

Topic Report on Renewable Energy Systems

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[Writer Name]

[Date]

Introduction

Energy has always been one of the main factors to human's utmost aims and to his/her ideas of a better world. In certain occasions, it is said that the humans who live in a cave began along the path to evolution following they had employed the energy in fire to get light and to produce heat, and the energy in their body, through the club and the bow, for food and survival. Since that period, humans' search for material and well-being has been connected mostly to the controlling of diverse energy forms in different materials including petroleum, electricity, coal, etc. In contemporary eras, humans have devised more and more complex and effective approaches of exploring energy for more complex objectives and purposes. At present, the hunt for the moon is made possible by reining chemical energy for the latest rockets at Cape Kennedy; and the investigation about planets will rely heavily on harnessing the energy in the atom's nucleus.

But the question still is that what renewable energy is. Energy is not something humans can always discover with the senses. If a physicist wants to define an apple to somebody who had never seen one, the physicist might just pick an apple and place it on a table to describe, to smell, and to taste. However, energy cannot be put by one on a table as it can be appeared in several forms. Energy can be appeared as the energy of motion, also called kinetic energy in science, in the heat and light form. It can also be appeared on an atomic or molecular scale in the form of chemical energy. Energy can be appeared on a nuclear scale in one of the most direful forms as nuclear energy. Even, energy can be appeared in an apple form, because Sir Isaac Newton was discovered gravitation force when he was hit by an apple that had dropped from a tree. Potential energy was released while apple dropping. If rise of civilisation is due to the mastery of energy, so energy may also lead to the downfall of humankind. With ever-increasing energy at humans' grasp, they are capable not only of improving their everyday lives but, regrettably, to wage battle on a well-organised and impressive scale as well.

Background

Climate Change and Global Warming

Climate change in the form of global warming is the phenomenon of increasing ocean temperatures and the Earth's atmosphere on a global scale. In particular, it is observed on the last 25 years. For most scientists, this warming is due primarily to humans. (Silver, 2008)

The climate of the Earth has naturally gone through several cycles of warming and global cooling during the last 400,000 years. The cycle is: abrupt warming and gradual cooling hot weather and ice age. At the end of the Ice Age, it heats up again and the cycle restarts. But then, today these natural cycles are disrupted by humans and their activities. (Silver, 2008)

The consequences of global warming are the increase in the concentration of carbon dioxide, rising temperatures (scientific projections range from +1 to +6 degrees) and the rise in the level of the oceans and seas. Today it is difficult to accurately list all the long-term effects but we think that in the ages to come there will be an increased risk of deforestation, storms, droughts or flooding, ecosystem changes (appearance and disappearance of species of fauna and flora), and that different parts of the globe, and the degrees of increase in global temperature. (Gaughen, 2005)

One of the existing effects is the rise of the oceans. Here is a concrete example Tuvalu, a Polynesian archipelago of nine islands inhabited by 11,000 people: according to the calculations of scientists, these islets whose height does not exceed 3 meters above the sea should be engulfed in a fifty years. In parallel, we note that human activity has increased the hostile phenomena pollution due to industrial accidents, desertification, and deforestation. (Gaughen, 2005)

Renewable Energy and Climate Change

Fossil fuels are emitting greenhouse gases when burned. Coal, the most abundant fossil fuel, is the one that emits the most CO₂. Natural gas emits 30% less than oil. This CO₂, in the air, trapping heat near the ground and prevents it from escaping into space. It plays the role of glass in a greenhouse. It is a greenhouse gas (GHG), responsible for climate change in the form of global warming. Therefore, we now seek to limit the use of fossil fuels. (Edenhofer, Pichs Madruga and Sokona, 2012)

A wood fire also emits CO₂, but it only returns CO₂ to the atmosphere that the tree absorbed to grow. CO₂ emitted during combustion will be absorbed by the trees that have been planted to replace it. Today, the forest is progressing in the UK and other European countries. It covers 28% of the territory and is well exploited. Wood, a renewable resource, is an energy that is currently experiencing a strong infatuation. (Mathiesen, Lund and Karlsson, 2011)

CO₂ remains one to two centuries in the atmosphere before being absorbed by plants or the ocean. But for 150 years, its concentration increases in our atmosphere. Indeed, oil burning,

gas and coal releases into the atmosphere carbon (as CO₂), which has long been trapped underground. The consequence is that even if CO₂ emissions stop today, the climate would continue to warm for decades because concentrations accumulated since the industrial era. (Mathiesen, Lund and Karlsson, 2011)

The Policy of UK Government Regarding Climate Change and Renewable Energy Systems

The UK Government said in 2004 that the target of 20% reduction in CO₂ emissions by 2014 should probably be revised down, close to 14% (Corner et al., 2011). For the Minister of the Environment on that date, Elliot Morley, the worst score is related to the reduction in the production of nuclear energy for the benefit of the use of coal power plants, due to the increase national energy demand (House of Commons, 2010). In response, the association “Friends of the Earth” (FoE) has proposed the establishment of revised objectives and incremented each year rather than referred to 10 or 50 years less easy to reach (Haggett, 2011).

