ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

Study of Biomass Production for Energy in Forming Prospective

Pappu Kumar Verma[1], Jitendra Kumar[2], Pappu Kumar[3], Nitish Pratap Singh Sengar[4], Praveen Kumar[5], Raman Dewangan[6]
BE Student[1], M. Tech Student[2, 3, 4, 5, 6]
Department of Mechanical Engineering
Chhattisgarh Swami Vivekananda Technical University, Bhilai, India[1]
Kalinga University, Raipur, Chhattisgarh, India[2, 3]
Raipur Institute of Technology, Raipur, Chhattisgarh, India[4]
Government Engineering College, Jagdalpur Chhattisgarh, India[5, 6]

Abstract:
Traditionally in engineering, in view of high energy potential in agricultural residues species and an improving interest in their employment for power generation an set about has been made in this research to assess the proximate analytical thinking and energy content of antithetic elements of four chooses agricultural residues such as maize, coconut, paddy, arhar, and their impact on power generation and land need for energy plantations. The net energy content in coconut industry was found to be higher than other studied agricultural balance. The result shows that approximately 718 hectares, 1124 hectares, 1512 hectares and 4329 hectares of land are need to generate 20,000 kWh/day current form, coconut, paddy, maize, and arhar pulse residues respectively. Coal samples, obtained from six authentic local mines were also analysis for their qualities and the solutions were compared with those of research biomass materials. This comparison reveals much higher power output with minimum emission of suspended particulate matter (spm) from biomass materials. It has been observed that coconut, paddy and arhar agricultural remainder can be carried out safely up to the temperature of 955°C.in case of use of maize agricultural residue, it may be much safe to operate the boiler at temperature infra 800°C. Since it has been determined that maize has worst IDT (Initial deformation temperature) and lowest FT (Flow temperature), while coconut and paddy have advanced IDT and FT.

1. INTRODUCTION

The Fossil fuel reserve is extremely limited in nature and these reserves are demur to last up to 100 years more. Thermal power plant and metallurgical plants are considered to be the mammoth deplete of fossil coals. Thermal power industries produce a rhetorical amount of pollutants, such as CO_2, SO_4, fly ash, etc which are dangerous for human survival on the earth planet. Hence, scientists and researcher world-wide are in search of choice sources of energy whose development is not defamatory for the human beings. There are many choice sources of energy including Bio-mass.

Due to speed depletion of fossil fuel resources for energy generation and growing concern over the environmental degradation caused by conventional power plants, power generation from biomass is becoming attractive across the world. Sustainable production and usage of biomass in power generation can resolve the vital issues of atmospheric pollution, energy crisis, wasteland evolution, rural employ generation and power transmittal losses. Thus, the evolution of biomass-based power generation system is thought to be approving for majority of the developing nations including India. Unlike other renewable, biomass materials, pre-dried up to about 15% moisture, can be stored for an appreciable time period without any difficulty. Alongside electricity supply to the national power grids, biomass offers giant opportunities for decentralized power generation in rural areas at or near the points of use and thus can make small industries self dependent in respect of their power requirements. It is observed that the decentralized power production systems reduce peak loads and maintenance cost of transmitting and probability network.

1.1 The Various Sources of Energy

The having energy and environmental problems colligate with the utilize of fossil fuels in electricity production, scientist and technocrats, worldwide, are in search of the suitable option of fossil fuels for power production. The various different sources of energy having a potential to be used in electricity generation are as follows:

(a) Nuclear Energy

The nuclear energy stored in the nucleus of an atom and released by fission, fusion, or radioactivity is known as nuclear energy. In these processes a small quantity of mass is converted to energy according to the relationship $E = mc^2$, where E is energy, m is mass, and c is the speed of light.

