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ESTIMATION OF POWER GENERATION POTENTIAL OF AGRICULTURAL BASED BIOMASS SPECIES AND COAL-BIOMASS MIXED BRIQUETTES

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Abstract - With the advancement in technology the power consumption is rising steadily. This necessitates that in addition to the existing source of power such as coal, water, petroleum etc. Other sources of energy should be searched out and new and more efficient ways of producing energy should be devised. Power generation from biomass becomes attractive way for energy generation due to their high energy potential and less pollutants.

This study reviews the estimation of power generation potential of biomass species and coal-biomass as well as the future importance of biomass power generation. This study aims to estimate the potential of biomass power generation and its impact on power generation expansion planning as well as mitigating carbon dioxide emission from the power sector. The harvest area and crop yield per area are taken into consideration to estimate the future biomass availability. The supplies of biomass are then applied as a constraint in the least cost electricity generation expansion-planning model.

Keywords: Biomass, Power generation, Coal-Biomass, Biomass energy

I. INTRODUCTION

In today's world, fossil fuels are becoming one of the major origin of power generation. About 83% of the world's energy supply comes mainly from fossil fuels. In India, more than 89% energy demand is fulfilled by fossil fuels. The demand of energy is increasing rapidly as a result of rapid industrialization and population growth, the conventional sources of energy are not able to meet the growing requirement. Toxic wastes like CO_2, SO_2, bottom ash, fly ash, etc. are emitted in large amount due to consumption of fossil fuels which makes human survival difficult on the earth planet as well as in climate. Conventional sources are limited and non-renewable in nature. Due to that it has become important to search and develop new sources of energy. New sources of energy are renewable and environment friendly. The development of new sources of energy will reduce dependence on conventional sources up to a great extent. Thermal power and metallurgical industries are assumed to be the prime consumers of fossil coals. Thermal power plants make a large amount of pollutants, like CO_2, SO_2, fly ash, etc which are risky for human continued existence on the earth planet. Therefore, scientists and technocrat's world-wide are in investigation of alternative origins of energy whose exploitation is not destructive for the human beings. Biomass is emerging as one of the secondary sources of energy.

In today's world, biomass is used as an attractive substitute for power generation because of rapid depletion of fossil fuel resources and growing concern over the environmental degradation caused by conventional power plants.. The major issues of atmospheric pollution, energy crunch, wasteland development, rural employment generation and power transmission losses can be solved by sustainable production and usage of biomass in power generation. Thus, the development of biomass-based power generation system is becoming one of the favorable alternatives for majority of the developing nations including India. The important plus point behind increasing usage of biomass resources are that it can be pre-desiccated up to about 17% moisture and store for a large period of time lacking any difficulty. Biomass offers massive favorable circumstances for decentralized power generation along with electricity supply to the national power grids in rural areas near the points of use. Thus this can make villagers or small industries self-dependent for their power requirements. The decentralized power generation systems lower peak

loads. They also reduce maintenance cost of transmission and distribution network. To feat biomass materials in electricity generation, categorization of their various properties like energy values, chemical compositions, reactivities close to oxygen, bulk densities, etc. is essential.

The current project work is carried out as exercise on proximate investigation, ultimate investigation, ash fusion temperature and energy value of different components of Coconut, Maize, Paddy and Arhar biomass species (horticultural residues) and their impacts on power generation. Few years ahead, these biomass materials have no profitable value and are under-exploited. However, they have numerous advantages as fuel crops.

They are fast growing and extent to maturity in two years only. They can be produced on poor, useless and semi-desert land surviving with relatively low percentage of water.

Power generation from biomass is proven as one of the favorable way for energy generation due to their high energy potential, environmental friendly and less pollutants. Biomass power generation can solve the major issues of climate pollution, land that is uncultivated or barren development, rural employment, energy crisis and power transmission losses.

