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## The impact of oil price fluctuations on common renewable energies in GCC countries

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### ABSTRACT

The decline of petroleum resources is a real problem that needs to be addressed by the non-renewable energy policies applied by world governments. Renewable energies such as solar and wind sources, nuclear power, or hydrogen fuel cells may become viable alternatives to conventional fuel in the future. This study reviews the conditions of the world's leading oil producers for the coming 50 years, i.e. the Gulf Cooperation Council (GCC) countries. On the other hand, this study clarifies the share of renewable energies today and how it will continue to increase steadily.

This study demonstrates that the increase in oil and shale gas production will affect the GCC countries, especially kingdom of Saudi Arabia (KSA), the largest oil exporter in the GCC. The study demonstrates that the GCC have failed in the separation between economic development and energy demand in the past decades. Therefore, the GCC economies are among the least efficient in the world. The growth in energy consumption is faster than economic growth in the region.

Sustainable energy in GCC states has been considered since 2008. Resource efficiency programmes, clean technology research, alternative energy projects, green building codes, green economy strategies, and public transport systems have become a part of mainstream news. The GCC states have started to have a stake in the transition to sustainable energy. The GCC states have already undertaken some policy, projects, and sector-wide efforts. These projects, if implemented, will boost the investment, and its effect on the environment will be apparent. Many of these policies and plans, however, still exist only on paper. The green building codes and national solar targets has been discussed.

### 1. Introduction

The Arab world is central to the world's energy supply and energy production resources. The Arab world holds 49.6% of the world's substantiated oil reserves and about 29.1% of the world's natural gas. Its importance for the international energy markets cannot be over-emphasised. In 2011, the proven oil reserve of Arab world countries was about 43% of the world's total (713.6 billion barrels) [1]. The Arab world contains 22 countries, and 16 of these are producers of oil [2]. The entire Arab world produced over 26 million barrels per day (mb/d) in 2011. This number was ranked third globally in terms of oil supply. As a result, the Arab world has become the world's largest oil producing region [3]. The oil wealth of the Arab world has shaped its overall development trajectory. This situation is ensuring that Arab world countries are integrated into the international economic system.

These countries are the world's primary source of oil, and the global oil situation is unlikely to change in the near future. However, there

have been many recent discoveries of oil reserves outside the GCC region such as shale oil in the USA, deep offshore in Brazil and oil sands in Canada. These countries are expected to play a fundamental role in international oil market dynamics.

The GCC was established on May 25, 1981 in Abu Dhabi. This council consists of six countries, namely the United Arab Emirates (UAE), Bahrain, Kingdom of Saudi Arabia (KSA), Oman, Qatar and Kuwait, as shown in Fig. 1. The total area covered by the GCC region is about 2,500,000 km<sup>2</sup>. The estimated population of the GCC was about 46.8 million in 2011, while it was about 33.2 million in 2004. It is expected to rise to 52.8 million in 2016. The GCC countries' global Gross Domestic Product (GDP) increased about 29% in 2010 and reached about 1.4 trillion US\$ in 2011 [4].

The GCC countries are mainly coastal regions on the Arabian Gulf. These regions are composed of dry deserts and have humid coastal climates with only two main seasons, summer and winter. November to March is the winter season where temperatures are around 26 °C and

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Fig. 1. GCC countries [4].

15 °C during the day and night times, respectively. The summer season is between April and September, where temperatures approach 50 °C. This can be lower near coastal areas due to high humidity (approximately 90%) and wind speed. Some mountainous areas are cooler with average temperatures in the range of 10–14 °C [5].

With the exception of Oman, rainfall is sparse and inconsistent in the region. Average rainfall in all countries is between 140 and 200 mm per year while Oman experiences rainfall of up to 350 mm/year. Rainfall in the winter months is a combination of north-westerly winds from the Mediterranean Sea and atmospheric depressions, primarily in February and March. In coastal regions the rainfall is lower in summer. However, some years there is no rain or it rains very few times. In 2015, the region had heavy rains in some countries, which created problems since the infrastructure is not able to deal with this situation [6]. Moreover, the desert exposed to Shamal winds, which are forceful dust storms.

The growth in population in the GCC continues is prepared to increase rapidly. The population doubled in 2010 compared with 2005. The urban population is about 83% of the total population, with this number increasing hugely between 2005 and 2008 [7].

