

A STUDY ON NON-WOODY BIOMASS AND COAL-BIOMASS MIXED BRIQUETTES WITH ESTIMATION OF POWER GENERATION POTENTIAL

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ABSTRACT

Ever increasing consumption of fossil fuels and rapid depletion of known reserves are matters of serious concern in the country. This growing consumption of energy has also resulted in the country becoming increasingly dependent on fossil fuels such as coal and oil and gas. Rising prices of oil and gas and potential shortages in future lead to concerns about the security of energy supply needed to sustain our economic growth. Increased use of fossil fuels also causes environmental problems both locally and globally. It is a carbonaceous material. There are various type of renewable energy sources such as solar, wind, hydropower, biomass energy etc. out of these renewable energy sources, biomass is more economically viable for almost all the continents in the world. Biomass is a carbonaceous material and provides both the thermal energy and reduction for oxides, where as other renewable energy sources can meet our thermal need only. Till date, India has been capable to generate only 2000 MW (approx.) of electricity per year in spite of declaration of several incentives by the govt. of India. Hence, there is an argent need to increase the utilization of biomass in power generation. In view of energy as well as environmental problems associated with the use of fossil fuels (coal, petroleum and gas) in power production, deeply attention is being paid world-over by the scientists and technocrats for the utilization of renewable energy sources in power production, metallurgical industries etc. There are different type of renewable energy sources like solar, wind, hydropower, biomass energy etc. In all of renewable energy sources, biomass is more reasonably feasible for almost all the continents in the world. Biomass is provided both the thermal energy and reduces oxides, where as other renewable energy sources can fulfill our thermal need only.

Keyword: - Thermal, Biomass, Energy, and Source etc.

1. INTRODUCTION

The overall energy demand of world is increasing at faster rate than the increase in population. India being a developing nation, sustainable growth is more important. Energy is a basic requirement for economic development. Every sector of Indian financial system– agriculture, industry, transport, commercial and domestic – require inputs of energy [1]. Energy is an important factor for any growing country. Ever increasing consumption of fossil fuels and rapid depletion of known reserves are matters of serious concern in the country dependent on fossil fuels such as coal and oil and gas. Biomass has always an important energy source for the country considering the payback it offers. Biomass offers thermal energy as well as reduction for oxides [2]. It is renewable, widely available and carbon-neutral and has the potential to provide significant employment in the rustic areas. Biomass is also capable of providing firm energy. About 32% of the total primary energy use in the country is still derived from biomass. A majority of the Indian population does not have access to convenient energy services (LPG, electricity) (Pillai et al, 2009). Though India has made significant progress in renewable energy, the share of modern renewable in the

energy mix is minor. This paper reviews the condition and potential of different renewable (except biomass) in India. Bio-energy technologies (BETs) are presented as potential carbon abatement opportunities substituting fossil fuel or traditional (less efficient) biomass energy systems (Ravindranath et al, 2006). India being a developing nation, sustainable development is more important. Energy is a basic requirement for economic development. Every sector of Indian economy – agriculture, industry, transport, commercial and domestic – needs inputs of energy. Energy is an important factor for any developing country. Ever increasing consumption of fossil fuels and rapid depletion of known reserves are matters of serious concern in the country. This growing consumption of energy has also resulted in the country becoming increasingly dependent on fossil fuels such as coal and oil and gas. Rising prices of oil and gas and potential shortages in future lead to concerns about the security of energy supply needed to sustain our economic growth. Increased use of fossil fuels also causes environmental problems both locally and globally. Biomass has always been an important energy source for the country considering the benefits it offers. Biomass provides both, thermal energy as well as reduction for oxides. It is renewable, widely available, carbon-neutral and has the potential to provide significant employment in the rural areas. Biomass is also capable of providing firm energy. About 32% of the total primary energy use in the country is still derived from biomass. Ministry of New and Renewable Energy has realised the potential and role of biomass energy in the Indian context and hence has initiated a number of programmes for promotion of efficient technologies for its use in various sectors of the economy to ensure derivation of maximum benefits. Biomass power generation in India is an industry that attracts investments of over Rs.600 crores every year, generating more than 5000 million units of electricity and yearly employment of more than 10 million man-days in the rural areas. For efficient utilization of biomass, bagasse based cogeneration in sugar mills and biomass power generation have been taken up under biomass power and cogeneration programme.

