

Energy Consumption and Carbon Emission in the UAE

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Abstract. Energy is central to improved socio-economic well-being, indispensable to most industrial and commercial production; and is vital for eradicating poverty, improving human welfare and raising living standards. The provision of adequate and reliable energy services at affordable costs in a secure and environmentally benign manner, and in conformity with social and economic development needs, is an essential element of sustainable development. In this paper an analysis of Energy consumption and consequent emission of carbon dioxide in the UAE is presented. Due to unprecedented high economic growth rate, population increase and a fairly low energy cost, heavily subsidized by the government, the UAE's energy consumption has risen tremendously in the past decades, making it one of the highest energy consumers per capita globally, with consequent high environmental pollution and CO₂ emission. To address the potential crisis that may result from the high per capita energy consumption the UAE Government has launched various initiatives aimed at identifying alternative means for producing the power needed to fuel its economy.

Keywords: UAE, Energy consumption, Fossil fuel, Natural gas, Oil, Sustainability, Per capita carbon emission

1. Introduction

Adequate and affordable energy supplies is therefore key to economic development and the transition from subsistence agricultural economies to modern industrial and service-oriented societies, and is as well an essential factor in overall efforts to achieve sustainable development. However, most current patterns of energy supply and use are unsustainable. Countries striving to this end are seeking to reassess their energy systems with a view toward planning energy programs and strategies in line with sustainable development goals and objectives. The United Arab Emirates (UAE) has the world's sixth largest proven oil reserves and the fifth largest natural gas reserves, making the country a major supplier in global energy market [1]. Total energy production continues to increase and remains higher than total energy consumption as shown in Fig. 1, making UAE a major world energy supplier.

2. Energy Consumption in the UAE

The UAE has one of the world's highest energy consumption rates. In 2008, the total primary energy consumption reached 3.257 quadrillion BTU from 0.27 quadrillion BTU in 1980. Figure 2 shows the rapid increase in energy consumption in the UAE [1]. Energy demand in the UAE grew by around 2.14 per cent in 2010 to make it the second largest consumer of oil and other hydrocarbon products in the Arab world. The high energy (in form of electricity) demand in the UAE is attributed to a steady expansion in non-hydrocarbon sectors over the past years, mainly manufacturing which has become the second largest component of GDP after oil. As is depicted in Fig. 2 the increase in energy consumption corresponds very closely with rapid economic growth in terms of GDP.

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The UAE has massive natural gas reserves. After the Russian Federation, Iran, Qatar, and Saudi Arabia, the UAE holds the fifth largest proven gas reserves in the world, namely 3.5 percent of the total global reserves. Estimated at 6.43 Trillion cubic meters (TCM) at the end of 2009, UAE reserves should last another eighty-five years at 2009 rates of production.³ The bulk of UAE gas is located in the capital of the UAE, the Emirate of Abu Dhabi, which holds approximately 5.62 Tcm of the UAE's total reserves, or more than 90 percent of UAE gas. Because the UAE is almost totally reliant on natural gas for power generation, its total gas consumption is very high and is expected to reach 107.5 Bcm/yr by 2020. Its gas demand has steadily outstripped incremental production increases since late 2006. The UAE therefore has to import natural gas from Qatar to meet its increasing consumption needs (Fig. 3). In 2007, domestic consumption of gas outstripped production for the first time, and the use of natural gas for injection into mature oil fields further compounds the strain on natural gas supplies. Despite the UAE's large natural gas reserves, capital costs and high sulfur content present major impediments to development. One reason the UAE natural gas demand is so high is because of the disproportionate use in power generation, accounting for 98 percent, with fuel oil comprising the rest.⁸ Additionally, the UAE's rapid economic and demographic growth caused it to have the second highest consumption rate in absolute terms, after Saudi Arabia, amongst members of the Organization of Arab Petroleum Exporting Countries (OAPEC).