(b) Ocean Energy

The Ocean thermal energy conversion is a tool to produce power using the temperature difference of sea water at different depths. The method involves pumping cold water from the ocean depths to the surface and draw out energy from the flow of heat between the cold water and warm surface water. Ocean thermal energy conversion utilizes the temperature difference that exists between deep and shallow waters with in 20° of the equator in the tropics to run holding like energy values, chemical compositions, reactivates towards oxygen, bulk densities, etc. is necessary. The present project work deals with the research on proximate investigation, ultimate analysis, ash fusion temperature and energy value of different components of

Coconut, Maize, Paddy biomass species and their impacts on power production. Few times ago, these biomass species have no commercial value and are under-exploited.

(C) Geothermal Energy
The Internal heat of the Earth creates geothermal energy. This heat rises towards the surface, warming volumes of water between a few hundred and about 3,000 meters down. These volumes of hot water can be used to furnish energy or electricity calculates on their temperature.

(D) Wind Energy
The Wind turbines are used by Wind energy systems to produce electrical energy by diminishing the energy in wind. Wind energy can in stand-alone practical applications or can be create centrally and distributed to the electric grid. Wind is a form of the solar energy, caused by the uneven heating of the earth's surface. This occurs at local, regional and global scales. Winds which flow close to the earth's surface are slowed down due to friction, which engender gusting and turbulence.

(E) Solar Energy
Radiant energy brings forth in the sun as a result of nuclear fusion reactions is known as Solar Energy. It is the transmitted to the earth by space in quanta of energy called photons, which interact with the earth's atmosphere and surface. The capability of solar radiation at the outer edge from the earth's atmosphere when the earth is taken to be at its average distance from the sun is called the solar invariable, the mean value of which is 1.36×10^6 ergs per sec per cm^2 , or about 2 calories per min per cm^2

1.1 BIOMASS POTENTIAL IN POWER GENERATION
The Biomass resources are doubtless the world's largest and most sustainable energy origin for power production in the 21st century [1]. Indicates that the annual sustainable world-wide biomass energy use; is about 104 EJ/a [2]. The share of non-woody biomass is about 60%. The Large potentials of non-woody biomass are acquirable in Latin America, Africa and Asia. The total potential of non-woody and non-fodder biomass acquirable for power in India was estimated to be 325 MT in 1996-97, and the suggest value for 2010 is 450 MT [3]. Clearly indicates that in most parts of the world, the current biomass uses, agricultural residue in particular, in electricity generation is possible.

1.3 APPLOCATION OF BIOMASS:

A REDRESS TO COMBAT POLLUTION EMISSIONS FROM POWER PRODUCTION INDUSTRIES
Air Pollution is an immense concern faced by the world today and encroachment all of us in so many various ways. Our approach in dealing with pollution issues is, therefore, built around the high priority accorded by developing countries to economic development and the poverty eradication importantly, our ability to effectively address air pollution is important to our pursuit of promoting sustained economic development and sustainable development. The decisions concerning the fight against air pollution should be guided through the understanding that economic growth, social growth and environmental protective cover are interdependent and usualness reinforcing components of sustainable development.