2. DIFFERENT RENEWABLE ENERGY SOURCES

Renewable energy sources are continuously replenished by natural processes. For example, solar energy, wind energy, bio-energy – bio fuels, hydropower etc., are some of the examples of renewable energy sources. In view of energy and environmental problems associated with the use of fossil fuels in power generation, scientist and technocrats, world over, are in search of the suitable substitute of fossil fuels for power generation. The various forms of renewable energy sources having a potential to be utilized in power generation are as follows:

- Wind Energy
- Solar Energy
- Hydropower
- Geothermal Energy
- Nuclear Energy
- Biomass and Bio-energy

3. BIOMASS AND BIO-ENERGY

Biomass does not add carbon dioxide to the atmosphere as it absorbs the same amount of carbon in growing as it releases when consumed as a fuel. Its advantage is that it can be used to generate electricity with the same equipment that is now being used for burning fossil fuels. Biomass is an important source of energy and the most important fuel worldwide after coal, oil and natural gas. Bio-energy, in the form of biogas, which is derived from biomass, is expected to become one of the key energy resources for global sustainable development. Biomass offers higher energy efficiency through form of Biogas than by direct burning. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats. Biomass fuels provide about 3 percent of the energy used in the United States. People in USA are trying to develop ways to burn more biomass and less fossil fuel. Using biomass for energy can cut back on waste and support agricultural products grown in the United States. Biomass fuels also have a number of environmental benefits.

4. POWER GENERATION POTENTIAL FROM BIOMASS AND BAGASSE BASED COGENERATION

Biomass resources are potentially the world's largest and most sustainable energy sources for power generation in the 21st century (Hall & Rao, 1999). The current availability of biomass in India is estimated at about 500 million metric tonnes per year. Studies sponsored by the Ministry has estimated surplus biomass availability at about 120 – 150 million metric tonnes per annum covering agricultural and forestry residues corresponding to a potential of about 17,000 MW. This apart, about 5000 MW additional power could be generated through bagasse based

cogeneration in the country's 550 Sugar mills, if these sugar mills were to adopt technically and economically optimal levels of cogeneration for extracting power from the bagasse produced by them (Ministry of New and Renewable Energy). The details of the estimated renewable energy potential and cumulative power generation in the country, indicating that the available biomass has a potential to generate around 17,000 MW of electricity. The Ministry has been implementing biomass power/co-generation programme since mid-nineties. A total of 288 biomass power and cogeneration projects aggregating to 2665 MW capacity have been installed in the country for feeding power to the grid consisting of 130 biomass power projects aggregating to 999.0 MW and 158 bagasse cogeneration projects in sugar mills with surplus capacity aggregating to 1666.0 MW. In addition, around 30 biomass power projects aggregating to about 350 MW are under various stages of implementation. Around 70 Cogeneration projects are under implementation with surplus capacity aggregating to 800 MW. States which have taken leadership position in implementation of bagasse cogeneration projects are Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Uttar Pradesh.

5. WOODY BIOMASS AND NON-WOODY BIOMASS

Woody biomass is characterized by high bulk density, less void age, low ash content, low moisture content, high calorific value. Because of the multitude of advantages of woody biomass its cost is higher, but supply is limited. Woody biomass is a preferred fuel in any biomass-to energy conversion device; however its usage is disturbed by its availability and cost.

The various agricultural crop residues resulting after harvest, organic fraction of municipal solid wastes, manure from confined livestock and poultry operations constitute non-woody biomass. Non-woody biomass is characterized by lower bulk density, higher void age, higher ash content, higher moisture content and lower calorific value. Because of the various associated drawbacks, their costs are lesser and sometimes even negative.

6. BIOMASS-A SOURCE OF POWER GENERATION IN SMALL SCALE INDUSTRIES

In India, there are over 11 million small-scale registered industrial units that provide employment to more than 27 million people (Kumar & Patel, 2008). They contribute to 40% of the country's industrial production and 34% of exports. A major number of these units require large quantities of electrical energy. The high cost of supply, which is mostly unpredictable and unreliable on account of scheduled / unscheduled power cuts, drives industries to invest in imprisoned power generation. As fossil fuels are limited and polluting, such order provides an attractive platform to renewable for providing different energy solutions to particularly small and medium enterprises, industrial and commercial establishments. Biomass energy systems can be deployed to meet power requirement in industries. Such electricity generation will help industries in becoming independent and relieve pressure on fossil fuels.

