AN INVESTIGATION OF THE UTILISATION OF ENERGY AND WATER CONSERVATION TECHNOLOGIES IN BAHRAIN

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ABSTRACT

Purpose: This study investigates public awareness of government energy conservation programmes, and people's willingness to purchase products related to Electricity and Water Conservation Technologies (EWCT) for the purpose of creating business opportunities based on customer acceptance of and preference for EWCT within the Kingdom of Bahrain. A review of the literature contributed to the development of the theoretical and conceptual research framework.

Design/Methodology/Approach: Questionnaires were distributed to a random sample of 400 Bahraini households, aimed at investigating the awareness of government energy conservation programmes, customer needs, and willingness to purchase EWCT within families in Bahrain. A market feasibility was developed for the saleable EWCT devices.

Findings/Expected Outcome: In general, outcomes revealed that Bahrainis are educated and aware of conservation concepts. The results indicate that Bahraini households are willing to implement EWCT appropriate devices in their homes. A market feasibility study and business model for EWCT business technologies was developed based on these findings. This study assesses the market potential for EWCT in Bahrain.

Practical Implications/Social Implications: This study could form important guidelines for both the government and among businesses that might want to invest and sell energy and water conservation technologies to the public.

Originality/Value: This study underlines the business opportunities of Energy and Water Conservation Technologies in Bahrain on the basis of awareness, acceptance and business feasibility.

***Keywords*:** Conservation technologies; Bahrain; customer preferences; government programme; EWCT acceptance; technologies; awareness

INTRODUCTION

Increasing consumption of electricity, water, and other forms of energy around the world continues to be a major challenge for many states. At the same time, the sharp decline in oil prices since 2015 has resulted in significant shortages in revenue for many oil energy exporting nations, making it difficult to continue subsidising the energy sector for its local consumers. The electricity and water sector is directly affected by the global fall in oil prices. As a result, governments in the Gulf oil producing countries were forced to reduce the subsidising of local oil prices, and increase the cost of power and water to local consumers. This has created an opportunity for consumers and entrepreneurs to investigate the potential of accepting energy and water conservation technologies in Bahrain.

LITERATURE REVIEW

Definition and concept of conservation

Conservation is the act of preserving, guarding, protecting something or using it wisely. According to Zehner (2012), "energy conservation is the process of reducing the energy consumption of through lesser use of amount of services that generate energy". Leiserowitz et al. (2012) argued that while energy conservation reduces energy services, it can increase environmental quality, personal financial security, national security, and produce higher savings; it also lowers energy costs and prevents future resource depletion. It is classified at the top of hierarchy of the sustainable energy.

Natural Resources Canada (2014) pointed out that the terms 'energy conservation' and 'energy efficiency' are used interchangeably, but there are some differences; basically, energy conservation refers to using less energy and it is a behavioural habit, such as turning off lights or setting the thermostat lower. Conversely, energy efficiency is a technological change and means using energy more effectively. Energy efficiency measures the difference between the amount of energy used to provide the same level of comfort, and the performance or convenience by the same type of product, building, or vehicle. Conservation reduces energy use, but it is not always the best solution as it may affect comfort or safety as well. On the other hand, efficiency maintains the same level of output and uses less energy to achieve it. An ideal solution is combining both energy conservation and energy efficiency measures.

Preferences and utilisation of EWCT devices

In their market research in the UK, Busnelli et al. (2013) reported that:

> "consumers are positive saving to energy, but they expect business and the government are the leaders toward the low energy home, rather than act on their own initiative".

In this market research, it was also reported that, for most of them, cost is the reason for reducing energy consumption. However, when people purchase appliances, their priorities are more for features of functionality, brand, design and technological simplicity rather than saving energy. In addition, most consumers perceive low-energy products to have lower performance and not as good on the above features. The researchers suggested that:

> "consumers want to have more control over their energy usage, and they are most excited about technologies, such as sensor-lighting and home automation systems, when they tested energy-management products and services, which increased level of control" (Busnelli et al., 2013).

