Advances in Science and Technology Vol. 5, No. 1S, August 2011, pp59 - 64

Renewable And Alternative Energy: Socioeconomic Issues

A.M. Umar*
Management and Information Technology Programme, School of Management Technology
Abubakar Tafawa Balewa University, Bauchi, Bauchi State, Nigeria.

Abstract

The Industrial Revolution bequeath to mankind, among other things, the ability to mass-produce goods, which was made possible in part by the exploitation of the combustion engine with fossil fuel as the energy of choice. However, it came at a cost: the destruction of the environment. As a result of this, it became pertinent to consider alternative sources of energy which are clean and sustainable. This paper presents the argument for and against renewable and alternative energy from the point of view of their socioeconomic implications. Socioeconomic issues such as the market forces, financing, energy diversification, trade balance, inflation, investments, tariffs, infrastructures, added value, agriculture and employment were highlighted especially in the light of the competition between bioenergy and food security. It was discovered that the development of renewable and alternative energy, though not a new phenomenon, is still in its infancy. However, as technology improves, it is hoped that these sources of energy will contribute substantially to the huge and increasing energy needs of the world in a sustainable way.

Key words: Alternative energy, Bioenergy, Renewable energy and Socioeconomic issues.

1.0 Introduction

The Industrial Revolution, which describes major changes in modes of production, introduced the use of machinery driven by power for mass production of goods. This was made possible in part with the development of machines powered first by steam engine then by the combustion engine driven by fossil fuel. However, by the end of the 21st century, the limitations as well as the negative impact of fossil fuel became apparent. This necessitated a drive towards the development and utilization of renewable and alternative energies.

Before the knowledge and large-scale burning of fossil fuels, energy provision came essentially from renewable resources like wood, vegetable and animal oils, and thousands of small-scale hydro schemes. More recently there have been many dam-based hydro schemes built and wind turbines installed around the world. Initially, such large-scale schemes were seen as quite benign but in the past ten years the true scale of the environmental as well as social impact because of, for example, the displacement of whole villages for hydro schemes, and the highly intrusive nature of wind farms, has been recognized. Renewable energy is energy present in the natural flows of wind, water, and sunlight in the environment and that is continually replenished as quickly as it is extracted and used up. Its sources can be replenished in a short period of time. The five renewable sources used most often are:

i. Biomass - including wood and wood waste, municipal solid waste, landfill and biogas, ethanol, and biodiesel
ii. Water (hydropower)
iii. Geothermal
iv. Wind
v. Solar

While the continuous use of fossil fuel has polluted the atmosphere to the point of endangering the health of earth, renewable energy is clean. However, some renewable energy technologies are criticized for being intermittent or unsightly, yet the market is growing for many forms of renewable energy.

Alternative energy is an umbrella term that refers to any source of usable energy intended to replace fuel sources without the undesired consequences of the replaced fuels. The term "alternative" presupposes a set of undesirable energy technologies against which "alternative energies" are opposed. As such, the list of energy technologies excluded is an indicator of what problems that the alternative technologies are intended to address (Wikipedia, 2009).

***Author's e-mail: muazu_2004@ yahoo.com**

Furthermore, many renewable technologies are suited to small off-grid applications, good for rural, remote areas, where energy is often crucial in human development. At the same time, such small energy systems can contribute to the local economy and create local jobs.

This paper will discuss the socioeconomic issues of renewable and alternative energies in general with particular emphasis on bioenergy.

2.0 Renewable and Alternative Energy

Renewable energy is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which are renewable (naturally replenished in a short period of time). In 2006, about 18% of global final energy consumption came from renewables, with 13% coming from traditional biomass, such as wood-burning. Hydroelectricity was the next largest renewable source, providing 3% (15% of global electricity generation), followed by solar hot water/heating, which contributed 1.3% Modern technologies, such as geothermal energy, wind power, solar power, and ocean energy together provided some 0.8% of final energy consumption (Wikipedia, 2009).

By way of contrast, fossil fuels such as coal, oil, and gas, although originally laid down effectively as biomass, take millions of years to form and need to be regarded as finite, non-renewable resources.

Wind power is growing at the rate of 30 percent annually, with a worldwide installed capacity of over 100 GW, and is widely used in several European countries and the United States. The manufacturing output of the photovoltaic industry reached more than 2,000 MW in 2006, and photovoltaic (PV) power stations are particularly popular in Germany and Spain. Solar thermal power stations operate in the USA and Spain, and the largest of these is the 354 MW SEGS power plant in the Mojave Desert. The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18 percent of the country's automotive fuel (Wikipedia, 2009).

