data and linking this to the quantitative analysis, it is evident that increased energy efficiency awareness can be achieved through education.

Research Findings (Interviews)

On a positive note, all of the interviewees were aware of the issue of energy issues in Saudi Arabia. Interviews were conducted in order to explore participants' points of view about energy efficiency and energy security in the country.

The Current Energy Landscape in Saudi Arabia

Firstly, the data collected through interviews confirms what the literature review indicates about the current energy landscape in Saudi Arabia in terms of challenges, constrains and opportunities. In this regard and in demonstrating the energy challenges in the country, the sixth respondent indicated that:

> *"The energy landscape in Saudi Arabia is characterized with reactionism; slow to move, lack of leadership and continuous gap between where we ought to be and where we are."*

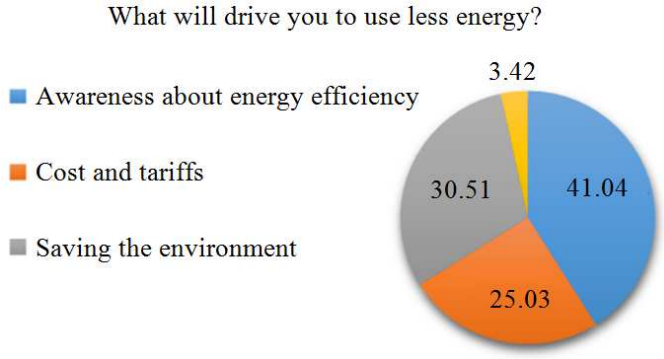

Fig. 4. Energy efficiency motivation source: Base of survey results

Moreover, the opinions of other interviewees indicated that Saudi Arabia faces several serious challenges. Some of the key challenges in Saudi Arabia's energy sector are the heavy dependence on oil export revenue, the massively growing domestic demand, the rapid population growth and the lack of interest in efficiency and conservation. The biggest challenge in Saudi Arabia is reducing uncontrolled demand, production sustainability and energy pricing. One respondent stated:

> *"Saudi Arabia has many challenges that could threaten its future. These are technical, political, policymaking and most importantly customer behaviour. These challenges are well known and currently being addressed by many Saudi government and private organizations under the umbrella of the yet-to-be-approved National Energy Strategy".*

One respondent's comments reveals that the challenges ahead of Saudi Arabia are: *"diversity away from oil in one hands and optimizes the country energy consumption in another hand".* This respondent also indicated that one of the big challenges in Saudi Arabia is the need to reduce energy waste without raising the domestic energy price.

Serious Enforcement on Energy Efficiency in Saudi Arabia

The lack of enforcement measures in Saudi Arabia are largely related to two factors: Consumers, which includes the lack of awareness and lack of accountability and supply, which includes prices and the lack of focal organizations in the country. This is evidenced by the following quote from one participant:

> *"Lack of awareness which is closely linked to the artificially-made cheap energy prices, which do not reflect the external costs to the environment. Mind you, addressing the subject of energy subsidies is very sensitive especially given the current unrest that prevails in the region".*

Furthermore, another respondent claimed that *"efficiency is still not considered a political priority".*

The Consumer's Role in Energy Efficiency Measurement

Saudi Arabia's primary energy consumption per capita is 3.6 times higher than the world average. With this growing demand, less efficiency and less awareness, the country may face difficulty in the future. As this research paper focuses on consumer behaviour, interviewees were asked to describe the consumer role in any energy efficiency policy and measurement. One interviewee stated:

> *"Consumers as the actual users of the energy, ideally, will use the energy similar to any other commodity, if cheap, he/she will over consume and if expensive will under the consume, therefore, we need to subsidize the energy to those in need and raise the price to the rich".*

Another participant argued that energy pricing could help to change consumer behaviour. However, this is not always effective. The respondent viewed the UK as an example of high energy pricing:

> *"Consumers in UK where energy prices are comparatively high, that does not always incentivize these choices. Consumers can change their behaviour through understanding their duty as a citizen or duty to future generations, interest in environment and awareness of emissions and/or even through competition with their neighbours/business competitors".*

Windows for Improvements

In asking interviewees to describe a winning recipe in designing a national energy efficiency program in Saudi Arabia, some interesting answers were obtained. One respondent pointed out that The Saudi Energy Efficiency Centre (SEEC) is *already on the right track.* However, the respondent also indicated that the Royal Decree

should provide authority and resources for energy efficiency initiatives. Three significant steps that should be taken immediately were outlined:

> *"(1) Give executive approval of the ECRA plan to reduce peak demand and over all electricity demand by 2021. (2) Incorporate the Energy Efficiency master plan into the 5 year development plans. (3) Set high level national targets-e.g., in reducing fossil fuel intensity (oil equivalent consumed per unit of GDP) and per capita electricity and water consumption-with responsibilities for monitoring and interim evaluation points".*

Another participant suggested that:

> *"Restructuring the Ministry of Petroleum to be a Ministry of Energy overseeing all energy affairs in Saudi Arabia for synergizing and integrating all existing and future energy programs/strategies and practical accountability".*

Moreover, another main concern was subsides and awareness. One respondent indicated that the winning recipe to design a successful energy efficiency programme could be done through the following recommendations:

> *"Gradual phasing out of energy subsidies + providing alternative subsidies programmes aimed at lower and middle-class groupings + intensive awareness campaigns at all levels + strict energy labelling and regulations enforcement".*

The above comments indicate that most energy experts have the same views about the current energy landscape in Saudi Arabia in terms of challenges and opportunities. In fact, they introduce significant solutions to reduce consumption through energy efficiency improvement.

Conclusion

This study has attempted to bring facts regarding consumer behaviour towards energy efficiency in Saudi Arabia. The key assertion highlighted in this study is that there are major problems relating to consumer behaviour in Saudi Arabia, especially with low income and undereducated individuals. However, even well educated people who demonstrate some awareness of energy efficiency measures do not appear to follow any energy efficiency habits in their daily life. In order to tackle the risk of increased energy consumption, a number of measures can be taken at a residential level.

Despite government efforts in response to the increasing energy demand, bad consumer habits remain. Consequently, we propose a number of recommendations to improve energy efficiency and to increase consumers' positive attitudes towards energy consumption. These recommendations are: Focus on consumer education, market efficiency via Friday prayer speech, improve the school curriculum to educate children and (indirectly) their parents about energy efficiency and develop renewable energy options and 'sing smart' meters. Energy efficiency programs must be administered. Finally, this research recommends that the country may use a balanced system of energy subsidies.

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Author's Contributions

Samar Khan: Literature review, data collection and analysis

Hafez Abdo: Literature review, methodological approach, discussion and conclusion

Abdulrahman Al-Ghabban: Data collection, analysis and discussion

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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