Gibbon (2014) focussed on the investigation of how the public conserves energy and water, highlighting the potential of increasing water-use efficiency at home, in businesses, and in government. At home, the adoption of water-saving appliances and fixtures, and replacement of lawns with water-efficient landscapes could reduce total residential water use by 40—60%, saving around 2.2 to 3.6 million acre-feet per year. Prior analysis showed that efficiency could be increased by 30—60% and would save around 0.74 to 1.6 million acre-feet per year in the commercial, institutional, and industrial sectors. These efficiency improvements could save 2.9 to 5.2 million acre-feet per year.

Reinhart et al. (2013) reported on the global effort towards identifying ways of reducing energy consumption and cope with growing demand. Their focus is on reducing energy consumption in residential homes, with the potential for saving energy in many sectors. In their study, they developed a system that combines home automation and energy usage monitoring technologies; the system offers tools for mobile devices to assist users in monitoring their energy usage and allows them to control home appliances to conserve energy. Findings show the benefits of mobile technology.

Kappel and Grechenig (2009) suggested a way of promoting water conservation through providing feedback via an ambient display that can be easily integrated into current shower types. To study the potential of such a device, they built a prototype for feedback. These shower water meters (show-me) display the amount of water used during one shower through a light emitting diode (LED) assembled on a stick to visualise the increasing water level. The user study revealed two groups: the

first group considered themselves ecologically conscious, changed their behaviour and turned the water flow down or off while soaping, and are willing to pursue this behaviour. The second group, who did not have the goal to act, were surprised about their water consumption and they tried to reduce it. After the removal of the show-me device they did not maintain this and returned to their previous behaviour.

Randolph and Troy (2008) studied the attitudes towards these EWCTs. In their study, they discussed a similar variable on the attitudes towards these EWCTs for ways we can reduce demand for domestic water. We need to understand the complexity of the forces shaping demand in the context of the socio-demographic composition of households in different kinds of dwellings. We also need to understand the cultural, behavioural, and institutional aspects of consumption if public policy is to be successful in reducing consumption and/or providing alternative domestic supplies of potable water.

One of the energy and water conservation technologies profiled in the literature was the Water Efficiency and Public Information for Action (2000) in Jordan. This was produced by the team who assessed the state of Water Saving Devices (WSDs), with the objective of exploring potential savings in water consumption and the conditions required to retrofit these to large water consumers. The overall findings of the team indicated that the amount of potential water savings was greater than the annual production of the Mujib Dam, the largest dam in Jordan. They noted that retrofitting alone would be insufficient to sustain savings; policy and regulatory incentives must be encouraging and facilitate the use of WSDs. There was variability in terms of type, make, and condition of sanitary and plumbing fixtures observed between buildings and sometimes on the same site. Another note were the variations in flow rates and water quality, since many of the toilets' leakage was due to scale and sediment precipitates in the water, or because of manufacturing deficiency. The study suggested that considering a comprehensive water audit for all selected sites before purchasing fixtures was important because these factors indicate that future retrofitting programmes should be implemented.

The issues and policy frameworks on energy and water conservation

Related literature on the policy frameworks for energy and water conservation initiatives was created by the US Environmental Protection Agency (2013). It described a government initiative that provides a comprehensive, straightforward overview of strategies for local governments to reduce greenhouse gas (GHG) emissions. The public can use these guides to plan, implement, and evaluate their climate change mitigation and energy projects. The different technologies, issues, and policies in energy and water conservation were reflected in the report of the Clean Energy Business Council (2013). The report highlighted that no other region in the world, such as the Middle East and North Africa (MENA) and Gulf Corporation Countries (GCC),

has the confluence of water scarcity and need to balance their food security worries with overuse of precious groundwater resources. In relation to the issues and policies associated to the water consumption in the Kingdom of Bahrain, Al-Zubari (2014) stated that the current domestic tariff structure has to be revised, particularly for the third consumption block, in order to conserve water and eventually help to achieve social equity among water consumers.