Interest in renewable energy came to the fore during the worldwide energy crises of the 1970s, when high oil prices highlighted the world's dependence on fossil fuels. Secure and affordable energy provision is vital for nations' development, as all industrialization, manufacturing, and building programmes consume vast amounts of energy.

Alternative energy is an umbrella term that refers to any source of usable energy intended to replace fuel sources without the undesired consequences of the replaced fuels. Typically, official uses of the term, such as qualification for governmental incentives, exclude fossil fuels and nuclear energy whose undesired consequences are climate change and difficulties of radioactive waste disposal. Over the years, the nature of what was regarded alternative energy sources has changed considerably, and today because of the variety of energy choices and differing goals of their advocates, defining some energy types as "alternative" is highly controversial.
Examples of alternative energies are:

i. Ethanol alcohol from corn and other foodstuffs as an alternative to coal and oil
ii. Coal as an alternative to wood
iii. Petroleum as an alternative to whale oil
iv. Alcohol as alternative to fossil fuels
v. Coal gasification as alternative to expensive petroleum

In November 1997 representatives from many countries met in Kyoto, Japan, to agree a strategy to reduce the impact on climate change resulting from the burning of fossil fuels that causes the emission of carbon dioxide (CO_2). The conference called for industrialized nations to adopt a target to reduce greenhouse gas emissions by 15 per cent of 1990 levels by the year 2010. The Kyoto negotiations settled on reductions between 6 per cent and 8 per cent for a group of six greenhouse gases for the period 2008 to 2012 (Fells, 2006).

Unburnt hydrocarbons and the products of combustion, such as oxides of nitrogen and sulphur cause far-reaching damage to health and the environment. Renewable energy is largely available without chemical processes and hence production of CO_2 and other gaseous emissions involved in renewable energy is negligible as they are only generated during the manufacturing and installation

of the necessary devices. The burning of biomass, such as wood, does, however, directly produce CO_2 as a result of combustion but the gas is absorbed by new wood as it grows and hence the net emission is zero, as long as the fuel crop is completely replenished.

In the past, renewable energy has generally been more expensive to use than fossil fuels, this is because they are often located in remote areas and it is expensive to build power lines to the cities where they are needed. The use of renewable sources is also limited by the fact that they are not always available (for example, cloudy days reduce solar energy, calm days mean no wind blows to drive wind turbines, droughts reduce water availability to produce hydroelectricity). However, the production and use of renewable fuels has grown more quickly in recent years due to higher prices for oil and natural gas and a number of Government incentives as well as environmental concerns. The use of renewable fuels is expected to continue to grow over the next 30 years, although we will still rely on non-renewable fuels to meet most of our energy needs.

3.0 Pros and Cons of Renewable Energy

Critics suggest that some renewable energy applications may create pollution, be dangerous, take up large amounts of land, or be incapable of generating a large net amount of energy. Proponents advocate the use of "appropriate renewables", also known as soft energy technologies, as these have many advantages. While most renewable energy sources do not produce pollution directly, the materials, industrial processes, and construction equipment used to create them may generate waste and pollution. Some renewable energy systems actually create environmental problems.

Whatever the argument for or against renewable energy, there are attendant socioeconomic issues to grapple with as the world 'goes green'. However, renewable energy is still in its infancy and there is also difficulty with integration into existing energy stock. Currently, there is competition between bioenergy and food for human consumption.

3.1 Bioenergy

According to the Energy Information Administration, (2008), the term bioenergy can be used to describe any energy that is derived from plants and other organic materials. These materials, referred to collectively as biomass, can be burned to generate heat or electricity; fermented to create liquid fuels such as biodiesel and ethanol; or converted into high-value chemical compounds that are used to make polymers and plastics.

Biofuels have been the subject of much debate in recent years. This is because biofuels are sourced from agricultural food products, such as corn, wheat, sugar cane, palm oil, cassava, and jatropha. Apart from using the food materials as source, there is also debate on the use of agricultural land for planting sources of biofuels like jatropha. It is however believed that fuel will essentially compete with food only when: food crops are used for fuel production; fertile lands are grown with fuel crops; and value added is not locally distributed.

4.0 Renewable and Alternative Energy: Socioeconomic Issues

As renewable energy developments become more and more abundant around the globe, there will be many positive and negative effects on the social and economic fabric of the countries involved. The supply of fuel and energy to communities has had a profound influence on the development of housing and industry and has caused the migration of communities towards fewer larger conurbations. In addition, wind farms, wave machines, and solar cells need to be installed in large numbers, all of them requiring manufacturing, maintenance, transportation, and support industries. It has been suggested that the renewable market will boom when cost efficiency attains parity with other competing energy sources.