1.4 Process of power production by using Biomass Species:

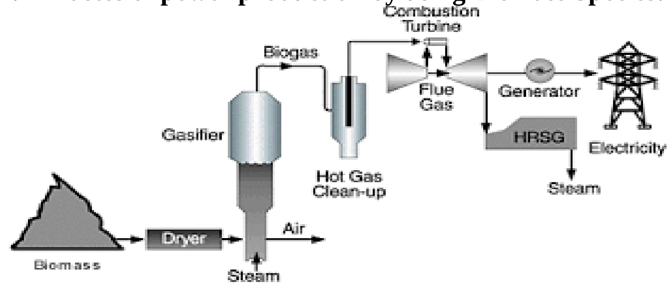

Figure.1. Biomass integrated gasification combined cycle system schematic

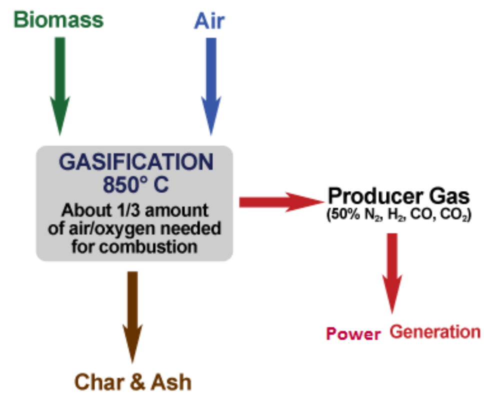

Figure.2. Biomass Gasification via Partial Oxidation (Auto Thermal)

2. MERITS IN THE USE OF BIOMASS IN POWER GENERATION:

(1) Growth of biomass occurs through photosynthesis reaction. Here, the biomass absorbs carbon dioxide from the atmosphere and gives out oxygen.

(2) In comparison to coal, the ash content in biomass is very less. Thus, the use of biomass in power production will lead to substantial reduce in the amount of suspended particulate matters in the atmosphere.

(3) Sustainable plantation and potential of biomass in electricity production will afford tremendous employment opportunity to the people who are mostly benefits for populous countries like India, China, etc.

(4) Energy content in biomass is more than those of E and F grade coals.

(5) The responsiveness of biomass towards oxygen and carbon dioxide is much higher than that of coal. This permits the process of boiler at lower temperatures resulting in greater saving of energy.

(6) The Sustainable plantation and use of biomass in electricity generation will afford tremendous employment chance to the

people who are highly benefit for populous countries like India, China, etc.

(7) The energy generation on decentralized basis is possible by the utilization of biomass.

(8) Power production on decentralized basis will decries the transmission losses.

(9) Biomass plantation will prevent the soil erosion from floods.

3. OBJECTIVES OF PROJECT WORKS:

The objectives of the present investigation are as follows:

1. The option of agricultural based biomass species and appraisal of their generation by field trial.
2. In the Characterizations of these biomass parts for their energy values.
3. Impairment of proximate analysis of their various parts, such as stump, branch, leaf and bark.
4. The Characterization of these biomass parts for their ultimate analysis.
5. The Impairment of ash fusion temperature of ashes obtained from these biomass species.
6. Estimation of power production potentials of these biomass species for short thermal power industries on decentralized basis.