The captive biomass-based energy units having capacity ranging from about 100 KW to few MW can be set-up by an industrial unit. In general, combustion-based systems are suited for MW-scale projects, whereas gasifiers are appropriate for small and decentralized power projects up to 1 MW capacity. In addition to electricity, the bio-power plant is also likely to produce activated carbon (a valuable product) that further offsets the working cost of the plant. Under a broad rural development policy, the increase in crop diversity agricultural productivity, crop diversity and the generation of rural income and employment have been given high priority in many developing countries. Promoting and improving rural industries, naturally, is an important strategy for attaining such policy objectives. The majority of small industries are in peri-urban and rural areas. For fuel, majority still uses wood and agricultural residues. The traditional processes in small-scale industries are often traditional and operate under highly competitive conditions.

7. BIOMASS- ENVIRONMENTAL AND CLIMATE CHANGE BENEFITS

Over the past few years, people throughout the world have become very much aware of the terms 'global warming' and 'greenhouse gases'. This has to do with what is going into the atmosphere and how it affects our way of life. When fossil fuels are burned they send carbon dioxide (CO₂), sulphur oxides (SO_x), NO_x emissions and ash production into the atmosphere. It is believed that these emissions stay there for tens of thousands of years and are creating a barrier, which separates the earth from the sun. Reducing this threat to the atmosphere is one of the Environmental Benefits of Biomass. Air/Atmospheric Pollution is a major challenge faced by the world today and impacts all of us in so many different ways. Importantly, our ability to effectively address air pollution is fundamental to our pursuit of promoting sustained economic growth and sustainable development. Our approach in dealing with pollution issues is, therefore, built around the high priority accorded by developing countries to economic growth and poverty eradication. The decisions concerning the fight against air/atmosphere pollution should be guided by the understanding that economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development. Air pollution has

serious negative impacts on human health, socio-economic development, ecosystems and cultural heritage. Urgent and effective actions are, therefore, required in regard to both indoor air pollution from traditional biomass cooking and heating and ambient air pollution from all sources.

8. BIOMASS POWER GENERATION SYSTEMS

Electricity for lighting and development of small-scale industries, thus making the villagers / small industries self-dependent. Growth of biomass occurs through photosynthesis reaction. Here, the biomass absorbs Carbon dioxide from the atmosphere and gives out oxygen. Thus the sustainable generation and use of biomass in power plants will definitely help in reducing carbon dioxide concentration in the atmosphere and thus the greenhouse effect. In comparison to coal, the ash content in biomass is very less (2-6% approx. as against 20-50% in coal). Thus, the use of biomass in power generation will lead to substantial decrease in the amount of suspended particulate matters in the atmosphere. Energy content in biomass is more than those of E and F grade coals (mostly exploited coals in Indian power plants). Reactivity of biomass towards oxygen and carbon dioxide is much higher than that of coal. This permits the operation of boiler at lower temperatures resulting in greater saving of energy. Power generation on decentralized basis will reduce the transmission losses. Feasibility of installation of biomass gasifiers in any location or village. Easy availability of technology and backup systems.

9. CONCLUSIONS

There are various type of renewable energy sources such as solar, wind, hydropower, biomass energy etc. out of these renewable energy sources, biomass is more economically viable for almost all the continents in the world. Biomass is a carbonaceous material and provides both the thermal energy and reduction for oxides, where as other renewable energy sources can meet our thermal need only. Till date, India has been capable to generate only 2000 MW. Air/Atmospheric Pollution is a major challenge faced by the world today and impacts all of us in so many different ways. Importantly, our ability to effectively address air pollution is fundamental to our pursuit of promoting sustained economic growth and sustainable development. Our approach in dealing with pollution issues is, therefore, built around the high priority accorded by developing countries to economic growth and poverty eradication. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats. Biomass fuels provide about 3 percent of the energy used in the United States. People in USA are trying to develop ways to burn more biomass and less fossil fuel. Using biomass for energy can cut back on waste and support agricultural products grown in the United States. Biomass fuels also have a number of environmental benefits.

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