Present research work deals to determine the proximate investigation calorific value and energy value of two groups of biomass species in which group-I having two biomass species and group-II having four biomass species and mixed-biomass briquette and to find out the best applicable ratio for power generation for both groups as well as land essential for plantation

II. BIOMASS AND BIO-ENERGY

Biomass is organic substantial made from plants and animals. Biomass contains stored energy of the plants from the sun. Plants take up the sun's energy in a process termed as photosynthesis.
The chemical energy in plants gets passed on to animals and human beings that eat them. Biomass is one of the renewable energy sources because we can always grow more no. of trees, plants and crops, and waste will consistently exist and recycled. Some examples of biomass fuels are wood, crops, manure, and some waste. When biomass is burned out, the chemical energy stored in biomass is released as heat. Wood waste or litter can be burned to produce steam to generate electricity, or to provide heat to industries and homes. If biomass is burning then it is not the only means to release energy stored in it. Biomass can be transformed to other utilizable forms of energy such as methane gas or shipment fuels.
Smelly stuff, like rotting litter, and horticultural and human waste, release methane gas - also termed as "landfill gas" or “biogas." Crops like corn and sugar cane can be fermented to produce the moving fuel. Biodiesel or shipment fuel, can be produced from left-over food goods such as vegetable oils and animal fats In the United States, Biomass fuels energy recycling contribute about 3 percent of the total energy recycled. People in the USA are trying to develop means to burn more biomass and fewer fossil fuels.
Biomass energy is the usage of energy stored in organic matter. It is humanity’s oldest external source of energy, dating back to prehistoric man’s first practice of fire. And biomass is still an important part of the world’s energy structure; the use of conventional biomass-charcoal, firewood, and animal dung-in rising countries accounts for almost 12% of the world’s primary energy supply. Bio-energy can be utilized in variety of the applications: Biomass can be combusted to produce heat (huge plants or localized biomass boilers), electricity, or used in combined heat and power (CHP) plants. Biomass has potential to take over petroleum as a source for transportation fuels.
Biomass can also be used in mix with fossil fuels (co-firing) to improve efficiency and to reduce the build-up of ignition residues. Biomass is also used in conjunction with fossil fuels for electricity generation in “waste-to-energy” projects. These are niche applications, which rely upon the biomass having no other commercial cost and being in close proximity to the application

III. WHY BIO-MASS ENERGY?

Biomass is tempting energy source for a number of reasons:

- Biomass is a renewable energy source generated by natural processes and as a by-product of human action.
- It is also more evenly distributed over the earth's surface than fossil fuel energy sources, and may be exploited using more cost effective technologies.
- It provides us the opportunity to become more energy efficient and helps to reduce environmental change.
- It helps farmers, ranchers and foresters in better management of waste material, providing rural job opportunities and stimulating new economic opportunities. 1.4 BIOMASS: CLASSIFICATION Woody biomass -Woody biomass is characterized by less void age, low ash content, low moisture content, high calorific value and high bulk quantity. As supply of timbered biomass is limited and benefits are enormous, its cost is higher.
- Woody biomass is a favorable fuel in any biomass-to energy conversion device; however its usage is affected by its limited availability and high cost. Non-woody biomass-The various horticultural crop residues resulting after harvest, and poultry procedures constitute non-woody biomass. Non-timbered biomass is characterized by higher void age, higher ash content, higher moisture content, lower calorific value and, lesser bulk density.

