



Strategic Energy Management in Sultanate of Oman

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ARTICLE INFO

Received November 11, 2015
Received in revised form – Feb. 24, 2016
Accepted Mart 21, 2016
Available online Mart 25, 2016

JEL classification:

N75; F01; Q40;

DOI:

10.14254/1800-5845/2016.12-1.7

Keywords:

Energy,
energy management,
Sultanate of Oman,
GCC,
energy policies,
energy challenges

ABSTRACT

Various economic sectors have set up a competition against themselves in the developing world which calls for an overwhelming need for energy sources that are reliable enough. It is important to have efficient energy supply for a smooth economic running. There is a high endowment of resources of oil in the Middle East that creates an equal determination to provide the proper management of the resources. Managing energy can only be done when there are a business culture and the environment that enables it.

As far as information and technology is concerned, there is a new dimension that has been acquired in the relationship that exists between the mining industry and the sectors of renewable energy. Having drawn efforts from different corners of the globe, the primary focus has been put on the Gulf region known for the greatest supply of fossil energy. Oman leads the Gulf area as a gate pass that is strategic enough to get into the Arabian Gulf. This area has shown complete passion about the pertinence of necessary steps early enough that will lead to attaining sources of renewable energy that are more reliable. All discussion areas have an aim which is to show how determined the Gulf Cooperation Council is, emphasising more on Oman, in the bid to obtain more alternative sources of renewable energy that are reliable.

1. INTRODUCTION

Practically all operations by human beings require energy. Day to day activities and processes consume energy in quantities that vary. Within the household, in companies, institutions and organizations are examples of places that consume energy supplied on a daily basis. It can clearly be seen that when energy is insufficient, there is very little amount of work that can go on successfully. With adverse energy effects, there is the determination of loss or profitability in any business undertakings. It is the engine that drives every economy and when there is insufficiency or loss the development of the economy of the regions or states in question is observed to lag behind

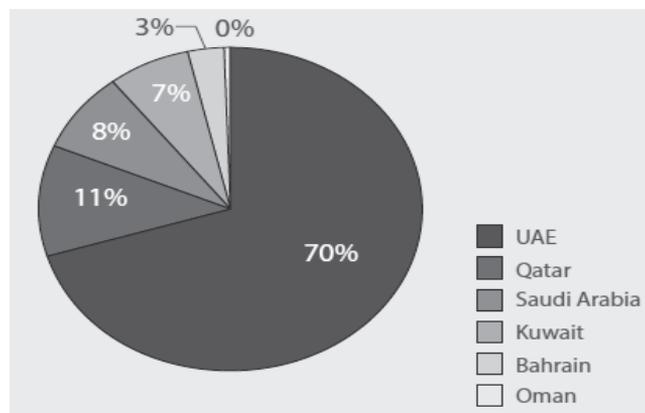
There are indefinitely large sources of both renewable and non-renewable energy. There is, however, an alarming trend in the energy that is being depleted due to over using the natural

resources over the years. As a result of the depletion, prices of fuels have shot up hence leading to an increase in generation of electricity that is used to operate corporations and businesses premises. (Miller, John, and Patrice, 2008). A huge split has emerged between energy demand and supply. The resulting glut has caused initiatives to be established ensuring energy conservation for use in the future. Since the Gulf regions are blessed with a rich reservation of fossil energy, there are strategies that have been established to make sure there is no single wastage of resources. Business awareness has been raised in the world to ensure that management of energy and conservation is efficient. This article explores the initiatives taken by industries to manage and conserve energy in the Gulf area economic sectors. The article aims at:

- Providing an analysis of the strategies of management employed by industries in the area.
- Examining the consequences the management approaches have on the environment.
- Providing a review of how effective such approaches are and how implementing them is of help to the environment.

Oil, coal gas, biomass and electricity are the main components of the total energy of a country.

Figure 1. Tower building stock across the GCC (CREDO report)



Source: based on CREDO report

The same report states that in the GCC, the sum of the saving potential in towers of residence and commercial towers is 3.5 billion dollars.

The quantity of energy that can be produced is termed as primary production. In cases where there is a relation to natural gas, it is a referral to re-injected energy. An example is that production of hydro energy, nuclear or geothermal energy is considered primary energy. Primary consumption should adhere to the primary production pattern on every scale. Primary energy consumption implies consuming all products that arise from the production of energy. What is meant by primary consumption of energy is that the primary sectors of the consumption by the economy are supposed to balance well with the quantity of primary production.