Businesses on electricity and water conservation technologies

Hitachi Construction Machinery Trading Ltd. (2008) sells energy-saving devices, such as the "Be Next", a controller for air conditioners and freezing machines to cut energy consumption, and inverters for mercury lamps and fluorescent lamps. They continued to endeavour to increase sales of these products based on the understanding that the sales of the products leads to reductions in Carbon Dioxide (CO_2) emissions. As a result, they sold 60 units of "Be Next", which is similar to the number sold last year, 62 units, despite the drastic deterioration in economic conditions. They also sold inverters to a tyre manufacturer and to other customers. They will make further efforts to increase sales of this product; hence, it can be termed that the increase in the price of electricity and oil became a blessing for this type of business.

Due to the increase in the price of electricity and oil, people become more attracted towards the purchase of products manufactured by EWCT businesses. Moreover, the Jamaica Public Service Company (JPS) (2013) rolled out retail stores that sell energy-saving products, and kick-started a more empowering engagement with customers. JPS initially offered around 40 different energy-saving products, such as power efficient gadgets, timers, and sensors. Their products are in three major categories: equipment that saves energy, equipment that protects investment, and equipment that understands usage. JPS has partnered with several suppliers, overseas and local, by providing a specific brand of surge protectors. JPS planned to focus on teaching consumers about energy consumption and how use energy efficiently while items are on sale. JPS has 15 offices and 4 'e-stores' around Jamaica offering the new services in all the locations. The company, which did not disclose how much money was invested, has an uneasy relationship with the Jamaican public because they have become frustrated with high electricity bills; this led the company to be rapacious.

The Financial Web (2013) reported that, "businesses have the opportunity to reduce costs and gain higher profits by switching to energy saving devices". They stated that the first step is to work on energy conservation, but team members and employees have to be in agreement with this. Large profits always make a difference for whatever number of sales is accomplished.

One of the new energy-saving technologies that business owners can take

advantage of is a 'smart power strip'. Equipment not in use but plugged into a 'smart power strip' will be turned off by the strip. On the other hand, an internetworks protocol can run on low idle mode when there is no load on the net. Business owners of this type can therefore improve energy efficiency by implementing the "power strip device" mentioned above. The energy consumption will be much lower when users are not using the network. In other types of conservation technology, businesses can limit the use of certain electric devices by using a key card, which is programmed to allow or deny access to electricity-based devices, such as air conditioning.

RESEARCH METHODOLOGY

This research was proposed in order to determine the appropriateness of the EWCT business model for the Bahrain market; the paper is based on a technical and financial feasibility study. In order to achieve this, the research had two approaches. First was the investigation of the current utilisation of the energy and water conservation technologies within families in Bahrain; this was done by confirming which available technologies were normally implemented in buildings to assist in energy conservation. It will also measure the extent and frequency of EWCT utilisation among families, their attitude towards using them, and their awareness towards Bahrain energy conservation programmes. The second approach explored the global technologies currently available in energy and water conservation in terms of their financial profitability, government regulation, support towards implementing them, and technological aspects.
The researcher proposed some types of electricity and water conservation devices through online research of manufacturers' sites for these technologies. It is believed that these technologies are suitable for Bahraini citizens; they are available at a reasonable price and can be classified into three conservation categories based on their usage in houses:

- electrical technologies (such as energy efficient lighting, mobile phone energy saver adaptors, wireless motion sensors, personal computer power down devices, retrofit energy saving devices, and smart meters);
- sanitary technologies (such as shower timers, electronic water mixers, tap aerators, save flash devices, pressure assisted tank toilets, leak detection devices, and toilet leak detection tablets);
- and garden technologies (such as garden irrigation timers).