All sectors in the GCC, with varying degrees, have been affected by climate change. Climate change showed clearly in the GCC countries. Substantial warming has taken over the GCC countries between 1960 and 2010. Between 1960 and 2003, the cool days and nights occurred over this period and there were more warm nights throughout the region. Average summer temperatures increased across the area as a result of the impact of human activities on climate. These activities made the occurrence of warm summer temperatures more frequent and cold summer temperatures less frequent.

In this study the oil and gas situation in GCC countries, in terms of resources and prices had been revised and investigated. The high reduction in oil prices and the long period for prices instability was discussed. Also, the oil prices impact on the economics of the six countries in the GCC region has been analysed. The impact of this situation on energy resources, renewable energy investments and programmes, and economic has been discussed.

## 2. The economic strength of GCC countries

The GCC countries had a larger surplus than either Germany or Japan in the year 2012–13 due to higher oil prices boosting exports. The GCC countries have relied on oil as the primary source of income over the past decades, and their economies revolve around it. This rapid economic development resulted in increased growth of industrial

development, leading to larger energy demand in the GCC region.

KSA, Kuwait, Iraq, and the UAE are among the world's ten largest producers of oil. 98% of the Arab world's total oil reserves come from KSA, the UAE and Kuwait along with Iraq, Algeria, and Libya. Substantiated oil reserves of KSA alone are more than 265 billion barrels, which represents about 16% of total global reserves [8,9]. The GCC region has a primary position in international trade of crude oil. The oil revenues can be considered as an essential source of affluence for the GCC region as a whole. This wealth has driven the socio-economic in the region and its growth. Hydrocarbon fuels still play a critical role as a domestic fuel, covering about half of the area's needs.

The energy consumption of the GCC countries has grown 74% since 2000 and is forecast to double by 2020. This growth in energy and electricity demand has synchronised with the high global concern over carbon emissions and climate change [10].

As an example, the domestic consumption of oil and gas of the KSA increased to about 69% in 2009 from its values in 1999. Meanwhile, the crude oil consumption for power in the KSA was estimated to be 582,000 barrels per day in 2011; this amount rose by about 340% from its 2006 level [11].

This large rise in consumption has caused the UAE, Oman and Qatar to mix their power generation with the energy from natural gas power stations. However, natural gas prices are not as cheap as they were in the last century. Another obstacle added to the increased power costs is the high pollution resulting from oil and gas production as well as their use in electrical power generation and transportation. The effort in curing the environmental damages resulting from pollution added to the increasing prices of oil and gas and electricity that is subsidised by GCC governments creates additional pressure on the financial affairs of these countries [12].

The GCC countries have realised the importance of using green generated power by using alternatives to oil and gas. This region has high solar intensity and enough wind velocities that can make these two renewable energies, the solution for the lack of electrical power generation and large pollution concentration in the region. The oil and gas subsidies that are used to produce electricity (the subsidised of both the fuel used and the generated power) might be used to build and construct new plants [13].

Solar power is the primary renewable energy that is ready to use in GCC countries. It is now economically viable thanks to many factors, such as the rise of fuel costs used in conventional power generation, the reduction in the cost of solar panels, and the real suitability for demand patterns which is high in summer where solar radiation is high. There was a traditional view among policy-makers of the GCC region that solar energy is still uneconomic compared with the abundant hydrocarbon resources in the region [14].

## 3. Oil dependence volume in GCC economies

Gulf Cooperation Council (GCC) members became global players, thanks to the increase in world oil prices from US\$22 to US\$147 per barrel during the period from 2002 to 2008. The geographical site between the East and the West with oil and gas -rich reservoirs have put the GCC countries in a position of influence in the global economy. Revenues from foreign exchange of up to US\$912 billion have been achieved by these countries during this period [15,16]. In KSA, the national income from oil exports increased from US\$42 billion per year in 1999 to US\$307 billion per year in 2008. The UAE's national income increased from US\$13 billion to US\$87 billion for the same period. In Qatar, an increase from US\$4 billion to US\$27 billion was achieved during the same period. In Qatar, after a decade of investment in infrastructure in the liquefied natural gas (LNG) sector, it becomes the third greatest source of gas in the world. In general, economic growth for these countries reached 13% thanks to this investment in 2000. In addition, exports of up to 77 million barrels per year will be achieved in 2020 [17].

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