2. METHODOLOGY

The methodology aims at making solutions that are generic for various technologies at the domestic level as well as house technologies. There is a possibility of islanded scenarios or houses linked to a grid. Such scenarios function to provide a connection, to widget generation

at the domestic level and buffer technologies such that there is a guarantee for the supply of electricity and heat for owners of houses.

Managing energy requires:

- level of the device;
- a level of comfort that is guaranteed;
- manifold scenarios;
- harmony between the controller at the global level and one at the local level;
- electric power and heat, and
- online scheduling.

The liberty of domestic devices presents within the confines mentioned are specifically used for optimization. The objectives at the global level, as a result, are determined by the cost signals that are sent by the controller at the global level for import and export of electricity. At this point, the local controller is less aware of the state at the global level thus; he can return an impulse or impression about the signals that are being steered from the global controller.

Algorithm can be used to determine the distinguishing features in subsections. Algorithms are decomposed in time and then run relatively while determining each time interval that has parameters where time intervals start to set in. When demand is equal to supply, it behaves like the initial algorithm constraint. In incidents like these, demand is allocated to an input distinguishing factor that matches one, obtained from grid two, produced by the third generator and minimizes and switches off consumers four. There is a cost attached to each matching in this scenario. When the summation of the possibilities one, two, three and four produces more electric power and heat compared to the demand, however, the energy that corresponds flows to the grid and the buffer. Therefore, energy delivery to the grid is observed as an equivalent that is adverse that causes negative cost. In houses, every grid plus every device matches a particular measure of demand in energy for specific costs, and the energy which flows into a buffer can be observed as a matching that is negative. A group can analyse various billiards of consumers, buffers, control algorithms and producers that are domestic based was formed by the system that simulates an environment. In this case, the simulator has a basis of the grid that consists of multiple houses linked to the grid by the import and export of electricity. New technologies can be coalesced to it because it is generic in nature. Every user, therefore, begins to devour given time that goes on for a certain length of time and has a profile for usage for electricity. Using this method, the controller is in a position to send signals to that person in charge of production as well as consumers such that they can start and halt the devices.

The houses that were employed in carrying out simulations contained a micro CHP, a 15kwh capacity Gledhill Heat buffer and a 1kwh capacity battery. Those who consumed are given an extra total of 17.5kwh and a consumption of heat of 42kwh on a daily basis. Things that consume energy fuel in this case include house appliances which consume over a reasonable period. This section based its study on Reference scenario, global and local optimizations and outage of power.

3. LITERATURE REVIEW AND A SHORT HISTORY OF ENERGY IN THE GULF REGION

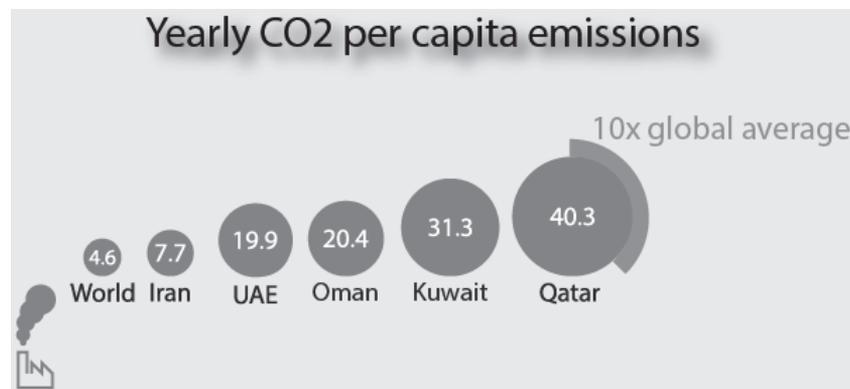
Creating alternative energy sources that can replace natural energy sources effectively has been the overall target of the Gulf region. Convectional energy sources cannot be neglected, and it is essential that the process of conserving energy has been taken into account by a program that is well developed. The Saudi Arabian government has displayed relentless effort in the cultivation of the culture of responsibility by encouraging health improvement of citizens and afforestation. Strategies have been implemented to make women groups' social welfare

better, to provide water for irrigating the land and drinking and also producing bio-fertilizer in a bid to reduce the degree at which there is exposure to effects of natural energy sources that are adverse.