4. LITERATURE SURVEY:

Potential biomass resources of Sicily for electric power generation

V. Alderucci, A. Giordano, A. Iovino, N. Giordano and V. D. Phillips The literature review Based on an analogous biomass energy valuation of the Hawaiian Islands, a method for assessing the biomass resource potential of Sicily is explain. The methodology features land availableness and land suitableness criteria for evaluating biomass productivity potential, biomass energy plantation species and site selection, and plantation management scheme. A technical and economic comparison of two biomass-transition technologies for generating electric energy, non-catalytic biomass gasification coupled with a combined-cycle gas turbine and catalytic biomass gasification coupled with a molten-carbonate fuel cell, is perform. Recommendations for growth an economically-viable biomass plant in Sicily are also included. An exploratory review of Sicily's candidate biomass feed stocks which identify yields and costs of both agricultural residues and dedicated biomass energy crops are featured. Yukihiko Matsumura, Tomoaki Minow and Hiromi Yamamoto In the estimation about use of agricultural residue in Japan as an energy resource, based on the amounts produced and availableness. The main agricultural residues in Japan are rice straw and rice peel. It is a Based on a scenario wherein these residues are collected as is the rice product; we evaluate the size, cost, and CO_2 discharge for power generation. Rice residue has a production potential of 12 Mt-dry year^{-1}, and 1.7 kt of rice straw is collected for each storage location. Amit Kumar, Jay B. Cameron and Peter C. Flynn The power value and optimum plant size for power plants using three biomass fuels in western Canada were determined. The three fuels are biomass from agricultural residues, whole boreal forest, and forest harvest residues from existing lumber and pulp operations. Forest harvest residues have the smallest economic size, 137 MW, and the highest power cost, \$63.00 MWh^{-1} (Year 2000 US\$). The optimal size for agricultural residues is 450 MW (the biggest single biomass unit judged feasible in this research), and the power cost is \$50.30 MWh^{-1}. If a larger biomass boiler could be built, the optimal project size for husk would be 628 MW. D. O. Hall Division Life Sciences, King's College London, London W8 7AH, UK Available online 8 December 1997 The Biomass fuels currently (1994) supply around 14% of the world's energy, but most of this is in the form of conventional fuel wood, residues and dung, which is often inefficient and can be environmental, detrimental. Biomass can supply heat and electricity, liquid and gaseous fuels. WrightLink Consulting, 111 Crosswinds Cove Road, Ten Mile, TN 37880, USA Received 10 December 2004; revised 25 August 2005; accepted 26 August 2005. Available online 19 May 2006. Bio-mass energy ingestion is greatest in countries with heavy subsidies or tax incentives, such as China, Brazil, and Sweden. Conversion of forest residues and agricultural residues to charcoal, district heat and home heating are the most common forms of bio-energy. Biomass electric production feed stocks are predominantly forest residues bio-gases, and other agricultural residues. Bio-fuel feed-stocks include sugar from sugarcane (in Brazil), starch from maize grain (in the US), and oil seeds (soy or rapeseed) for bio-diesel. Of the six large land areas of the world reviewed, total biomass energy consumptions amounts to 17.1 EJ. Short-rotation woody crops (SRWC) established in Brazil, New Zealand, and Australia over the past 25 years equal about 50,000 km^2.

5. EXPERIMENTAL WORK

5.1 Materials selections

In the present project work, for various types of non-woody biomass species were gathered from the local area and their parts were distant separately and kept for air drying in a cross ventilated room for about a month. Three non-coking coal samples of three different mines of Orissa were also collected for comparative studies. The moisture contents of these parts reached in equilibrium with that of the atmospheric air in one month. The local and botanical names of the biomass species, selected for present project operation, have been outlined in the table. The air dried biomass samples were rough into powders and then processed for their proximate and ultimate analysis and calorific value impairment.

5.2 Moisture Determination

One gram of air dried powdered sample of size -72 mess was taken in a broil glass crucible and keep in the air oven maintained at the temperature 115˚C. Weight loss was recorded using an electronic balance. The percentage loss in weight gave the percentage moisture content in the sample. The sample was soaked at this temperature for one hour and then taken out from the furnace and cooled in a desecrator.

5.3 The Calorific Value Determination

The calorific values of the biomass samples were measured in a Bomb calorimeter apparatus by the method outlined in reference [8]. The sample was then fixed inside the bomb and rise in temperature of water was noted with the help of Beckman

Thermometer. In this test an over dried sample briquette of weight 1gm was taken in a bomb and oxygen gas was filled into this bomb at a pressure of 25-30 atm. The calorific value was calculated by using the following formula:

Gross Calorific value = (W.E × Δ T) / W_o – (fuse wire + thread connections)

Where,

ΔT = Maximum rise in the temperature in ˚C.

W.E. = water equivalent of the apparatus.

Wo = Initial weight of briquette sample.

6. THE RESULT AND DISCUSSION

Proximate analysis of presently selected plant components obtained from agricultural residue:

The researches of proximate analysis of fuels energy sources are important because they give an approximate idea about the power cost and extent of pollutant discharge during combustion. Freshly felled agricultural industry parts contain a most amount of free moisture, which must be abolishing to reduce the transportation value and improve the calorific value. In the industry species choice for the analysis of the present study. The time required to bring their moisture contents into equilibrium with that of the atmosphere was found to be in the range 3-3.5 week during the summer season (temp - 37 –42 ° C, humidity 10-25 %.