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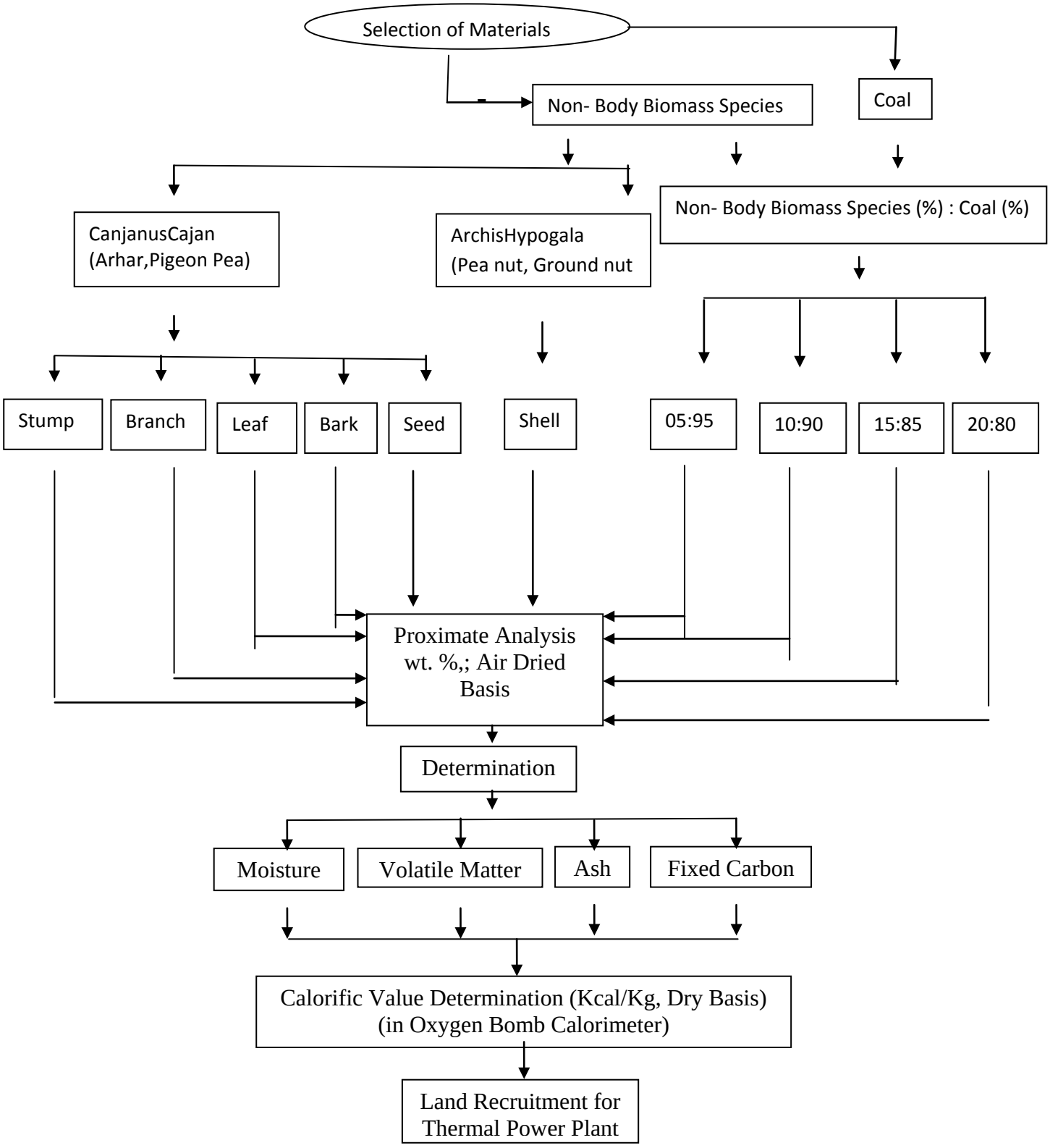
IV. METHODOLOGY

This is flow chart of overall methodology or approach which we have used in this study to meet the objectives.



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V. RESULTS

Proximate investigation of presently selected plant components obtained from farming residue

It is important to determine the humidity contents, ash contents, volatile matter and fixed carbon of a fuel energy source to know their power generation potential. Thus the study of proximate analysis of fuels energy sources gives an approximate idea about the energy values and extent of pollutant emissions during combustion. Agricultural based biomass has large amount of free moisture. To decrease the transportation cost and increase the calorific value which must be removed. In the plant species selected for the current study the time required to bring their humidity contents into equilibrium with that of the air was found to be in the range of 25-30 days during the summer season (temp 35 –420C, humidity 12-25 %).