Oman's location is on the Arabian Peninsula, which is also very close in proximity to the Arabian Gulf and Sea. An efficient entry is granted to the primary energy corridors in the Middle East. There is a plan by Muscat to come up with a refinery that is world class and storage equipment that will make it easier to provide effective management of the resources of energy that it is blessed with.

In the GCC, the only country that has a Ministry representative of affairs to do with climate and the environment. Sultan Qaboos promulgated a decree to generate ten percent of the sum electric power that is acquired from sources of energy that renewable which was considered to be a message of change full of ambiguity (Pauceanu, 2015). GCC countries, according to the information released of late, have ranked very high in per capita emissions of carbon consistently.

Figure 2. The per capita carbon emissions of the various GCC countries.



Source: <http://www.bq-magazine.com/gcc-illustrated/2014/08/co2-emissions-gcc-countries>

From the figure above, it is clear that the GCC countries consist of a per capita emission of carbon that is way higher than that of the remaining world. The lowest is Iran whereas the highest is Qatar. Kuwait follows very closely, followed by Oman and then UAE.

Adopting CCS in the Gulf nations has constantly attracted attention since it is broadly seen as a means of alleviation that suits a place that weighty geological exploitation has caused prosperity and richness. Also, availing captured carbon dioxide for an oil recovery process that is enhanced is expected to develop economic value that is significant enough. Lack of coordination in the regulation regime of the environment to cover emissions of carbon in the future is posing risks that are significant for the further development of CCS (Vijo et al., 2013).

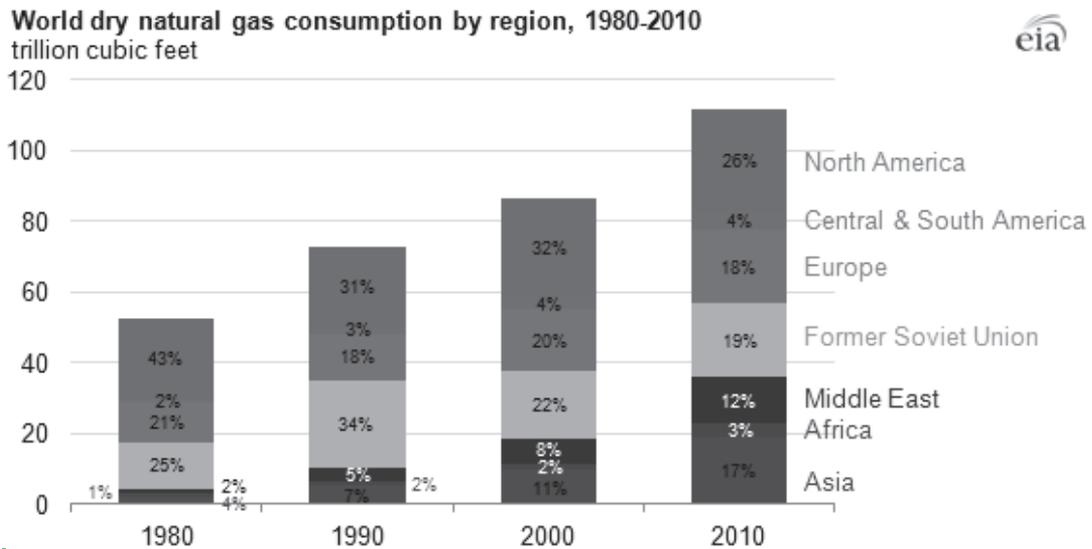
Founding EU-GCC network for clean energy was for the sole purpose of establishing a collaboration that is powerful enough and a process of exchanging knowledge. (It also answers the interests that are common among stakeholders, in both the EU and GCC, transitive in the clean energy field.) The network is an instrument of practical development of corporation activities that are concrete on clean energy, inclusive of the policy and aspects of technology that are related, among different players across the GCC and EU countries (Želazny, 2015).

Five discussions groups operate within the network. They focus on areas of interest of the EU and GCC, to be specific: Energy sources that are renewable, management of demand of en-

ergy and the efficiency of energy, natural gas that is clean and clean technologies that are in relation, interconnections of electricity and integration of market, and CCS. (Doukas et al. 2013; Kasperowicz, 2015; Balitskiy et al., 2016).

The consumption of natural gas is increasing at a rate that is alarming, and 50% of the gas and above is used in the generation of electric power and seawater that has been desalated in a CPDP, cogeneration power desalting plants.

Figure 3. The increasing use of natural gas worldwide.