The Appraisal of Decentralize energy production Structure in Rural Areas:

The appraisal of power production to meet the electricity requirement of villages, a group of 10-15 villages consisting of 3000 families may be considered for which one energy station could be planned. The electricity requirement of lighting and domestic work in these villages may be assumed to be order of 6000 kWh/day.

6.1 CONSTRAINTS FOR PROMOTING ENERGY FINESSE

In the view of vast natural resources in the form of wasteland, sunshine, etc., the most promising solution to energy crisis in tropical country appears to be the use of solar energy through energy plantations (Gurumurti et al., 1984; Boyles, 1986; Awasthi et al., 1979). Until recently, bio-mass production and conversion have attracted little attention from scientists and technologists. The following could be some of the reasons for the lack this lack of interest.

Table.1. The Electricity production potentials of non-conventional energy sources in India (Renewable energy statistics, 2005)

S.No.	Source	Cumulative Installed Capacity (MW)	Estimated Potential (MW)
1	Biomass Energy	16000	4,434.00
2	Wind Energy	45,000	376.00
3	Small Hydro (up to 25 MW)	15000	491.00
4	Bio-gases	3500	1,748.00
5	Waste-to-Energy	2700	45.76
6	Solar Photovoltaic	20 MW/km^2	2.80

Energy calculations:

On oven dried basis, total energy from one hectare of land

= (21926 +1044.5 +1966) x 10^3

= 34333 × 10^3 kcal

Assumptions:

• Conversion efficiency of wood fuelled thermal generators = 30 %

• Overall efficiency of the power plant = 85 %

Energy value of the total utilizable biomass obtained from one hectare of land at 30% efficiency of Kcal generation = 34334 × 10^3 × 0.30

= 10300.2 × 10^3 k-cals

= 11968.6 kWh

Power production at 85 %

The Overall efficiency = 11968.6 × 0.85

= 10173.33 k W h /ha

$= \frac{73 \times 105}{10173.32}$

=7171 hectares

Table.2.Total energy contents and power generation structure from 4 months old, coconut plants

S.No.	Component	C.V. (Kcal/t)	Energy value (kcal/ha)	Biomass production (t/ha, dry basis)
1	Coir pith	4385 × 10^3	3930 × 10^3	2.5
2	Shell	4277 × 10^3	10443 × 10^3	5
3	Back	3930 × 10^3	1965 × 10^3	0.5

Energy calculations:

On oven dried basis, total energy from one hectare of land

= (13039 + 4902 + 2820.2 + 1168.2) × 10^3

= 21927 × 10^3 K-cals

Assumptions:

• Conversion efficiency of wood fuelled thermal productions = 30 %

• Overall efficiency of the power industries = 85 %

Energy value of the total utilizable biomass obtained from one hectare of land at 30% efficiency of Kcal generation = 21296 × 10^3 × 0.3

= 6578.12 kcals

= 7643.761 kWh

Power production at 85 %

The overall efficiency = 7643.761 × 0.85

= 6497.191 kWh /ha

Land required supplying electricity for the whole year

= 73×10^5

= 1124 hectares

7. CONCLUSION:

1. In case of coconut balance, shell has higher calorific value, which is splendidly higher than pitch and bark, severally.

2. In the case of maize residue corn pad has higher calorific value which is higher than bark, stump and leaf severally.

3. In case of paddy residue stump and leaf have about the same calorific value.

4. In the case of arhar residue stumps has higher calorific value followed by leaf, shed cover, and branch severally.

5. the Calculation result have established that nearly 715 hectares, 1124 hectares, 1512 hectares, 4316 hectares of land would be need for regularly production of 20,000 KWh energy per day from coconut, maize, paddy and arhar agricultural residue severally.

7. In the contrast to locally accessible coals, the studied agricultural residue plant showed higher energy values and much higher energy value and much lower ash contents. This indicates higher energy production possible in Biomass than coals.