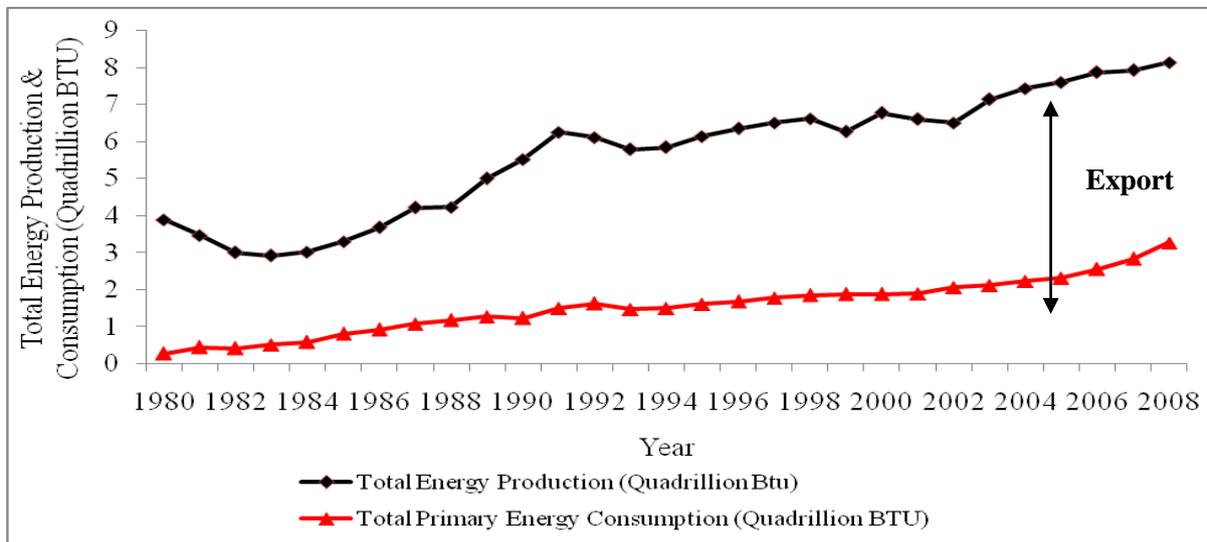


Fig. 1 UAE total energy production and consumption from 1980 to 2008

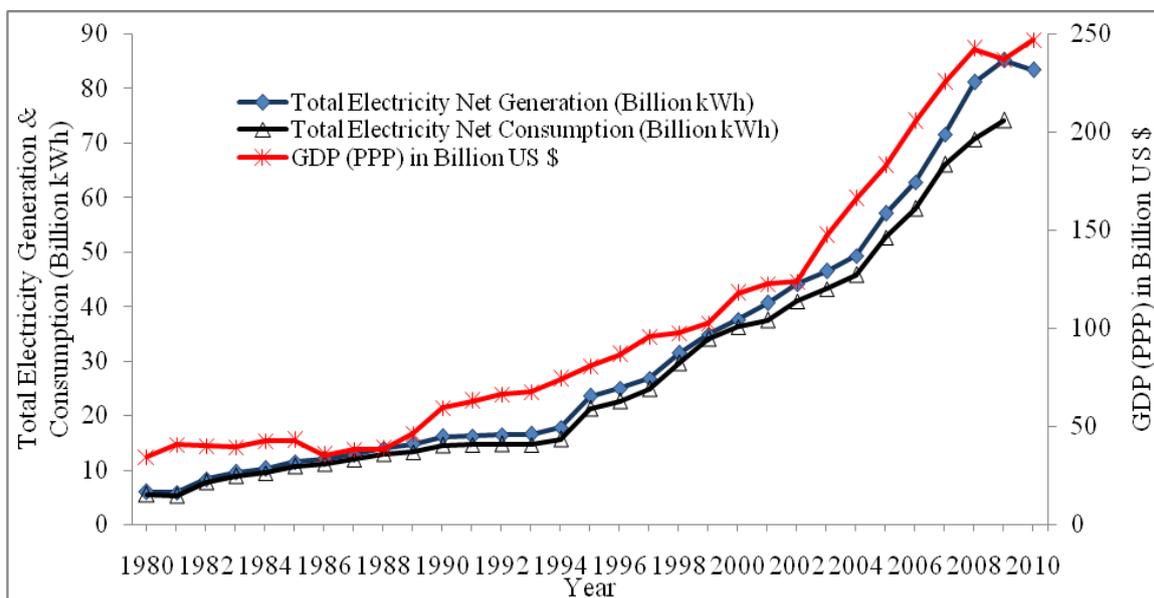


Fig. 2 showing total electricity net generation and consumption in billion kWh

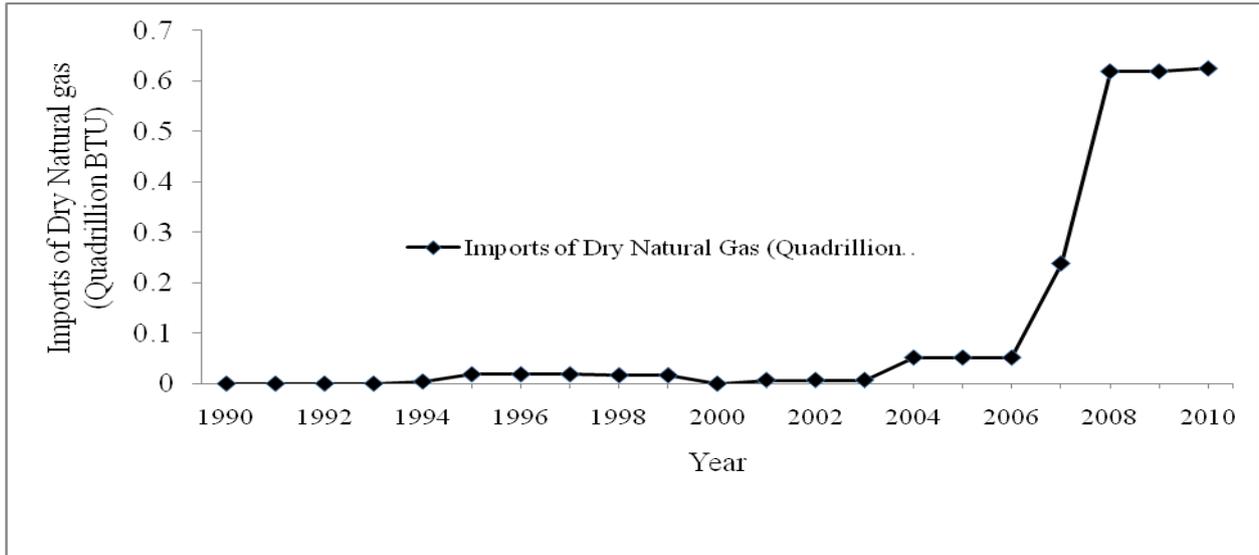


Fig. 3 showing UAE’s imports of dry natural gas (in quadrillion BTU)

3. Energy Demand and Population Growth

UAE is an energy-exporting country with significant oil resources. Energy consumption per capita in the UAE is among the highest in the world and is caused by a high standard of living, a harsh summer climatic condition which necessitates cooling, highly subsidized energy costs and rapid economic growth. Currently, more than 20% of the produced energy is consumed locally, and this quantity is continuously increasing. There are many factors that contribute to this problem. Population growth in the country is rapidly accelerating; thus, a drastic shortfall in energy supply is expected for the coming years. Besides the influence of population growth, there is a significant amount of waste and over-consumption of energy, which adds to the insufficiency of the energy supply. There has been a continuous increase in population in the UAE, with an average growth rate of 3.3%. The population increased from 557,887 in 1975 to 4,106,427 in 2005. A simple linear continuation of this trend would lead to a population of approximately 8,000,000 in 2010 (Fig. 4). This growth in population highly affects the energy consumption in UAE.