Source: <http://www.eia.gov/todayinenergy/detail.cfm?id=5810>

In the bid to lower the consumption of energy by raising the CPDP efficiency (at the side of supply) and to conserve energy at the side of demand, primarily, there is the performance of energy footprint. Natural Gas data and data on oil proven reserve, consumption and production have a limitation and are distributed randomly. There is the necessity of having a picture that is clear that shows how the supply, consumption, demand and losses of energy flow, in particular sectors to find out the possible points of conservation. Prime energy might look abundant today, but consumption can happen within a few decades locally with minimal control. (Darwish, 2013)

4. ENERGY MANAGEMENT EFFORTS IN THE MIDDLE EAST AND OMAN

The main income for Oman, over some years, has been the oil resource. The mining process however, has been using up energy as it relies on steam obtained from the natural gas in the process of pumping oil from the wells. This process consumes a lot of energy, and although the returns are of much profit, there is a lot of energy wasted which could be used for developing other areas. The solar system has been embarked on largely by the OOC to salvage its oil resources. The technology in question is new and has not been put to use before. In the process, a system of mirrors is used. The mirrors are made to concentrate the rays of the sun towards the pipes which are black in colour. The pipes absorb the rays of the sun and in the process, the water is heated up to produce steam that is used in pumping oil from the well resources.

The Oman government is determined to use hydroelectric energy sources to run the economy rather than natural gas. The authority that manages electricity has been keen to involve the Ministry of water. Its main work has been to coordinate the different sectors of energy in economic development in a bid to provide engagement of the shift the more utilization of the electricity. There are two main networks in the sector of electricity in Oman. The largest MIS covers the region in the north. The RAECO ensures adequate electrical supply in the non-urban regions of Oman. The government has made efforts which have had very high returns of over 97% of the population that has access to electricity. Due to the trend mentioned, the cost of energy in Oman has been minimised and natural gas consumption has dropped sharply domestically as well as in fields of business.

There is an investment declaration by the EAU that is of a hundred billion dollars aimed at developing solar panels as an alternative method to curb the state of relying too much on natural energy. The size of the investment by UAE is a step bold enough to help in controlling the consequences of energy that is wasted. Other GCC countries are supposed to take this as a challenge and engage in efforts that help preserve energy. The use of wind turbines has been explored to a large extent for extra energy generation. The GCC finances any ideas that may lead to innovation of methods of conserving natural energy. Anybody who has an alternative energy source that is clean has a platform to express themselves in Doha, Qatar as the government fully supports such ideas.

Figure 4. Savings available from capital expenditure with less than one-year payback

	No Capex <i>Operations & Behaviours</i>	Low Capex <i><1 year payback</i>	High Capex <i>>1 year payback</i>
Details	<ul style="list-style-type: none"> Change behaviours - switch off lights/increase A/C temp etc. Prioritise energy usage in PPM and reactive maintenance scheduling 	<ul style="list-style-type: none"> Improve & integrate current systems - BMS & CAFM Small scale capex improvements - LLDs, IVAC optimisation etc. 	<ul style="list-style-type: none"> Larger capex improvements - reflective window screens, smart metering etc. Renewable energy initiatives - solar panels, turbines etc.
Source of energy savings	<ul style="list-style-type: none"> Reduced energy wastage Efficient equipment operation 	<ul style="list-style-type: none"> Reduced consumption 	<ul style="list-style-type: none"> Reduced system demand Self-generation
Impact on other costs	<ul style="list-style-type: none"> Likely to require incremental increase in FM resourcing 	<ul style="list-style-type: none"> Potential upside on FM utilisation as an improved CAFM will positively affect efficiency 	<ul style="list-style-type: none"> n/a
	↓	↓	↓
	No capex, short term wins	Minor capex drives major savings	Major capex with longer payback period

Source: base od CREDO report

5. POLICIES AND INITIATIVES

The government of Oman has been outspoken in its effort to uphold its energy. It does this by coming up with policies of management of energy in homes of its citizens. Oman's government has in situ an authentic CDER (Commission of Domestic Energy Regulation), which works

closely with the Home Affairs ministry to make sure there is a little usage of natural gas energy in households of its citizens. The government of Omani punishes any resident citizens who are found guilty of unlawful storage of crude oil materials in their homes. These standard criteria help in ascertaining a dependable way in which energy management is integrated as part of the functions of the government. Those who have ventured into businesses also have the responsibility of using energy considerably well. There is a social unit in Muscat whose task is to take statistics concerning energy used by business places.