Both quantitative and qualitative approaches were used. The quantitative approach was used because the variables are measured by the numerical data associated with each category of conservation technology in the questionnaire. The qualitative approach was used for the technological aspects through a ratings scale

type questionnaire that was distributed to and evaluated by two engineers from Electricity and Water Authority (EWA). The purpose of this instrument was to measure the strength of each EWCT product proposed in terms of the technological aspects of these products and government support. In order to study market feasibility, a competitor analysis was used. Competitor analysis is a type of marketing analysis tool that assesses the position and power of the current and potential future competitors. The analysis begins by defining the competitors, how they deal with business core items and how they treat their customer's needs, as defined by Chen (1996). The sample size was estimated to be 384, as the population (Bahraini families) is around 151,000 based on the Bahrain census (2010). A total of 400 respondents were obtained based on an online survey from www.typeform.com.

Statistical treatment and analysis of data

The instrument used in this research was the Family Survey on Energy and Water Conservation Technology (EWCT) through a self-administered questionnaire that was answered by the families/households as the main respondents in this study. The questionnaire could be completed on paper or electronically through computers and websites (Bryman and Bell, 2015). For the statistical treatment and analysis of data, the Statistical Package for the Social Science (SPSS[1]) was used; the secondary data was analysed using descriptive statistics, such as the mean and the frequency counts of the responses. However, the Analysis of variance (ANOVA) correlation and regression tests were used to test the hypothesis of the research in relation to the utilisation of EWCT for the following areas:

- preference for the different EWCT devices among the households and families of Bahrain;
- the differences in EWCT utility in households according to type of residence;
- the differences in awareness according to educational level;
- the relationship between awareness and willingness to implement EWCT;
- the relationship between willingness to implement EWCT and acceptance of them; and
- the impact of the demographic variables on acceptance of EWCT devices.

ANOVA is defined as the analysis of variance; it is a technique for statistically analysing the data from a completely randomised design and uses the F static test to determine whether there is a significant difference in two or more independent

[1]SPSS is a package of statistical computer programs originally written over 20 years ago for the analysis of social science data.

groups. Black (2013) defined 'correlation' as a measure of the degree of relatedness of two or more variables, while he defines 'regression analysis' as the process of constructing a mathematical model or function that can be used to predict or determine one variable by any other variable.

RESULTS

The results sought were regarding the awareness and acceptance of EWCT, willingness to implement them, and support from government. The demographic distribution of respondents shows that 96.6% of the respondents were Bahrainis and 63.07% were male. Results also revealed that 54.57% occupied professional jobs and 43.32% held a bachelor's degree. Approximately 50.53% of properties owned in the study were private houses, with an average of 67.7% of them utilising power and water in an average consumption range of around 8,000kWh per day per household and 345 litres per capita per day. This is considered a high rate of consumption, as the normal water consumption in households is estimated to be between 200 and 250 litres per day on average, as stated in the Technical Guidelines for Internal Water Plumping Systems, EWA.

Research responses reflected a positive reasonable relationship between awareness and willingness to implement the EWCT. Among the respondents, 49.86% were aware of government conservation programmes, and 60.31% were willing to implement conservation technologies in their own houses. An average of 58% of respondents accepted the proposed EWCT devices specified in the questionnaires. The survey results showed that 58% of households had implemented the conservation technologies available in the Bahrain market, such as thermal insulation, double glazing on windows, and energy efficient lighting.

Research outcomes also revealed that Bahrain government regulations support and work towards the issues of energy conservation from different aspects, without restrictions or objections against conservation technologies. The Bahrain government's recent regulations are mainly concerned with lighting systems, air conditioning systems, and efficient toilet tanks, with no objections to any other devices used for conservation as long as they do not affect the main household power and water system. Some regulations concerning the installation of water plumbing systems in households and commercial buildings have been published; these regulations specified the criterion to be followed during the installation of water plumbing systems and during routine checks to monitor water leaks in buildings. These regulations are also published publicly online by the metrology section of the Ministry of Industrial and Commerce; they provide available regulations and specification that should be followed when replacing home electricity and water appliances with recommended ones.