The “Energy Saving Trust” (IS group to achieve energy savings) pointed to the government by criticising some voluntary attitude of the Minister of Transport (also Deputy Prime Minister) and his cabinet while the Defra makes every effort to face this problem (Energysavingtrust.org.uk, 2014). The “Business Council for Sustainable Energy” added (Energysecurity.parlicentre.org, 2014), about fuel efficiency, that Defra is responsible for the results while the DTI holds the main levers of action. It is therefore necessary to integrate and coordinate the policy on climate change among ministries for the sake of efficiency and credibility. The Committee on the Environment, Food and Agricultural Affairs recommends its part the creation of a Ministry of climate change with the sole function of coordinating actions among different government departments to achieve the goals of reducing greenhouse gas emissions.

Moreover, the “Renewables Obligation” requires that 10.4% of the UK electricity is generated through renewable energy and this figure should reach 15% by 2015 (Gov.uk, 2012). Currently, the UK is slightly behind on these objectives since, instead of 4.3% set for 2003 to 2004, the proportion of renewable energy was only 2.4% (Gov.uk, 2012). Although the RO is neutral to the technologies used, it appears that only onshore wind energy is developing for practical reasons of cost and deployment. The offshore wind is marketable but requires major investments while energy from waves, tidal power and solar are still not considered commercially viable. The Committee on the Environment, Food and Business

agricultural urges the government to encourage the development of biofuels and marine and solar energy rather than relying solely on wind farms. The Committee was particularly concerned about the decline of nuclear power, as if the nuclear power increases to 7% in 2020, the effort to developing renewable energy will have so far been unsuccessful.

Purpose of Report

The basic purposes of this report are to raise the issue of climate change and global warming to provide the UK Government with a comprehensive guideline on such issues and provide them with information related to renewable energy systems with emphasis on the positive and negative aspects for each system. In the end, the report will recommend the most appropriate renewable energy system (or systems) for the UK, for additional support from the government. So, in doing so, this report will provide a critical analysis and details for the entire issue and in the end, it will present some suitable recommendations to the UK government.

Increasing Energy Demand of India and China

Oil requirement of India and China has increased significantly since 1992. China was rich in oil in the mid-1990s and was the second top leading oil importer in 2004. In the meantime, both countries have scooped up shares in oil firms across the globe. According to British Petroleum (BP) (Li and Xiaowen, 2011), both countries will become the largest economies in the world as well as the third largest energy consumers by the next fifteen years, accounting for much of the demand increase in liquid fuels, particular crude oil. The increase in the demand of global liquids by China (8 Mb/d²) and India (3.5 Mb/d) will account for almost all the net global increase by the next fifteen years (Li and Xiaowen, 2011). Moreover, both countries will account for over 33% of the world population and are probable to represent over 90% of the net crude oil demand growth (Li and Xiaowen, 2011).

The increasing demand in India and China are likely to affect the oil markets in the West by leading to higher prices of crude oil, higher refining costs, and higher price volatility. The combined changes in the costs of crude oil costs and costs of refining could add from about 19cents to 38 cents to the one gallon cost of gasoline or diesel fuel in the West in the next decade. However, the major part of those possible increases would due to higher prices for crude oil. The situations regarding future growth in demand of India and China could cause increased costs of crude oil that, by themselves, would result in prices of gasoline that were

16 cents to 33 cents a gallon higher than what they would be otherwise. If oil supplies across the globe were more responsive to higher prices of oil than is usually assumed to be the case (a supposition underlying diverse available forecasts of oil prices), then the effects of high demand on prices in both Asian countries could be minor than the estimates. On the other hand, if the recent limitations on Saudi oil production did not loosen, the consequence of higher demand on prices could be increased yet. (Li and Xiaowen, 2011)

Renewable Energy Sources

- Steam Plants

In 1904, engineers, belong to Italy, nearby Lardarello in Tuscany happened on a means of developing inexpensive electric power which remains as optimistic energy reserve for the time to comes. Steam is the basic source of this energy developed deep underground by heat of earth which explodes especially from drilled wells and is deviated to run turbine generators. Now, annually 2 billion KW per hour of power is produced by steam plants of Lardarello that is an adequate amount to operate a larger part of railway system in Italy. The steam of earth is put to other purposes in other areas, too. More than 44,000 people in Iceland employ it to get heat for their homes. It is used hatch chickens in Kenya. In the California state as well as in New Zealand, it is used as the electricity source. To install a steam plant, the costs of installation are expensive, but savings in fuel make more economical such power substantially to produce than electric power from traditional establishments. (Kaltschmitt, Streicher and Wiese, 2007)