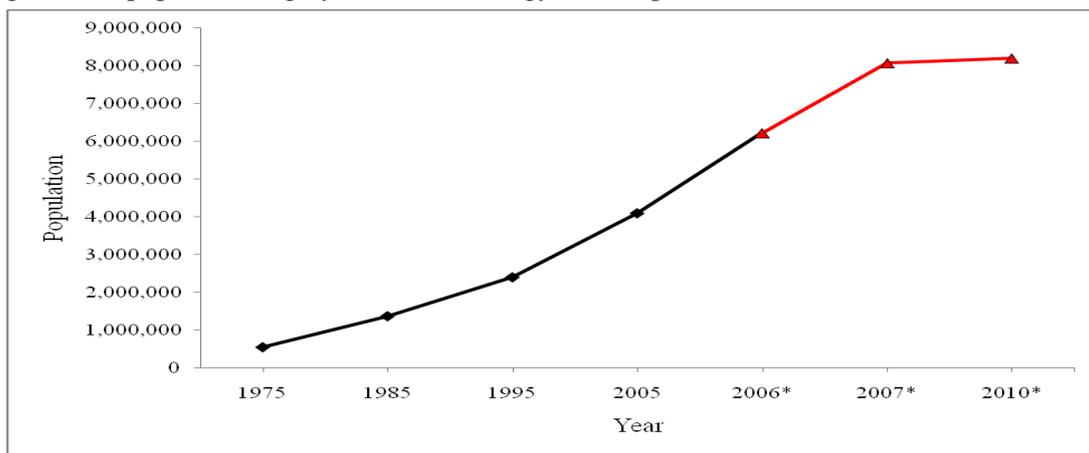


Fig. 4 showing the UAE’s population growth from 1975 to 2010. Population estimates between 2006 and 2010 are based on projections

Energy consumption and carbon dioxide emissions of the world are increasing at alarming rates. Continued carbon dioxide (CO₂) emissions are likely to lead to catastrophic problems such as the greenhouse effect. CO₂ emissions are driven by several factors, the most prominent being energy consumption from

fossil fuels and the level of economic activity [2]. Hence, efforts have been made to analyze the energy consumption and CO₂ emissions in different countries or regions of the world. The high energy consumption in the UAE has consequently led to higher per capita CO₂ emissions than all Middle East countries except Qatar and Bahrain (Figs. 5 and 6).