In general, outcomes revealed that Bahrainis are educated and aware of conservation concepts, which gives a sense that Bahrain is a good environment to utilise EWCT if the government make greater efforts to implement them. These efforts should include giving incentives and subsidies to the public to encourage them to implement these conservation technologies. All of the above mentioned outcomes support the hypothesis that the utilisation of EWCT among segments is equal; there is a preference for conservation technologies and willingness to implement them by the households of Bahrain, and the government supports the implementation of conservation technologies.

Market feasibility of energy and water conservation technologies

The research market feasibility study section identified and categorised the devices for energy and water conservation utilities into three groups based on household use: electricity conservation technologies, sanitary conservation technologies and garden conservation technologies. The devices were proposed after searching through websites of different manufacturers, based on researcher discretion

Table 1 Top 10 conservation devices accepted by the Bahraini public

Rank	*Conservation device*	*Mean value*	*Device benefits*
1	Energy efficient lighting for rooms	4.03	Saves 25% of energy consumption (www.manta.com), Columbus
2	Tap aerators	4.02	Mixes water with air and reduces 12% of water consumption (www.wessexwatershop.co.uk)
3	Smart meters	3.92	Monitors electricity consumption and provides real time information about usage (www.diehl.com)
4	Wireless motion sensors	3.90	Switches equipment/lights on or off, and cuts off unnecessary power (www.samsung.com)
5	Leak detection tablets	3.90	Detect water leaks in toilet and warns about necessary repairs (www.amconservationgroup.com), USA
6	Leak detection refill valves	3.83	
7	Save a flush bags	3.79	Saves water with every flush (www.wessexwatershop.co.uk)
8	Retrofit energy saving device	3.71	Save energy, power quality benefits or surge suppression (www.coolnomix.com)
9	Mobile phone energy saver adapter	3.70	Saves energy and provides safety against fire accidents (www.go-green.ae), Dubai
10	Personal computer power down devices	3.61	Cuts the power from all PC related devices when PC is switched off and turns them on when switched on (www.Powerdowntimer.com), USA

Source: Devised by authors

regarding their suitability in the Bahrain market. Table 1 shows the top 10 electricity EWCTs based on public willingness and acceptance of these devices via mean value of acceptance. The scope of marketing in Bahrain and a market study dictates that these devices are saleable; the majority were accepted based on the price attached to them that is affordable to almost all the families. The other fact is that some of these devices are used by households and businesses in Bahrain because they have a proven low consumption of electricity and water, leading to significant financial savings.

Evaluation of the business model scenario

To build a business network, it is recommended that big business start-ups are split into smaller phases. Scarborogh (2014) suggested that starting a business in stages allows the business owner to evaluate business operations and marketing activities and act accordingly. In order to select the most suitable business scenario among other types of scenarios in the Bahrain market in the field of EWCT, four possible scenarios were studied and evaluated in terms of requirements, advantages, and disadvantages. These include, online stores, shopping mall conservation shops, EWCT service providers, and creating the business and selling products through a third-party.

The advantages of the e-commerce module (online stores) include the absence of overheads and labour costs, absence of a commercial license in the first stage, absence of multiple machines, easy steps to launch, and customers can choose among different product qualities. However, a mark-up deduction will come from sales on each order, production and delivery time are partially out of control, product and client secrets might be exposed, and long delivery time and charges might be incurred because shipments come a long distance from the US, Europe, China, or Japan.

The shopping mall shop or commercial shop and store option focusses on mall customers. The main advantages are having a high number of visitors and being easy for customers to reach; disadvantages include higher rental charges, limited opening times, higher cost of decoration and purchase of equipment, and additional cost of obtaining official permits. Business requirements include shop rental, layout and location, and permanent expert employees.

The option of professional EWCT conservation solutions is a business providing solutions for the professional users in the industry, such as government, big industrial projects, and construction companies, all of which require high capital investment and skilled manpower.