The government of Omani admonishes natural gas wastage by coming up with energy regulation policies and making sure they are followed to the latter. It does this by increasing or decreasing the price of fuel consequently to deter the continuous consumption of the same. The population of Oman is estimated to rise by 20% in the following two decades, with this in mind the government is stern of hydrocarbon energy wastage because in the global trade it is its major financial gain.

The fundamental principle of management of energy can be understood evidently by coming up with sound deductions from the efficiency in the commercial enterprises due to the management of energy efforts. One way of pointing the urge of preservation of energy is the efficiency of operations of businesses. This report has been embraced by the United Kingdom by starting programs, in which all households are educated on the basic processes of saving energy. The energy sector shareholders are expected to employ how the UK effectively managed the hydrocarbons to address accordingly the wastage of energy sources.

For effective management of energy, various dimensions of management tasks, for example, controlling, planning monitoring have to be included. This calls for sensitivity of the citizens to change their attitude towards conservation of energy. A wide range of area is covered by the process of managing energy, thus improving decision-making process that relates to energy. At the company level, the process of managing energy may require allocating responsibility by forming chores of responsibility of the management of energy itself.

This process may lead to changes in the structure of management system of the organization. This is implemented by nominating qualified staff whose job is to efficiently manage energy resources and also to preserve energy.

Just as Oman, the Abu Dhabi, is interested in saving energy resources and it is committed to achieving its goal. A strategy to endow in solar panels has been adopted by the Abu Dhabi council at Shams. The solar plant is anticipated to produce over 100 megawatts of renewable and clean solar energy, just as the solar plant in Oman at Al Mazyunah - Dhofar Governorate. The aspirational plan is also gested to bring forth enough energy which will be exported in the future. The solar energy is anticipated to be pinned down by the final touches on the tall towers. The University of Masdar has largely contributed by offering technological advice and scientific innovations which improveth the creativity of the whole process. One of the main ways in which Abu Dhabi contributes to the city's blue print development is the project of solar energy. A sustainable urban development in conjunction with systems with new technology and the advanced building is the city's long-term goal. Oman and UAE better approaches towards development of inexhaustible energy are being followed by the Gulf States. For example, within the territorial boundaries of Iraq and Iran, there is a chosen path of exploring nuclear energies.

To achieve a long-term objective of having a sustainable inexhaustible energy, a series of constant investments need to be made. In Oman, the investments made have been vast although not enough by themselves as stated in Issues and challenges with renewable energy. As far as conservation efforts have pertained, there should be a long-term focus. For example, through the conference held in Muscat in 2009, the government of Oman has formulated an approach which by 2030 it will have focused on the fully developed conservancy. According to the long-term target, by 2030, 15% of energy will be saved. Alike long-term projects have also been employed in Kuwait, Bahrain, Saudi Arabia and in Egypt. Here, attention is put on targets

that are geared to offer a source of energy that is renewable in the GCC, because it contains resources for renewable energy that is not tapped.

The process works best with UAE because they enforced all ways towards saving energy. The use of tidal wave hydro- electric power was their best and most effective strategy. Other GCC countries have hardly commenced on the first stages of going through energy saving programs.

The side of demand of energy is equally important as the side of supply as stated by Palensky and Dietmar. The increase in global population also increases the demand for energy. The demand for energy resources is likely to fail to meet the supply if no measures are taken to manage energy resources because almost all countries are expecting a population increase as stated in the world biometric report.

An initiative has been decided upon to assist in controlling development in the local towns of Oman and Muscat by starting the council in charge of urban development. The council established a system of rating that is standard and compulsory that helps in achieving practices of development that are sustainable. The major work of the council is to ensure all buildings achieve a standard that is a minimum where the efficiency and standard energy that is efficient is concerned. The building standard in Muscat requires a construction pattern that will control energy wastage. Buildings belonging to the government are held to higher standards for them to be used as examples (Palensky et al., 2011). They have to lead by the front. They are supposed to set standards for developers who may be interested in investing in the city

6. THREATS EMERGING FROM THE MISMANAGEMENT OF THE ENERGY RESERVES

Heightened interests by those concerned in Washington, America's capital on the Arabian Gulf, have risen in relation to the exploration of the oil. There has been a vital bid by America to enhance efforts and create more stable security in the Gulf region. America's efforts have been pitched to achieving more economic approaches that are friendly concerning the running of the resources of oil in the Middle East. Wrongful use of nuclear power with military exploitation is the greatest problem faced by Iran and Iraq. To ensure a free flow of oil resource to the rest of the world from the Gulf regions has been American interest. The world economy has been founded on the central management of oil resources. It has been built for over 50 years. The economy of the world will come down quickly.