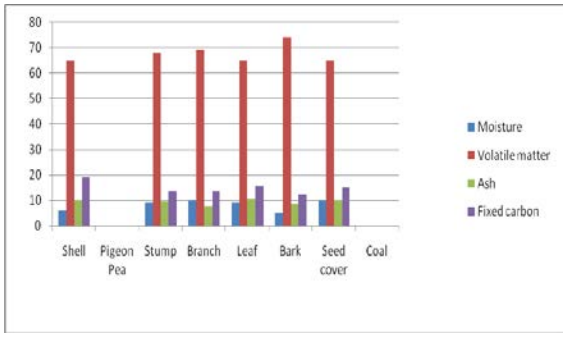

Figure 5.1- Variation of Proximate Analysis of Groundnut Shell, Pigeon Pea and Coal

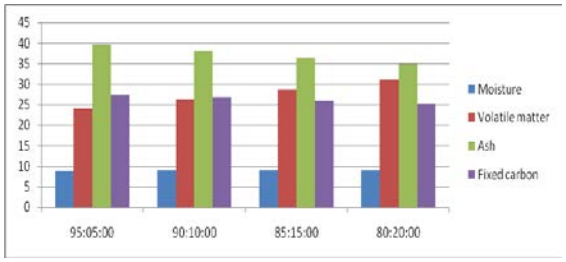

Figure 5.2- Variation of Proximate Analysis of Mixed Coal-Biomass (Pigeon Pea Stump)

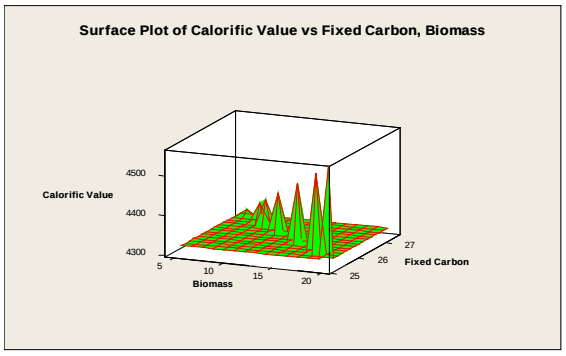

Figure 5.3 - Surface Plot of Calorific Values V/S Fixed Carbon, Biomass (Pigeon Pea Stump)

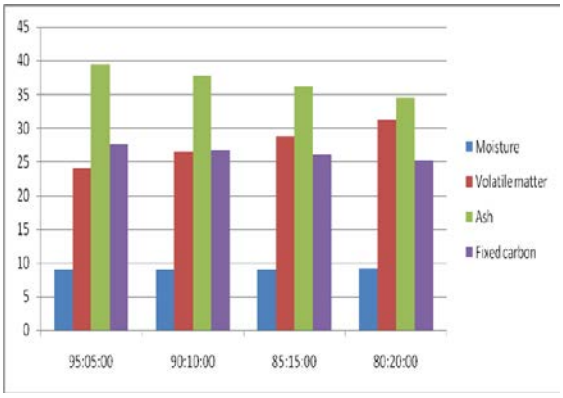

Figure 5.4 - Variation of Proximate Analysis of Mixed Coal-Biomass (Pigeon Pea Branch)

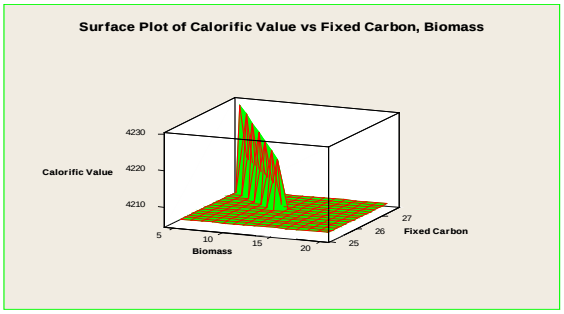

Figure 5.5- Surface Plot of Calorific Values V/S Fixed Carbon, Biomass (Pigeon Pea Branch)

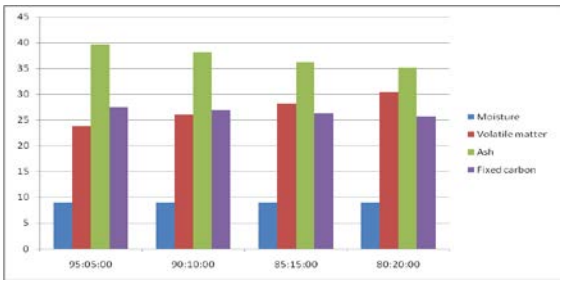

Figure 5.6 - Variation of Proximate Analysis of Mixed Coal-Biomass (Pigeon Pea Leaf)