Finally, with the option of a third party, the product provider purchases EWCT items online from overseas manufacturers, and coordinates with commercial shops that sell home appliances to market. They then sell the devices with some agreed

amount to be paid as a rental charge. Its advantages include the absence of overhead costs, absence of labour costs, absence of commercial license during the first stage, and absence of inventory stores. The main disadvantage is the long delivery time and the possibility of extended charges due to delivery mistakes.

Local market feasibility

The market has two major segments of customers to serve, namely, the enterprise customer and the individual customer. Enterprise customers comprise organisations and government agencies, who manage projects and big businesses. These segments can market EWCT devices directly into the local market through a professional relationship with their customers. The individual customer segment consists of families in Bahrain and smaller business organisations. The market of Bahrain can be considered one of the most important markets for these devices; this is because the non-growth of oil prices for the last few years has affected the national economy and citizens' daily lives as well. In turn, this has created the scope for the sale of these devices. It can also be determined that the reasonable prices of these devices can develop a better market prospect for families and small businesses. The competitors or rivals in the business of EWCT can be classified into three categories: local, regional, and international. Some EWCTs proposed by companies in Bahrain have a limited market, but there are signs of development and implementation of strategies for its diversification, with a high possibility of direct competition by local competitors as they have the capacity to duplicate the proposed model once it is launched in the Bahrain market. One of the best methods for mitigating this problem is by adopting the best cost strategy that can limit the local competitors in controlling the margins in the market. If this step is adopted, it will help to maintain customer loyalty.

Regional competitors are much less threatening in the Bahrain market since the competitors in the other gulf regions have a large market for their operations. They will be busy concentrating on their own local market; thus, EWCT businesses in Bahrain need not be worried about regional competitors.

For international competitors, it can be stated that due to the existence of a small local market in Bahrain, compared with those of the other international markets, there is much less of a threat from international rivals. Moreover, international markets have a higher prospect of business in their own markets, but international business organisations might implement their business through online services with minimum shipping charges in the markets of Bahrain. Hence, EWCT business technologies must maintain competitive prices compared with international competitors and maintain market intelligence reports, which can help move quickly in favour of any market changes.

Financial feasibility

Financial feasibility analyses the forecast of its revenues, which can be generated together with the cost of manufacturing the proposed devices. Mars (2011) provided a top-down forecasting approach to be used for pre-revenue start-ups. The top-down approach is suitable for start-up businesses because it does not require previous sales data to forecast sales: it is built on the basic experience and estimation of customers. However, since the module builds on a business owner's estimation, lack of experience can provide unrealistic results.

According to Mars (2011), the top-down approach is based on four steps:

- estimation of market potential;
- determination of adoption rate;

Table 2 The Business Costs, Revenues, and Profit in US Dollars

Devices	Sales and Marketing	Cost of Rev.	Total cost	Revenues	Profits
Electrical EWCT	$1,698.40	$1,002.40	$2,700.70	$18,597.90	$15,897.10
Sanitary EWCT	$1,698.40	$1,995.10	$3,693.50	$53,267.20	$49,573.60
Garden EWCT	$66.13	$167.60	$205.00	$3,703.70	$3,253.04

Source: Devised by authors

- prediction of market share; and
- development of revenue scenarios.

The market financial feasibility study for the proposed product mix assumes the purchase is through an online e-commerce shop, such as eBay, and items delivered through marine cargo. In this case, costs come down to around US$900 per 20-foot-long cargo container due to oil price reductions; it will take 1 month to 45 days to deliver the products.

Table 2 illustrates the estimated revenues and profits in the first year for the three proposed EWCTs, with an estimated volume of sales based on consumers' acceptance of products. The operating income is expected to be US$45,525.40 in the first year, followed by US$62,796.30 in the second year. As the business is expected to expand and attract new customers, where it will focus on the other type of segment that is the enterprise customers for professional solutions, the income is expected to reach US$91,542.30 at the end of the third year.