- Sunlight as Source of Power

As the declining of fossil-fuel supplies; more scientists show their concern and interest in sunlight that is the most readily available sources of fuel. This term refers to the energy provided by the sun. The sun is the most powerful source of energy and this energy is free, you just have to operate. The technologies are divided between active and passive. Active technologies transform solar energy into electric or thermal shape we can use directly. This is the case of photovoltaic cells which convert sunlight directly into electrical energy (pictured right), solar collectors that can heat water homes, solar heating and cooling, the solar concentrators that use mirrors to concentrate the sunlight and generate intense heat, turning water into steam and generate electricity with some machines, and even solar ovens. Passive

technology consists of orient buildings to the sun or to use materials of special and architectural models to harness solar energy. (Langwith, 2009)

- Hydropower

Water is also a renewable resource since it regenerates through evaporation and precipitation cycle. Its strength is known and exploited for thousands of years through dams, water mills and irrigation systems. Several technologies can exploit the energy produced by the fall or the movement of the water. Impellers may convert directly into mechanical energy (water mill), while turbines and electric generators to convert into electricity. (Currie, 2011)

- Geothermal Energy

Geothermal energy refers to the energy created and stored in the earth in thermal form. Sometimes, it is released to the surface by volcanoes or geysers, but it can also be accessed at any time, as in hot water sources. Geothermal energy can be used to produce electricity or heating and cooling. Energy is extracted from underground tanks buried very deeply and accessible through drilling, or closer to the surface reservoirs. Geothermal energy can also be used for domestic purposes through the small heat pumps. (Ueckermann, 2008)

- Wind Energy

Wind power is known and exploited for thousands years through windmills and navigation. Today we can harness this energy to with special propellers that store wind and machines that transform it into electrical energy. The wind turbines installed on land and at sea in places where the wind reaches a constant high speed. (Ueckermann, 2008)

- Biomass

The use of biomass goes back to the time when man discovered fire and was still using the wood for heat and cook his food! It is the energy contained in plants, and organic materials. Plant biomass comes from the sun, when the plant through photosynthesis, absorbs solar energy. Thereafter, the animals in turn absorb these plants. Biomass comes from various sectors and materials such as wood, crops (grown specifically for energy production, agricultural and forestry residues, food waste and organic material from industrial waste. There are a variety of technologies to convert biomass energy into a reusable form. These

technologies are changing the energy into usable forms directly (heat or electricity) or in other forms such as biofuel or biogas. (Klass, 1998)

Recommendations

In the UK, renewable energy contributes more than 11% of the electricity requirements adding to the generating capacity of hydroelectric plants, a renewable energy alternative (Sinden, 2007). As the EU has set its targets to reduce CO₂ emission, UK is coerced to support renewable energy systems to increase its generating electricity. Definitely, this will reduce heavy dependence on oil which the country produces.

Furthermore, the reduction in CO₂ emission is envisioned to abide by the Climate Change Protocol to preclude from further diminution of the ozone layer. So, the UK government strongly needs to balance between meeting the demand of energy and reducing greenhouse gas emissions. In the UK, there are some areas which already implementing the construction of gas-fired and coal-fired stations to generate electric energy and meet the current demands. There are many issues that the energy generating capacity is faced and these issues are related to eliminating contamination and reducing CO₂ emissions.

Because of the abovementioned reasons, some of the following measures which must be adopted by the government:

- The government should increase energy efficiency through developing programmes that saves sufficient energy;
- The government should promote fusion power which is being adopted by other countries in the European Union;
- The government should invest more on renewable energy systems and the best systems are solar plants, hydroelectric plants, geothermal plants, and windmill plants;
- The government should also continue to identify approaches to change the fuels' chemical composition which include gasoline, diesels, etc., so that carbon gas emissions will be minimised;
- The government should divert investments to infrastructures that support the use of vehicle run by electric power or hybrid cars;
- The government should rationalise the operational activities of drilling rigs to avoid over-production because many countries starts to concentrate on renewable energy sources as alternative to generate power;
- The government should provide incentives to renewable energy projects and infrastructures that support the reduction of greenhouse gas emissions;

- The government should lead information dissemination campaign on how to reduce emission;
- The government should replace its current transportation equipment with vehicles operated by renewable energy source (electric source and solar system); and
- The government should ask the private sector to adopt alternative renewable energy use by developing appropriate programmes, policies, and infrastructures.

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