Energy Analysis for GCC Countries

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ABSTRACT

This study provides an energy outlook for GCC energy production and consumption. The main rationale for such grouping of GCC countries apart from geographical proximity, is the similarity in the level of economic development as well as the common challenges for the energy sector. The GCC countries are among the main energy producers in the world but also are among the world's largest energy consumption per capita.
Qatar has the highest per capita energy consumption in the Arab world. In comparison, the per capita energy consumption in Qatar is 4 times that in the United Kingdom and 20 times the average Indians per capita energy consumption.

1. INTRODUCTION

The GCC council countries, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates, together, covers a total area of 2410 km^2, has population of about 47 million and a GDP of $ 1.6 trillion or about $ 33 300 per capita [1].

The GCC countries are major oil and gas producing countries. They hold approximately 30% of the world's proven oil and 23.6% of the world's proven gas reserves [2]. At the same time these countries represent a formidable energy consumer. For example, in 2011, the GCC countries, despite the relatively small size of their populations, consumed almost as much oil and gas as Indonesia and Japan combined, a quantity greater than the entire primary energy consumption of Africa [3]. Based on these facts, the GCC countries continues on its path towards becoming an increasingly important center of energy demand growth throughout the coming years. The key characteristic in the GCC energy system is the very high reliance on conventional energy supply technologies based on oil and gas and the large reserves of oil and natural gas resources [4].

The importance of energy sector in GCC countries encouraged researches to study and analyze different aspects of the energy sector in the GCC countries. An overview of energy balance and greenhouse gas emissions at UAE in order to prompt renewable and sustainable energy practices was summarized by Adel Juaidi [5]. Gulf Cooperation Council countries 2040 energy scenario for electricity generation and water desalination was presented and discussed for each of the six GCC countries [1].

This paper summarized an overview of energy production and consumption in the GCC countries. The data used in this paper are obtained from U.S. Energy Information Administration (EIA), International Energy Agency (IEA) IRENA and the World Bank.

2. ENERGY OUTLOOK

The total primary energy production increased clearly in the GCC countries during the last few decades as shown in Figure 1. Saudi Arabia is considered the second largest total petroleum and other liquids producer behind the United States. According to U.S. energy information administration, United Arab Emirates, Kuwait, Qatar, Oman and Bahrain ranked 6th, 11th, 14th, 21st and 57th, respectively. During the last 30 years the total primary energy production was doubled in the GCC countries. In some countries, like Qatar, the production in 2012 is 10 times that of 1980. Saudi Arabia primary energy production is almost equivalent to the production of all other GCC countries. This gives Saudi Arabia the leadership in increasing or decreasing the total primary energy production in the GCC countries.

The increase in the population has obviously been reflected in the increase in primary energy consumption in the GCC countries. The total number of population in the GCC countries increased from 15 million in 1981 to more than 50 million in 2014. As shown in Figure 2, during the last three decades the number of population in

Saudi Araba increased three times. The United Arab Emirates witnessed a sharp increase in population starting from 2005. The number of population in UAE doubled in the last 10 years. This is clearly reflected on the primary energy consumption as shown in Figure 3. The harsh climate in the GCC region causes high cooling demand throughout the year. Moreover, huge energy waste due to the use of low efficiency appliances, high living standards, government subsidies, and the energy intensive lifestyle in GCC countries have boosted the primary energy consumption in the GCC countries. Furthermore, the GCC countries lie in a geographical location that suffers from short supply of water, notably rainfall and groundwater. Therefore, the GCC countries rely mainly on desalinating seawater to meet their demand for potable water. This results high energy demand growth. According to U.S. energy information administration, Saudi Arabia is the world 9th largest consumer of primary energy. United Arab Emirates, Qatar, Kuwait and Oman ranked 18th, 24th, 25th and 32nd, respectively. This is expected taking in consideration the population of each country and its economic capabilities.