The study was also supported by a breakeven analysis of the proposed technology devices. A breakeven analysis is the analysis of the amount of price and quantity that

covers overhead and production costs (Bowen et al., 2009). A breakeven analysis for the proposed business model analysed the required sales quantity to be sold at specific prices for each proposed product. Results showed that breakeven points for energy efficient lights and tap aerators would be 42 and 32 units, respectively, to cover their costs. This is higher than other products since these units have lower prices; other products breakeven points range from 2 to 12 units. The analysis determined that the proposed devices would qualify for high sales rates in the Bahrain market.

INTERPRETATION OF RESULTS AND CONCLUSIONS

From the research hypothesis tests, it is concluded that the utilisation of EWCTs among segments is equal (T-one sample test used with p50.00), and there is a preference for different EWCT devices among households (T-one sample test used with p50.00). This meets Busnelli et al.'s (2013) conclusion that consumers are positive about saving energy and expect businesses and the government to take the lead on the journey towards a low-energy home. Another outcome of this survey shows that there is no significant differences in EWCT utilities in households according to residence type differences (one-way ANOVA, F statistic 5 0.167 with p-value 5 0.919 .0, null hypothesis rejected), which may indicate that EWCTs are utilised within citizens' households. This indicates a big market segment for this type of business.

The study concluded that a local supplier of EWCT devices with high quality products contributes towards raising the level of demand. Other conclusions showed significant differences in awareness according to education level (one-way ANOVA, F statistic54.97, p-value50.001), with a positive reasonable relationship between awareness and willingness to implement EWCT (correlation variable 50.592, p-value ,0.05), and a positive reasonable relationship between willingness to implement EWCT and acceptance of EWCT (correlation variable 50.484, p-value ,0.05). Finally, from studying the impact of the demographic variables on the acceptance of EWCT devices, it is concluded that the type of residence, education level, gender and living area have no significant impact on acceptance of EWCT devices. However, monthly income and nationality have a noticeable impact on acceptance of these devices.

Practical implications

This research has a valuable business significance because the results of the study form an important set of guidelines among businesses that might want to invest and sell energy and water conservation technologies to the public. If they are informed of the financial profitability of these devices, government support and regulation and the technological aspects of these devices and technologies, then they are able to determine which products would be feasible for marketing and selling in

the Kingdom of Bahrain. With the financial crises related to falling global oil prices, many financial, economic, social, and political dimensions will be impacted as a result of public financial resources, mainly oil dependency and not finding a real long-term alternative.

Recommendations

From the outcomes of the study, and for the benefit of the government of Bahrain, citizens, and future researchers in the field of EWCTs, it is recommended that the government of Bahrain proceed with subsidies on energy saving appliances for financial and production savings in power generation. The government of Bahrain needs to start policy and regulatory incentives that encourage and facilitate the use of EWCTs through partnership with overseas or local suppliers to provide a reliable brand of conservation devices, legislate and regulate import of electrical equipment, and promote equipment with higher energy saving ratings. Citizens should realise the importance of rationalisation and benefits by following the recommended guidance in the use of lighting and electrical appliances during peak times, which will benefit not only the government or state but every citizen in the Kingdom of Bahrain economically and financially.

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BIOGRAPHY

Professor Mukhtar AL-Hashimi is a Bahraini national, who has four degrees: undergraduate, two master's degrees and a PhD from the well-reputed University of Utah and Indiana State University, USA. During the last 25 years, he has served as an academic, advisor, director and executive member for a number of government and non-government organisations. He is currently working as an academic professor at Ahlia University, Bahrain. Professor Al-Hashmi's experiences are rich and a blend of academic, managerial and administrative activities at both government and private organisations. He gained much recognition for the development of a comprehensive medical information system "Al-Care System".

Mr Sayed Dheya H. Ahmed obtained an MBA degree from Ahlia University, under the supervision of Professor Mukhtar AL-Hashimi. His undergraduate degree, from the University of Bahrain, is in process instrumentation and control engineering. His professional experience is mostly in Reverse Osmosis (RO) Water Desalination Plants operation, where he has worked for the last 27 years. He is currently working as an RO plants process shift charges engineer.