Other than market forces, renewable industry often needs government sponsorship to help generate enough momentum in the market. Many countries and states have implemented incentives- like government tax subsidies, partial co-payment schemes and various rebates over purchase of renewables- to encourage consumers to shift to renewable energy sources. Government grants fund for research in renewable technology to make the production cheaper and generation more efficient.

The following are a few examples of socioeconomic implications on renewable and alternative energies:

i. Development of loan programs that stimulate renewable favoring market forces with attractive return rates, buffer initial deployment costs and entice consumers to consider and purchase renewable technology.

ii. Imposition of fossil fuel consumption and carbon taxes and channeling the revenue earned towards renewable energy development.

iii. Renewable energy facilities generally require less maintenance than traditional generators. Their fuel being derived from natural and available resources reduces the costs of operation, which makes it suitable for use in rural areas.

iv. Renewable energy projects can also bring economic benefits to many regional areas, as most projects are located away from large urban centres and suburbs of the capital cities. These economic benefits may be from the increased use of local services as well as tourism.

v. Greater energy security through a diversified energy portfolio is becoming a higher government priority.

vi. Domestic biofuel production helps replace oil imports and improve trade balance. In Brazil, for instance, it has been calculated that the replacement of gasoline by bioethanol saved some US$ 43.5 billion between 1976 and 2000 (Wikipedia, 2009).

vii. Demand for bioenergy generates a new demand for agricultural products with potential benefits such as new opportunity for agricultural value added.

viii. In less developed countries biofuel production supported by public investment competes with other sectors for scarce financial resources.

5.0 Bioenergy: Socioeconomic Issues

The following are some of the socioeconomic implications of bioenergy:

i. Operating a biogas plant offers farmers and agricultural business big advantages. The result of a study conducted by ABO-Wind (2007) indicated that in the next 20 years, the purchase of the produced energy is guaranteed by law and therefore a long-term secondary income is secured. The income from raw material produced for renewable energy is higher than the earnings gained from the sale of animal feed and grain. Another advantage is waste management, for instance liquid manure does not have to be removed it instead is used for biogas production and the remainder can be used as top quality fertilizer. Co-generators provide cheap heat that can be sold or used to heat entire buildings.

ii. According to ABO-Wind (2007), in Germany, more than 70,000 people are employed in the bioenergy industry for the most part in small/medium-sized businesses (like biogas, wood and bio diesel energy production). With profits of more than 2.5 billion Euros and a yearly growth rate of 20 percent, the bioenergy industry is clearly an important economic factor for Germany.

Furthermore, the construction of biogas plants brings new jobs to agricultural areas; it increases taxes paid to the local communities and secures the survival of many agricultural businesses. Biogas technology stimulates the local economy, which is important especially for the eastern German federal states. The ethanol and biodiesel production industries also create jobs in plant construction, operations, and maintenance, mostly in rural communities.

iii. Domestic biofuel production helps replace oil imports and improve trade balance. Demand for bioenergy generates a new demand for agricultural products. But lack of local technological capacities and investment could encourage developing countries to export the raw materials while the final biofuel conversion takes place in the importing country.

iv. Large-scale biofuel production will lead to food security problems, especially in the poorest developing countries (Tenenbaum, 2008). Greater demand for biofuels will lead to land being drawn from other purposes including food production. This could lead to food shortages and higher food prices for consumers. However, recent evaluations indicate that if land surfaces of 400–700 million hectares were used for biomass energy production halfway into the 21st century, there could be no conflicts with other land-use functions and the preservation of nature.

v. Fuel will essentially compete with food when food crops are used for fuel production; when fertile lands are grown with fuel crops; and when value added is not locally distributed (Tenenbaum, 2008).

vi. Bioenergy production has a positive impact on employment and livelihoods, when cultivation involves small-scale farmers and conversion takes

place near the sources of biomass in rural areas. However, there are risks: Tariff escalation encourages export of raw or unprocessed materials; large-scale cultivation undermines employment effect; and most profitable economic model discourages pro-development practices.

vii. Bioenergy can offer benefits over fossil fuels that do not show up in its cost—that is, it can offer externalities. Being carbon-neutral is one. Another is the very low sulphur content. A third is that biomass is available in most countries, while fossil fuels often need to be imported. The domestic production of bioenergy also brings macro-economic and employment benefits.

viii. Ethanol is not the only product created during production, and the energy content of the by-products must also be considered.

