
BIOENERGY SOURCES, ADVANTAGES AND THE ENVIRONMENT

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ABSTRACT

The world today depends on fossil-based fuel Fossil (provides about 90 percent of the total world energy) for its energy production, use and consumption and from researches carried out a lot of environmental associated harmful phenomena has been traced to its usage. Bioenergy based fuel is the viable alternative which is more environmental friendly. Agricultural residues have an enormous potential for the production of bioenergy (biofuel). Generally, residues are still used very inefficiently for electricity production, in many cases deliberately to prevent their accumulation, but also because of lack of technical and financial capabilities in developing countries. Developing countries could theoretically derive 15 per cent of present energy consumption from this source and industrialized countries could derive 4 per cent. It is pertinent for developing to seek ways to harness these agricultural residues.

Keyword: Bioenergy; Biofuel; Fossil fuel; Biomass; Residue

INTRODUCTION

According to Associate Professor Yongvarich, At present, the world has been confronted with an energy crisis due to depletion of resources and increased environmental problems. The situation has led to the search for an alternative fuel, which should be not only sustainable but also environment friendly. For developing countries, fuels of bio-origin, such as alcohol, vegetable oils, biomass, biogas, synthetic fuels, etc. are becoming important. Such fuels can be used directly, while others need some sort of modification before they are used as substitute of conventional fuels.

Today, energy has become a serious matter and international politics between the world super power (USA) with the world largest economy and other economies of the world is basically drawn along energy, primarily petroleum. That is the reason why today Iraq and Iran are very important. In Nigeria any form of escalation of the Niger/Delta crisis results to an increase in the price of world crude per barrel.

WHAT IS BIOENERGY?

Bioenergy are also known as Biofuels, which is energy derived from biomass i.e. basically plants and animal products and by-products. They are alternative renewable energy that has received considerable attention in the recent past (Idiata, 2009), among the well known biofuels include namely:

1. Bioethanol (bioalcohol), which is made from crop grains or sugarcane and other starch or cellulose, based plants.
2. Biodiesel, which is made from vegetable oils and animal fats and both are used as sources of power for cars, trucks and aircraft.
3. Biogas, which are made from organic decomposition of plant and animal waste.

SOURCES OF BIOENERGY AND TYPES

Agricultural residues have an enormous potential for production. In favourable circumstances, biomass power generation could be significant given the vast quantities of existing forestry and agricultural residues - over 2 billion t/yr. world-wide. This potential is currently under-utilized in many areas of the world. In wood-scarce areas, such as Bangladesh, China, the northern plains of India, and Pakistan, as much as 90 per cent of household in many villages covers their energy needs with agricultural residues. It has been estimated that about 800 million people world-wide rely on agricultural residues and dung for cooking, although reliable figures are difficult to obtain. Contrary to the general belief, the use of animal manure as a source is not confined to developing countries alone, e.g., in California a commercial plant generates about 17.5 MW of electricity from cattle manure, and a number of plants are operating in the Europe. There is 54 EJ of biomass energy theoretically available from recoverable residues in developing countries and 42 EJ in industrialized regions. The amount of potentially recoverable residues includes the three main sources: forestry, crops and dung. The calculations assume only 25 per cent of the potentially harvestable residues are likely to be used. Developing countries could theoretically derive 15 per cent of present energy consumption from this source and industrialized countries could derive 4 per cent.

Sugarcane residues (bagasse, and leaves) - are particularly important and offer an enormous potential for generation of electricity. Generally, residues are still used very inefficiently for electricity production, in many cases deliberately to prevent their accumulation, but also because of lack of technical and financial capabilities in developing countries (www.seps.sk/zp/fae.htm).

Table 1: Energy contents comparison table.

| | Content of water % | MJ/kg | KW/kg |
|--------------|--------------------|-----------|-------|
| Oak- tree | 20 | 14,1 | 3,9 |
| Pine-tree | 20 | 13,8 | 3,8 |
| Straw | 15 | 14,3 | 3,9 |
| Grain | 15 | 14,2 | 3,9 |
| Rape oil | - | 37,1 | 10,3 |
| Hard coal | 4 | 30,0-35,0 | 8,3 |
| Brown coal | 20 | 10,0-20,0 | 5,5 |
| Heating oil | - | 42,7 | 11,9 |
| Bio methanol | - | 19,5 | 5,4 |