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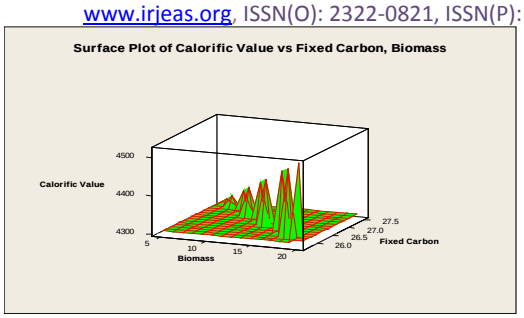

Figure 5.7 - Surface Plot of Calorific Values V/S Fixed Carbon, Biomass (Pigeon Pea Leaf)

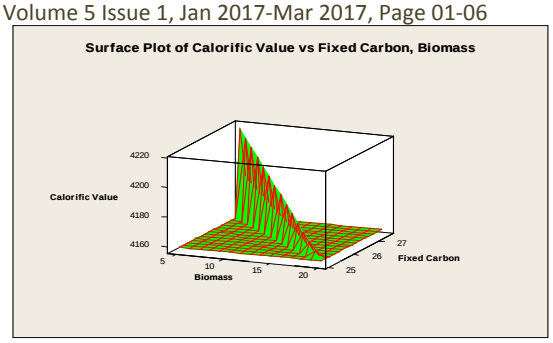

Figure 5.9 - Surface Plot of Calorific Values V/S Fixed Carbon, Biomass

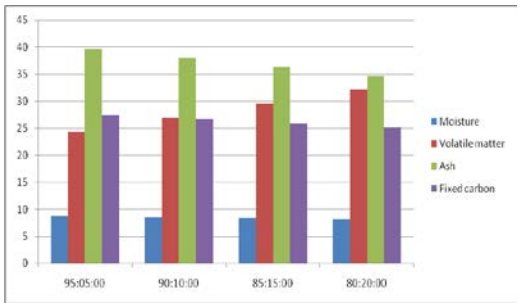

Figure 5.8- Variation of Proximate Analysis of Mixed Coal-Biomass (Pigeon Pea Bark)

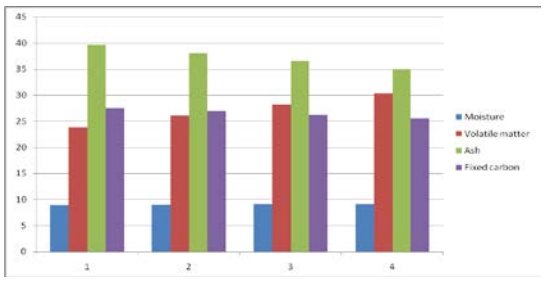

Figure 5.10 Variation of Proximate Analysis of Mixed Coal-Biomass (Pigeon Pea seed cover)

VI. CONCLUSION

In the future petroleum fuels will replace from liquid bio-fuels like biodiesel and bio-ethanol. So, these bio-fuels are most important in future. From renewable sources of feedstock the liquid bio-fuel like biodiesel and bio-ethanol derived.

Feedstock of bio-renewable can be converted into value-added chemicals and fuels with minimum waste and emissions. Bio-renewable is the thermo chemical and biochemical conversion processes for obtain various type bio-products like bio-oil, bio-ethanol, biodiesel, and diesel-like products. Biochemical and thermo chemical conversion are upgraded from bio renewable. The upgrading is done before ultimate refining processes and in the upgrading fractionation for separation of primary products.

The advantages of an integrated upgrading system are as following:

1. Numerous because of the diversification in feedstock's and products.
2. There are currently several different levels of integration which add to their sustainability, both environmentally and economically.

Production as well as economic benefits increases with the level of integration in the system. In developing countries biomasses often the only available, most attractive, non pollutant and affordable source of energy to fulfill their basic needs such as cooking and heating.

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