8. In the present studies could be useful in the exploration of agricultural residue based biomass species for power generation.

8. FUTURE SCOPE

(1) The Similar type of study required to be extended for other agricultural residue biomass species available in the region.

(2) Pilot plant study on laboratory scale may be carried out to production electricity from biomass species.

(3)The biomass species may be mixed with cow dunk, sewage wastes, etc in different ratios and the electricity generated potentials of the mixtures may be determined.

(4) The powdered samples of these biomass species may be mixed with the electricity generated potential coal in different ratios and the resultant mixed briquettes may be studies.

(5) The New technique of power production from biomass species may be formulated.

9. REFERENCES:

[1]. Biomass: “Versatile Source of Energy”, 2000. Indian Energy Sector; Newswatch Tracks. Hall, D.O., and K. K. Rao. 1999. Photosynthesis, 6th Edn., Studies in Biology, Cambridge University press.

[2]. Parikka, M. 2004. “Global biomass fuel resources”. Biomass and Bioenergy 27: 613-620.

[3]. Ravindranath, N. H., H. I. Somashekar, M. S. Nagaraja, P. Sudha, G. Sangeetha, S. C. Bhattacharya, and P. Abdul Salam. 2005. “Assessment of sustainable non-plantation biomass resources potential for energy in India”. Biomass and Bioenergy 29: 178-190.

[4]. Renewable Energy Statistics: “Renewable energy at a glance in the world”, 2006. Akshay Urja 2: 48.

[5]. Renewable Energy Statistics: “Renewable energy at a glance in the India”, 2005. Akshay Urja 1: 48.

[6]. Gupta, A. K. 2006. “Renewable energy in Industry”. Akshay Urja 2: 13-15.

[7]. Kumar. M., and R. C. Gupta. 1992. “Properties of acacia and eucalyptuus woods”. J1. of Materials Science Letters 11: 1439-1440.

[8]. Kalika, V., and S. Frant. 1999. “Environmental aspects of power generation”. Energy Sources 21: 687-704.

[9]. Bureau of Indian Standards. 1969. IS: 1350, Part I. “Methods of tests for coal and coke”, p.3, New Delhi.

[10]. Agrawal, B. C., and S. P. Jain. 1980. “A Text-Book of Metallurgical Analysis”, 3rd Edn., p.277. Khanna Publishers, New Delhi.

[11]. Alderucci V., Giordano A., Iovino A., Giordano N. and Phillips V.D.” Potential biomass resources of Sicily for electric-power generation”, Journal of Science Direct Applied Energy, Volume 45, Issue 3, (1993), p. 219-240.

[12]. Matsumura Yukihiko, Minowa Tomoaki and Yamamoto Hiromi “Amount, availability, and potential use of rice straw (agricultural residue) biomass as an energy resource in Japan”, Journal of Science Direct Biomass and Bioenergy, Volume 29, Issue 5,(November 2005), p.347-354.

[13]. Kumar Amit, Jay B. Cameron and Flynn Peter C. ,“ Biomass power cost and optimum plant size in western Canada”, Journal of Science Direct Biomass and Bioenergy, Volume 24, Issue 6, (June 2003), p. 445-464.

[14]. Hall D. O.”Biomass energy in industrialised countries—a view of the future Forest Ecology and Management”, Journal of Science Direct Volume 91, Issue 1,(March 1997), p. 17-45.

[15]. Wright Lynn,”Worldwide commercial development of bioenergy with a focus on energy crop-based projects”, Journal of Science Direct Biomass and Bioenergy, Volume 30, Issues 8-9, (August-September 2006), p. 706-714.

[16]. Ramachandra T. V., Kamakshi G. and Shruthi B. V.,” Bioresource status in Karnataka” Journal of Science Direct Renewable and Sustainable Energy Reviews, Volume 8, Issue 1, (February 2004), p. 1-47.