A REVIEW ON THE FEASIBILITY OF USING ALTERNATIVE ENERGY IN THE GULF COOPERATION COUNCIL COUNTRIES

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Abstract

The Intergovernmental Panel for Climate Change (IPCC) held its meeting in Abu Dhabi, United Arab Emirates, in May 2011. The IPCC through the meeting of its 11th session of Working Group 3 concluded that almost 80% of world's energy supply could be met by Renewable Energy (RE) by mid-century if backed by the right enabling policies. This will save about 220 to 560 Gt of CO2 from 2010 to 2050 and will keep the greenhouse gases concentration level to 450 ppm. The key factor for this development is falling costs of RE technologies per kWh.

This paper will give an insight of the importance of shifting into renewable energy in the Gulf Cooperation Council (GCC) countries. In addition, some examples of the existing initiatives and results achieved by some of the GCC countries in this issue will be presented.

Keywords: *renewable energy, greenhouse gases, technologies*

1. INTRODUCTION

Fossil fuels are still a major source of energy in the GCC countries. The increasing energy needs are therefore a cause of concern as the twin effect of the depletion of non-renewable sources and generation of greenhouse gas emissions is bringing forward the 'doomsday' forecast.

The only resources of primary energy in the GCC countries are oil and natural gas. Also, these are the only revenues from which national income is derived, including foreign exchange. Nevertheless, if local energy consumption continues to increase, production will not meet demand. The countries will be forced to reduce its oil experts, hence, affecting national revenues, or to increase its oil production which will deplete the oil reserves at a faster rate. Supplement the existing sources of energy with renewable energy is, therefore, an important economic for the countries, although, it is not critical. More importantly, to mitigate the adverse impact of CO2 emissions and other pollutants and improve the environment and to avoid any litigation in the near future by international agencies demanding reduction in greenhouse gas emissions, such a measure is essential and timely.

2. GCC ENERGY DEMAND FOR POWER AND WATER

Energy-intensive urban expansion across the GCC region, fast population growth and extreme climatic conditions, have increased the demand for domestic energy. This coincides with a period of demand uncertainty, with shortages in the availability of national gas feedstock (Alnaser, 2011) and resultant electric power shortages in many GCC countries during peak demand summer months. This has amounted to an enormous drain on the GCC's economic resources, with governments in the region subsidizing energy consumption with as much as 10 percent of their Gross Domestic Product (GDP) (Reiche, 2010). These government subsidies, in turn, are encouraging even more growth in electricity demand.

The availability of power and water are emerging as critical factors for sustained economic growth and society's well-being. Accordingly, to the GCC Renewable Energy Readiness Report 2011-2012 (Mondal & Khalil, 2012), power generation capacity must be expanded in order to be able to meet forecasted growth in demand in the Kingdom of Bahrain the annual energy growth rate was 10% in 2008 with the total installed power generation capacity was 2780 MW while the expected is 6500 MW by 2030. The per capita energy consumption of Kingdom of Saudi Arabia has increased by more than 30% since 2010;

especially the country uses oil to meet 60% of total energy consumption. The country's power generation capacity grew 11.8% reaching 51.2 GW in 2009. However, the population growth and economic expansion of Kingdom of Saudi Arabia are expected to increase the demand for electricity to 77.4 GW by 2020. The energy consumption of the State of Kuwait is increasing at a rate of 8% annually. In 1958 Kuwait installed the first desalination plant to produce water and electricity with a capacity of 15 MW, but by 2008 the total capacity grew to 11.6 GW. Kuwait forecasted that by 2020 a total capacity of 23 GW would be needed to meet the demand of electricity. The total peak electricity demand for the Sultanate of Oman was 3856 MW in 2010 with a 46.4% increase since 2005. The peak demand for Oman is expected to grow at an annual rate of 8% to reach about 6600 MW by 2018. In the State of Qatar the peak electricity demand grew from 1800 MW in 2000 to 8000 MW in 2011. The electricity generation for Qatar is expected to continue growing at an annual rate of 2.9%. In the United Arab Emirates, the natural gas was accounting for 98% of the total installed power generation capacity in 2009. However, the low energy costs and high economic and population growth rates have driven the energy consumption of Emirates to rise in the past decade with the annual electricity demand growth in recent years has been about 9%.

The GCC region is one of the most water-scarce regions in the world. The region suffers from less natural water resources, with severe depletion of underground reservoirs through years of unregulated deep bore drilling, on the other, water consumption rates in the GCC states are one of the highest in the world (Bachellerie, 2012). Today, Gulf demand for water for both domestic and industrial usage has grown exponentially. Water in the GCC is mainly produced from desalination with more than 57% of the world's desalination plants are located in the Middle East, particularly in the GCC, even though desalination requires higher amounts of energy with a very costly process, it is still the most practical way for providing the needed water of GCC states.

3. THE WORLD OUTLOOK FOR RENEWABLE Energy

The Global Energy Statistical Yearbook of 2011 (Total Energy Consumption, 2011) stated that the world energy consumption reached 5.5% in 2010. The report confirmed that world natural gas consumption in 2010 reached 3321 billion cubic meters (bcm) an increase of 58.3 % since 1990. Meanwhile, the consumption of refined oil products in 2010 grow to 3916 million tons (mt), up from 3054 mt in 1990, a trend caused by the fast-growing demand for industries and road and air transportation. The coal and lignite consumption in 2010 reached 7045 mt, up from 4684 mt in 1990. The world electricity consumption increased by nearly 82% over the 1990 level. The electricity consumption increased by 6.4% in 2010.