The USA also intends to keep the access of military to the geographically strategic vital region to keep up its comprehended effect on the outcome of the Middle East, and also Southern Asia not forgetting Central Asia. The increase of terrorist groups has boomed because of the unfitting management of oil reserves in the Arabian area as stated by Pollack in "Securing the Arabian Gulf". Without proper control of the oil resource, the money ends up in the wrong hands, the funds are then misused by financially supporting other unnecessary activities. Being occupied in the running of the resource of oil in the Middle East is the ultimate interest of humanity USA has done according to Pollack (Houcine et al., 2006)

The nuclear energy of Iran has gone to the extremes, and unless it is kept in the lane in the initial stages, it can be used for radical purposes. Instead of performing the intended work to offer a dependable and renewable energy source, the nuclear plants in Iran have started to produce nuclear weapons. This is dangerous not only to the neighbouring countries or USA but also to the world as a whole. The causes of radical agility in the areas of the Gulf are economic, social and involve political doldrums of the Arabian states found locally. The intercession by America into controlling the energy resources in the Arabian Gulf has not been easy. It has

faced opposition from self-leadership whose aim is to use the energy resources as a way to hold on to power (Darwish et al., 2013).

7. RESULTS AND RECOMMENDATIONS

To improve the initiative to improve, the government, shareholders and the remaining should be willing to take up responsibilities that come with it. Strategic plans should be put in place to involve managing, measuring, and proper documenting the trend to come up with a system where there is an improved and continued efficiency of energy. There were U.K essays from 2015 that propose that a systematic and progressperiodic report should be enforced so that the resources of energy are managed efficiently and the plans and strategies are better assessed. The reporting is to be done quarterly to facilitate the process of fixing other targets and adjusting the approach in the system of management.

In every sector, there should be a management team which is cross-divisional and appeals directly to the manager. A coordinator should lead the division. He should take responsibility to implement strategic plans that are propelled towards managing the resources of energy efficiently. Industries, households, institutions and the overall organization sectors should all form part of the divisions. A proposal which forms procedures and policies should be formed for the purpose of addressing every aspect of purchasing energy and managing it, its function and disposal. Through this, a sense of responsibility is created on the part of different fuel consumers.

CONCLUSIONS

The economy of the world is expected to rise to a significant extent in the coming 2-3 decades. Due to this, the administration in charge of information predicts that the rate at which oil will get consumed then will be 54% higher than the current consumption. International Energy Agency talks of a 60% increase in energy demand by 2030. As fossil fuels continue to dominate the world's reserve of energy, there is a scare that if managed poorly, the demand might not be attained for the sake of future generations. The economy, environment and security are significantly impacted by fossil fuels (Clowes & Choroś-Mrozowski, 2015).

Developing alternatives, for example, nuclear energies and other technologies that are renewable are appreciated ideas. (U.K Essays, 2015). The countries that will require more energy to develop are the likes of China and India because they have the highest population in Asia and the world. African countries are still developing to second and third world status, so the demand for energy in Africa is expected to go higher. When energy is managed efficiently, it is an expectation that living standards will ameliorate accordingly.

Operation by the military in the past was based on the assumption that energy sources would be available readily when the need for it arose. Today, however, it is seen that the fact that the world cannot be adequately supplied with energy is the biggest challenge being faced by military organizations globally. The rate at which the military relies on the resources of energy means that even when the supply is disrupted slightly, their chances of completing missions successfully are compromised. Military camps, as a result, have set up management of resources of energy that are efficient enough. For efficient running or the economy, the military included, surety, survivability and energy supply are extremely important.

There are more compelling action cases that aim at reducing consumptions of energy than ever before. There are strategies in place that aim at diversifying energy sources. Such strategies have drawn support from all over the globe and initiatives have been established in ensuring proper preservation and utilization of the small amounts of oil that are remaining in reserves. Oil demand is supposed to be met by an equal amount. In the past years, supply has not

equalled demand. The lack of investment has seriously strained suppliers and the industry has remained in languish in the infrastructure that is spread thinly. Management, therefore, is a call for all sectors to participate.

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