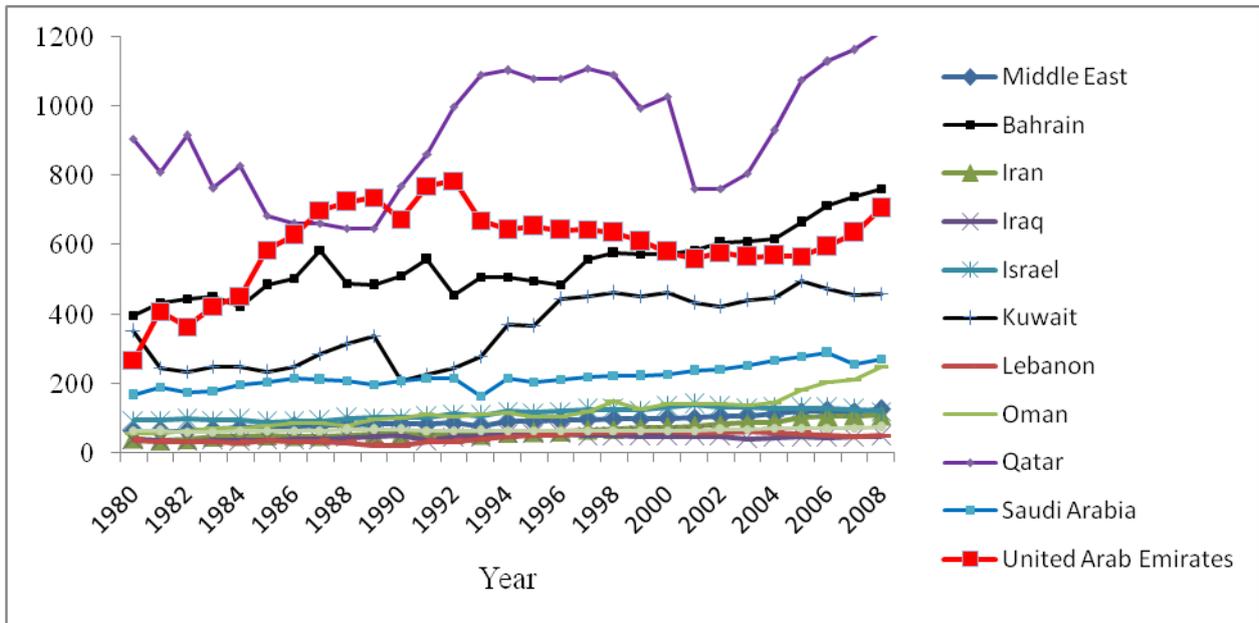


Fig. 5. Per capita CO₂ emissions by different Middle East countries (in metric tons) from the consumption of energy

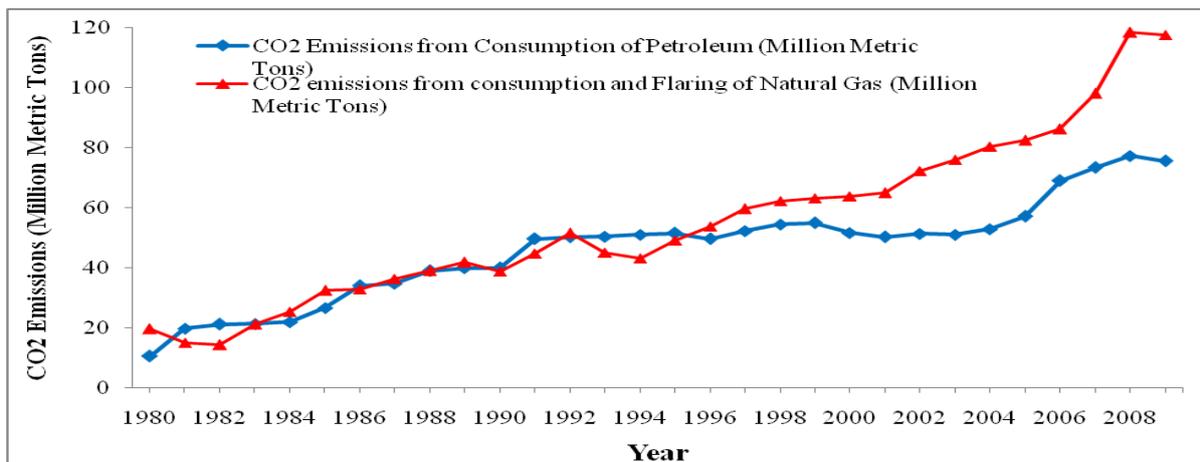


Fig. 6 UAE's CO₂ emissions (in million metric tons) from consumption of petroleum and flaring of natural gas

4. Conclusions

Economic growth across the UAE has led to massive increases in the demand for electricity. Current estimates indicate that the domestic demand for power will more than double by 2020, even given the global economic slowdown. The UAE is one of the highest energy consumers per capita in the world. Consequently, environmental pollution and carbon emission has been a major challenge facing the country over the past several years. Due to unprecedented high economic growth rate [2][3], population increase and a fairly low energy cost, heavily subsidized by the government, the UAE's energy consumption has risen tremendously in the past decades, making it one of the highest energy consumers per capita globally, with consequent high environmental pollution and CO₂ emission. With concerns about climate change and a sustainable energy supply the UAE Government has launched various initiatives aimed at identifying alternative means for producing the power needed to fuel its economy. The country is taking steps to reduce carbon emissions through major initiatives in both Abu Dhabi and Dubai emirates (two of its richest and

largest energy consumers) [4]. The emirate of Abu Dhabi, for instance, has committed more than \$15 billion in renewable energy programs. The Masdar Initiative, which focuses on the development and commercialization of technologies in renewable energy, energy efficiency, carbon management and monetization, water usage and desalination, underscores twin commitments to the global environment and diversification of the UAE economy[5]. The UAE government through its major electricity suppliers is also encouraging sustainable energy consumption among its residents.

5. References

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