Corn is typically 66% starch and the remaining 33% is not fermented. This unfermented component is called distillers grain, which is high in fats and proteins, and makes good animal feed. In Brazil, where sugar cane is used, the yield is higher, and conversion to ethanol is somewhat more energy efficient than corn. Recent developments with cellulosic ethanol production may improve yields even further (Wikipedia, 2009).

ix. In the United States of America, according to the Renewable Fuels Association, the ethanol industry created almost 154,000 U.S. jobs in 2005 alone, boosting household income by $5.7 billion. It also contributed about $3.5 billion in tax revenues at the local, state, and federal levels (Wikipedia, 2009).

x. Producing bioenergy in places where biomass is grown can create jobs and generate income for local communities. This type of renewable energy builds rural economies and infrastructure for future biofuels.

xi. Producing bioenergy in conjunction with animal agriculture can also increase efficiencies and reduce costs for producers and consumers.

xii. According to Cassman, (2007) farmers in countries that account for a majority of the world's biofuel crop production will enjoy the promise of markedly higher commodity prices and incomes. In contrast, urban and rural poor in food-importing countries will pay much higher prices for basic food staples and there will be less grain available for humanitarian aid.

xiii. In the United States, biofuel production has been prodded by government initiatives such as subsidies and tax incentives (Tenenbaum, 2008).

xiv. All biomass needs to go through some of these steps: it needs to be grown, collected, dried, fermented and burned. All of these steps require resources and an infrastructure.

xv. High level of poverty in developing countries put pressure on the land to the point where resources are not exploited in a sustainable way.

xvi. Funds from tax revenues, aid agencies and charities are unlikely to be able to provide energy services directly to any but the smallest fraction of poor people. This means that market services directed to only but the smallest fraction of poor people. This means that market and effectiveness will have to be massively expanded to meet current unmet needs and the needs of growing populations.

xvii. Bioenergy production has a positive impact on employment and livelihoods, when cultivation involves small-scale farmers and conservation takes place nearby the sources of biomass in rural areas. In China, the liquid biofuel programme is expected to create 9 million jobs leading to significant increases in income generation and rural development (Tenenbaum, 2008).

6.0 Conclusion

The development of biomass has proven the potentials of renewables, which now promises to make a large contribution to the future world's energy supply. Land for biomass production should not be a bottleneck, if the modernization ofconventional agricultural production continues. However, the relationship between bioenergy and food security still poses a big challenge. For now flexible energy systems of combining biomass and fossil fuels are likely to become the backbone for low-risk, low-cost energy supply systems but the days of fossil fuel are numbered. With all the prospects inherent in the renewables, there are still obstacles along the way that have to be overcome before these energy sources are exploited in a sustainable way.

Recommendations

With all the problems associated with fossil fuel, the window of opportunity lies with the development of

renewable and alternative energies. It is therefore pertinent that this opportunity be exploited. The technologies for adopting renewable energies should be developed so as to take advantage of these sources of energies.

The infrastructure necessary for the smooth development and utilization of both renewable and alternative energies should be put in place. Without these infrastructures, the energy will remain mere potentials and therefore not useful for development. Many think-tanks are warning that the world needs an urgency driven concerted effort to create a competitive renewable energy infrastructure and market. The developed world can make more research investments to find better cost efficient technologies, and manufacturing could be transferred to developing countries in order to use low labor costs. The renewable energy market could increase fast enough to replace and initiate the decline of fossil fuel dominance and the world could then avert the looming climate and oil crises.

Renewables are gaining credence among private investors as having the potential to grow into the next big industry. Companies and venture capitalists should be encouraged to invest in development and manufacturing of renewables.

References

ABO-WIND, 2007, "Why Bioenergy?", In http://www.abowind.com/en/bioenergy/whybioenergy.html

Cassman, K. G. 2007, "Climate change, biofuels, and global food security", *Environ.Res. Lett.* 10.1088/1748-9326/2/1/011002 in http://www.iop.org/EJ/abstract/1748-9326/2/1/011002

Energy Information Administration, 2008, "*Energy*" in Brief, How Much Renewable Energy Do We Use? http://www.eia.doe.gov/kids/energyfacts/sources/renewable/renewable.html

Fells, C. D. 2006**,** in Microsoft Encarta.

Tenenbaum, D. J. 2008, "Food vs. Fuel: Diversion of Crops Could Cause More Hunger" Environ Health Perspectives in http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2430252

Wikipedia 2009a, The Free Encyclopedia. Text of the GNU Free Documentation License. http://en.en.wikipedia.org/wiki/Renewable_energy

Wikipedia 2009b, The Free Encyclopedia. Text of the GNU Free Documentation License. http://en.en.wikipedia.org/wiki/Alternative_energy.