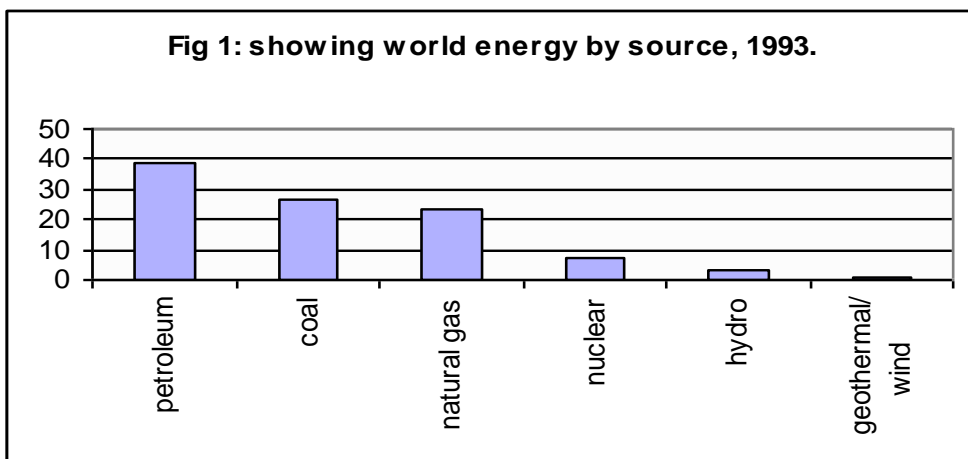
| | MJ/Nm3 | KWh/Nm3 |
|-------------------------|--------|---------|
| Sewer gas | 16,0 | 4,4 |
| Wood gas | 5,0 | 1,4 |
| Biogas from cattle dung | 22,0 | 6,1 |
| Natural gas | 31,7 | 8,8 |
| Hydrogen | 10,8 | 3,0 |

Source (www.seps.sk/zp/fond/fae.htm)

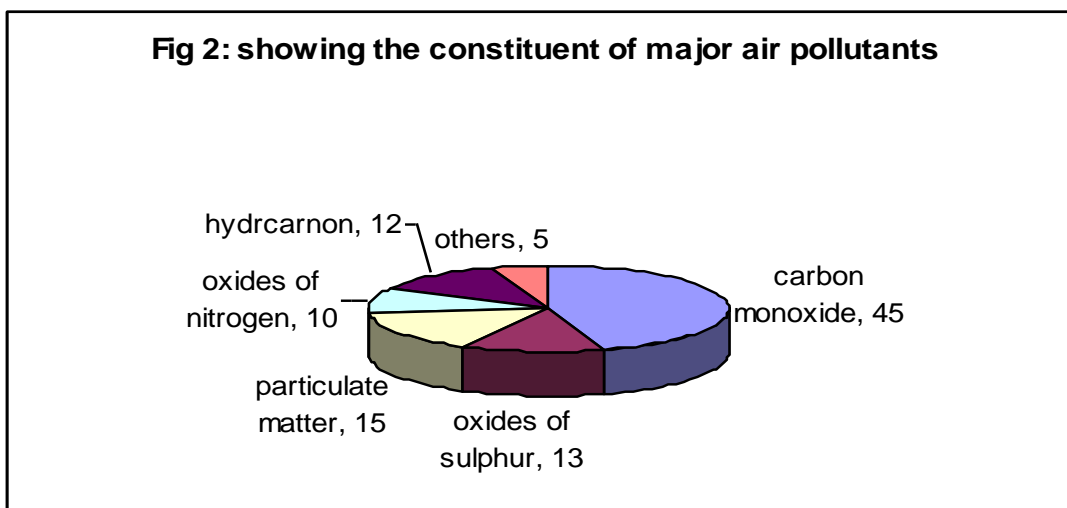
CHALLENGES OF PRESENT DAY SOURCES OF ENERGY

The world today depends on fossil-based fuel for its energy production, use and consumption.

We are faced with a dilemma-a situation in which a choice must be made between undesirable alternatives in the use of fossil fuel. Continuing reliance on fossil fuels, with the attendant environmental problems, is one alternative. The other alternative is to change energy use to other sources such as nuclear energy, hydropower, solar energy, tidal energy, wind energy; geothermal energy biomass etc. from the chart in *fig.1* the energy source is given in percentage and fossil fuel is made up of petroleum, coal and natural gas, these all make up 89% of the world energy by source.