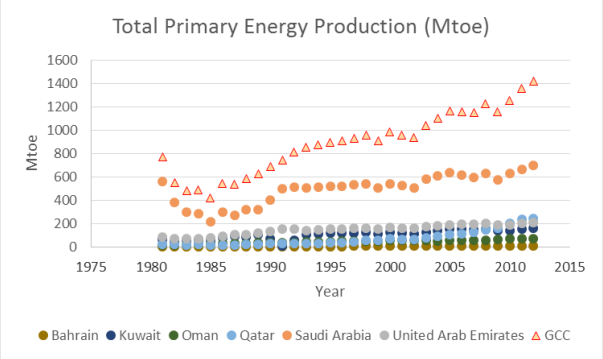

Figure 1: Total Primary Energy Production in GCC Countries

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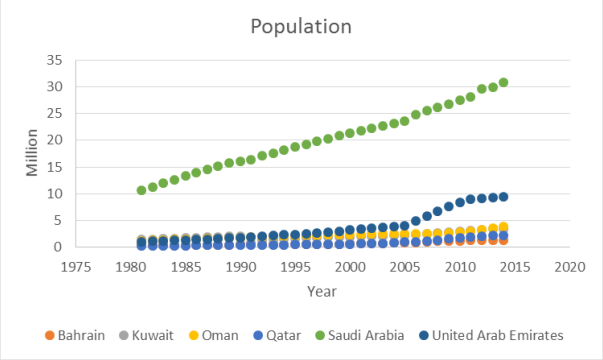

Figure 2: Population in GCC countries (1981-2014)

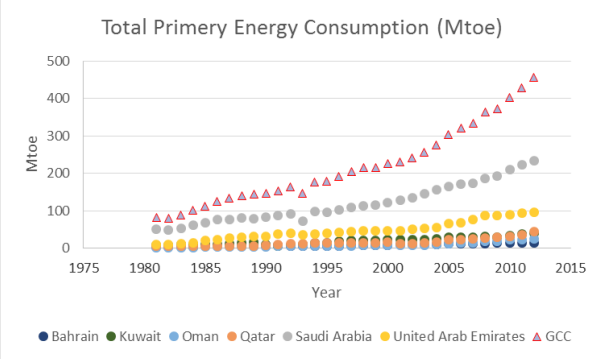

Figure 3: Total Primary Energy Consumption in GCC Countries

Figure 4 shows the total primary energy consumption/production in the GCC countries. Consumption/production ratio increased in all GCC countries in the last few decades due to rapid industrialization, population growth and increasing water desalination. Besides that low fuel prices over the past decades led to higher energy demand especially in the residential sector. All GCC countries, except Qatar and Kuwait, consume more than 30% of the total primary energy produced. Since 2000, United Arab Emirates has the highest increase in consumption/production rate. In 1991 total primary energy consumption/production in Kuwait jumped to 0.5 due to the Gulf war. Bahrain has the highest consumption/production ratio and currently consumes almost all its produced primary energy. In 2012, consumption/production ratio was highest in Bahrain followed by the United Arab Emirates, Oman, Saudi Arabi, Kuwait and Qatar respectively as shown in Figure 5. The average consumption/production ratio in the GCC countries is 32%.

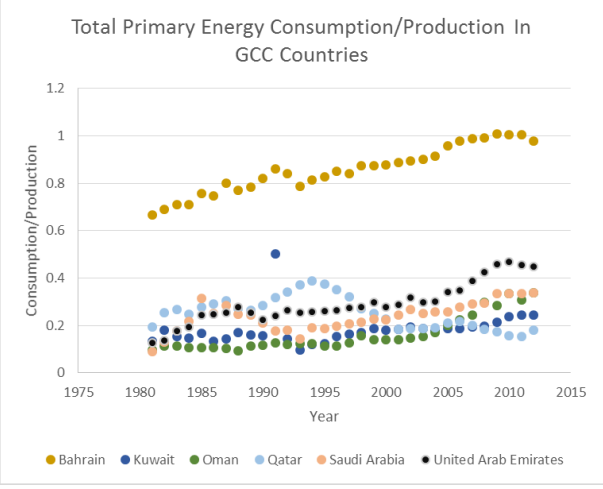

Figure 4: Total Primary Energy Consumption/Production in GCC Countries

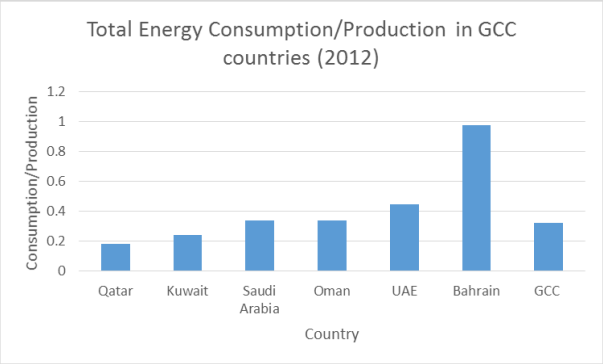

Figure 5: Total Primary Energy Consumption/Production in GCC Countries (2012)

The GCC countries ranked among the highest countries in term of energy consumption per capita. As shown in Figure 5, Qatar ranked first, followed by Kuwait, United Arab Emirates, Bahrain, Oman and Saudi Arabia, respectively. In comparison, the per capita energy consumption in Qatar is 4 times that in the United Kingdom and 20 times the average Indians per capita energy consumption. This can attributed to the harsh climate in the GCC region causes high cooling demand throughout the year. Also, low fuel prices over the past decades led to higher energy demand and less efficient energy use in the GCC countries.