The use of renewable energy to electricity production in 2010 was nearly 20 %. According to the 2012 newsletter of the Renewable Energy Network for the 21st Century (REN21, 2012), Europe has reported a new record of nearly 71 % of new installed power capacity being renewables-based in 2011 (32 out of 45 GW of new capacity), of which 21 GW was produced by solar photovoltaic (PV).

According to the Renewable Energy Network for the 21st Century (REN21, 2011) Global Status Report and the 2011 British Petroleum Statistical Review of World Energy, the world in recent years has become more interested in renewable energy technologies, which have attracted many manufacturers to invest in this area. The report has highlighted significant statistics as follows:

1. The contribution of renewable energy to total global energy consumption in 2010 was 16 %; of which 73% and 25% were generated capacity by solar and wind power respectively.
2. The global bio-fuel production and geothermal capacity grew by 14% and 1.8% respectively. The global waste biomass reached 65 GW, whilst hydroelectric power supplied an estimated 15% and 5% of total world electricity and commercial energy respectively in 2010.
3. The grid-connected power supplies have grown worldwide since 2000 with the renewable energy of PV, wind power, solar hot water, geothermal power, hydropower, ethanol and biodiesel by 53%, 32%, 21%, 4%, 3%, 10% and 9% respectively.

4. The total investment in renewables which has been reported showed annual increase since 2004 reaching an amount of $211 billion in 2010. This amount will be increased with the assumption of an annual growth of 35% in renewables.

4. THE DEVELOPMENT INITIATIVES OF RENEWABLE ENERGY IN THE GCC COUNTRIES

4.1. Kingdom of Bahrain

1. Installation of three wind turbines at world trade center to meet 13% of the building's energy demand.
2. A pilot solar energy street lighting project (Electricity and Water Authority).
3. Bahrain Petroleum Company has built the first zero emissions house with a hybrid energy system (solar, wind, and fuel cell) with total capacity of 7 Kw.
4. Electricity and water Authority in 2009 has announced the installation of a 5 MW capacity solar and wind project.

4.2. Kingdom of Saudi Arabia

1. In 1970, the King Abdulaziz City for Science and Technology was established for funding research and development projects including Renewable Energy.
2. In 2010, the King Abdullah City for Atomic and Renewable Energy was founded with an objective to contribute towards sustainable development through implementation of nuclear power plants and Renewable Energy projects in order to diversify energy supply and minimize CO2 emissions.
3. In 2011, the country invested $100 billion in renewable and nuclear energy to reduce its dependence on crude oil and to achieve 7-10% electricity generation by 2020.

4.3. State of Kuwait

1. The country has set a renewable energy production (solar energy) target to generate 10% of its electricity by 2020.
2. The establishment of the renewable energy program by the Kuwait Institute for Scientific Research (KISR).
3. Several pilot projects in wind, solar PV and solar thermal technologies have been completed by KISR such as solar cooling project with 172 solar collectors covering a total area of 300 m2, thermal and electricity application projects with daily electricity load of 80 kWh, 630 PV modules and 110 batteries with electricity production capacity of 24.2 kW, solar house with 76 PV modules and 48 batteries with electricity production capacity of 2.6 kW.

4.4. The Sultanate of Oman

The Authority for Electricity Regulation of Oman has outlined a roadmap for the development of renewable energy projects and published a report called "Study on Renewable Energy resources, Oman" in 2008. The study recommends several pilot projects of renewable technologies.

4.5. The State of Qatar

1. In 2010, a plan was announced to invest about $1 billion in solar power projects, and to install at least 100 MW of solar power in the next 5 years.

2. The Qatar Foundation will invest over $500 million to establish a polycrystalline silicon plant.
3. The Qatar Science and Technology Park will develop the first operational polycrystalline silicon plant in the GCC region.
4. In 2012, the country published the National Research Strategy and a strategy plan for implementing renewable energy projects.

4.6. United Arab Emirates

1. The country has established one of the world's most comprehensive clean energy initiatives through the Masdar Initiative.
2. The country has set a target of 7% of electricity generating capacity from renewable energy by 2020.
3. By 2030, the Abu Dhabi will generate electricity by 10% from renewable energy.
4. IRENA's headquarter was established in Abu Dhabi. The initiative is committed to develop renewable energy by 2030.
5. Dubai has set a target of 5% renewable energy generating capacity by 2030 (1000 MW).
6. The existing renewable energy technologies in Emirates include a 10 MW PV plant in Masdar City, Abu Dhabi and the Shams 1 project, a 100 MW collected solar power plant in the western region of Abu Dhabi.
7. There are other planned renewable energy technologies include; 100 MW PV plant, 28.8 MW wind plant, and 100 MW waste-to-energy plant.
8. The country has launched several international awards. The prizes are meant to encourage rational use of energy and energy resources and outstanding achievements and leadership in the global search for sustainable energy future.

5. CONCLUSIONS

The GCC countries have begun taking steps to explore alternative energy resources for power generation. The Kingdom of Saudi Arabia and United Arab Emirates in particular, have begun to invest heavily in renewable energy projects. The promoted rational for investing in alternative energy, the GCC countries will be able to reduce reliance on their valuable and finite fossil fuel resources for domestic use and increase their export earnings. The initiatives by the countries represent a proactive to addressing energy security and environmental issues at international, regional and national levels. The establishment of IRENA'S headquarters in Abu Dhabi, the United Arab Emirates prizes, hosting many workshops and conferences related to renewable energy has shown the strong interest and efforts of the GCC countries.

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