Fossil fuel provides about 90 percent of the total world energy. The burning of fossil-based fuel causes some of these environmental phenomena like materials & properties corrosion; acid rains; visibility problems; greenhouse & ozone layer depletion (global warming) etc. these environmental phenomena is as a result of the addition (effects) of one or more of the following emissions into the atmosphere: carbon dioxide; sulphur and its oxides; nitrogen and its oxides; water vapour; particulates and also CFCs (Idiata, Olubodun and Ukponmwan, 2008)



(Source: Goldfarb, 2000)

Fig 2 shows us the major air pollutants by their composition in the atmosphere. These pollutants find their way into the atmosphere basically through the burning of fossil based fuel whether in the presence of sufficient oxygen or not, these pollutants can cause a lot of discomfort and also threaten life (Idiata et al, 2007).

BENEFITS OF BIOMASS (AGRICULTURAL RESIDUES)

Rural economic development in both developed and developing countries are one of the major benefits of biomass. Increase in farm income and market diversification, reduction of agricultural commodity surpluses and derived support payments, enhancement of international competitiveness, revitalization of retarded rural economies, reduction of negative environmental impacts are most important issues related to utilization of biomass as energy source. The new incomes for farmers and rural population improve the material welfare of rural communities and this might result in a further activation of the local economy. In the end, this will mean a reduction in the emigration rates to urban environments, which is very important in many areas of the world.

The number of jobs created (for production, harvesting and use) and the industrial growth (from developing conversion facilities for fuel, industrial feedstocks, and power) would be enormous. For instance, the U.S. Department of Agriculture estimates that 17,000 jobs are created per every million of gallons of ethanol produced, and the Electric Power Research Institute has estimated that producing 5 quadrillion Btu's (British Thermal Units) of electricity on 50 million acres of land would increase overall farm income by \$12 billion annually (the U.S. consumes about 90 quadrillion Btu's annually). By providing farmers with stable income, these new markets diversify and strengthen the local economy by keeping income recycling through the community.

Improvement in agricultural resource utilization has been frequently proposed in EU. The development of alternative markets for agricultural products might result in more productive uses of the cropland, currently under-utilized in many EU countries. In 1991, the EU planted 128 million ha of land to crops. Approximately 0,8 million ha were removed from production under the set aside program. A much greater amount is planned to remain idled in future. It is clear that reorientation of some of these lands to non-food utilization (like biomass for energy) might avoid misallocation of agricultural resources. European agriculture relies on the production of a limited number of crops, mainly used for human and livestock food, many of which are at present on surplus production. Reduced prices have resulted in low and variable income for many EU farmers. The cultivation of energy crops could reduce surpluses. New energy crops may be more economically competitive than crops in surplus production.

ADVANTAGES OF BIOENERGY ON ENVIRONMENT

According to Wikipedia, www.ebb-eu.org/stats.php; www.attra.ncat.org/attra-pub/PDF/biodiesel.pdf; Garba et al, Knothe (2001); and Nitshe & Wilson, biofuel as fuel has several virtues which include the following:

- a. Biofuels has calorific value of up to 90% that of petroleum diesel and offers comparable engine power;
- b. They have higher viscosity, and offers better lubricity than petroleum diesel, hence

- reduced wear of engine and injector pump;
- c. They are non-toxic, has no aromatics and almost no sulphur;
- d. They are biodegradable and increases the degradability of biofuel when blended with it, thus any spillage of the fuel does not contaminate the environment;
- e. It reduces greenhouse emissions since the CO₂ emitted when it is combusted is equal to the amount consumed by the plant during its growth period;
- f. They dissipate engine heat better than problem fuel;
- g. It does not require engine and fuel system modification before use;
- h. Its feedstock is renewable;
- i. Bioethanol has high octane rating which prevent engine detonation (knocking) under load;
- j. They withstand high compression ratio in an engine which lead to more power per stoke, greater efficiency and better economy.

CONCLUSION

It can be seen from the work that Agricultural residue (biomass) can contribute significantly to the energy need of the world today if it is properly enhanced. From researches carried out it is far more environmental friendly than the present fossil-based fuel which is the world highest source of energy, contributing about 90 percent of the world energy.

RECOMMENDATION

From the foregoing one can suggest the following as part of the recommendation:

- i. Research centres and research grants be provided by both government and private entrepreneurs.
- ii. Training and re-training of personnel in this area.
- iii. Emphasis should be placed in this area.
- iv. Equipment provided for institution of higher learning in this regards.

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