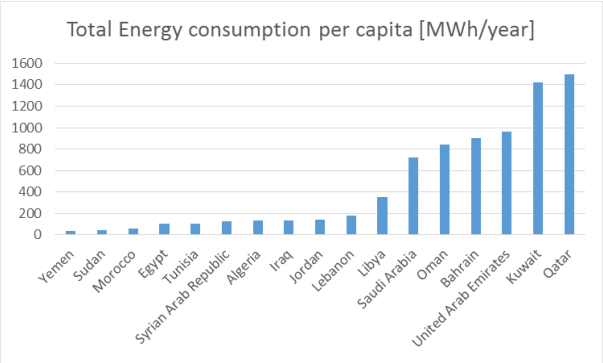

Figure 6: Total Energy Consumption per Capita

In the GCC countries oil and gas are the major energy sources. This is directly reflected on the emitted emissions especially CO_2. It is known that the combustion of fossil fuel is the most significant source of atmospheric CO_2. Figure 7 shows that Saudi Arabia is leading the six GCC countries in its CO_2 emission contribution followed by United Arab Emirates, Kuwait, Qatar, Oman and Bahrain. It is clear that Saudi Arabia has the highest increase rate compared with other GCC countries especially in the last 10 years. This is related to the significant economic and industrial growth in Saudi Arabia during the last few years. United Arab Emirates showed similar but a less steep growth in CO_2 emissions. In 2012 the share of Saudi Arabia CO_2 emissions of the total GCC is 52%, followed by United Arab Emirates with a share of 20%.

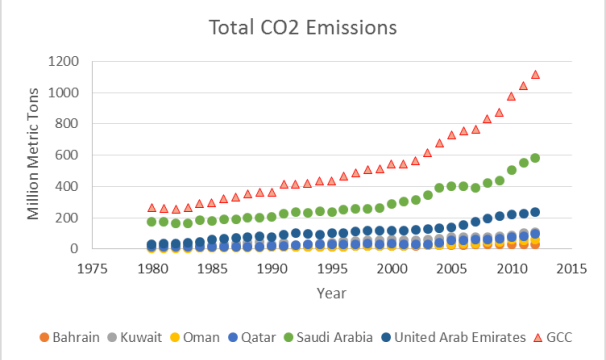

Figure 7: Total CO_2 Emissions in GCC Countries

Oil and gas will remain the major energy sources in the foreseeable future. The current share of renewable energy in the GCC countries is less than 1%. The UAE accounted for 70% of the installed renewables capacity in 2014, followed by Qatar (15%) and Saudi Arabia (13%) [6]. The GCC countries, therefore, are more scrutinized as far as their energy consumption and emission. Keeping business as is may risk their position with the emerging CO_2 taxation emission limits. They have better opportunity to reduce their consumption and emission and in spending today's fossil wealth in more sustainable, renewable and less emission energy alternative. This include energy policy reforms, promotion of energy efficiency and cogeneration, investment in renewable energy (wind, solar, geothermal etc.) at the local and global scale.

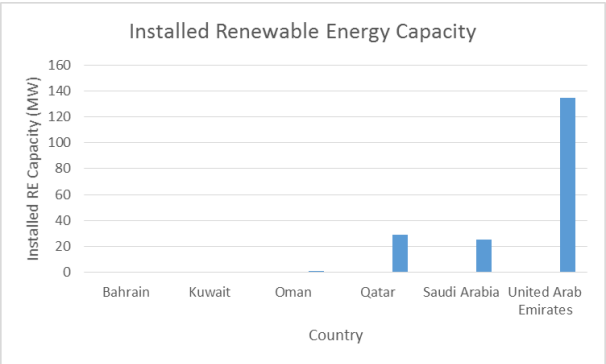

Figure 8: Installed Renewable Energy Capacities in GCC countries

3. CONCLUSIONS

The primary energy production in the GCC countries doubled in the last 3 decades. These countries witnessed

also a sharp increase in energy consumption. The average consumption/production ratio in the GCC countries is 32%. The analysis showed that the GCC countries ranked among the highest countries in term of energy consumption per capita. This high energy consumption reflected directly on CO_2 emissions in the GCC countries.

In spite that the GCC countries are heavily dependent on oil and gas, these countries have the opportunity to invest more in renewable resources. They can do so, as they are dually fortunate with plenty and spacious solar irradiation, wind to some extent, geothermal, and more so power plant integration and co-generation for water desalination

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