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A STUDY ON BIOMASS ENERGY RESOURCES, POTENTIAL, RENOVATION AND RULE IN INDIA

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ABSTRACT

The biofuel production resource, potential, energy conversion, and strategy for promotion adopted by the Indian government are addressed in this message. As of March 31, 2013, India's total installed capacity for electricity production was 2666GW. Renewable energy accounts for 10% of total generation, with biomass accounting for 12% of total power production. India has a surplus of agricultural and forest land, resulting in an annual biomass availability of approximately 500 million metric tons. The overall capacity of biomass power production in India is 17,000 MW. At the moment, 2660 MW of electricity is produced, with 1600 MW coming from cogeneration. This study also discusses the different types of biomass in India. According to the study, India has a huge potential for bio mass feed supply from several sources. The Indian government implemented several policies and initiatives for biomass power production. Such regulations have covered the whole biomass energy industry, including biogas, biodiesel, and other biofuels. With strategic strategy and program, the Government of India has concentrated on the deployment and promotion of biomass energy, which is a significant part of this research study.

KEYWORDS: *Biomass, Energy, India, Renewable, Power.*

INRODUCTION

Biomass energy production has been encouraged in many developed and developing nations via well-designed laws and financial incentives. Feed-in tariff systems were established by several governments as a policy tool to encourage investment in the renewable energy industry. India is a rapidly expanding nation, and its energy consumption is rising in tandem with its economic and industrial development[1]. Oil and coal are the primary sources of energy for India. India's energy consumption from conventional sources is 150 GW (coal, fossil fuels, and oil), 4.78 GW (nuclear energy), 29.40 GW (hydropower), and 26.52 GW (sustainable sources). Fig. 1 illustrates India's large percentage of different energy resources as of March 31, 2013.

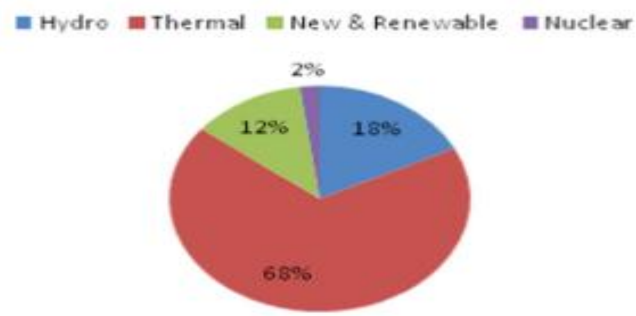

Figure 1: Illustrate the percentage share of various energy resources in India up to 31st March 2013

Due to a lack of knowledge and acceptance of renewable energy sources by electricity consumers in India, non-renewable fuels have been utilized often. There are many drawbacks to utilizing nonrenewable energy resources, including their limited availability in the environment, lack of environmental friendliness, and cost, since India imports all of these types of energy supplies[1]. As a result, it's critical to look into a variety of alternative sustainable energy sources. Biomass energy is one of the non-conventional sources that can supply grid-quality electricity. Biomass is a sustainable energy source that is made up of a complex mixture of carbon, nitrogen, hydrogen, and oxygen[2]. This content's biomass is derived from live or dead plants, agricultural residues, timber, and agro-based industries. In India, biomass energy consumption has been practiced from ancient times. It's found in cow dung cake, firewood, husk, and a variety of other natural feedstocks. Direct use of biomass in solid form, on the other hand, was neither safe nor painless since it produced a lot of smoke and ash[3].

As a result, the Indian government is encouraging biogas plants since they emit no smoke and are therefore pollution-free. Many incentives are available for the construction of a biogas plant. New biomass gasification technology is being developed. Technology has been developed that transforms biomass into more efficient syngas. Following the evaluation of biomass's potential, technology applied biological and thermochemical conversions in order to use biomass to generate fuel gases[4]. These fuel gases may be utilized to generate electricity. Biomass-based energy production is currently significantly on the increase. It is mostly due to rising electricity consumption in rural areas, as well as a lack of alternative fuel options. It is now critical to supply energy for civilization's progress via biomass. Global warming, resource depletion, and other worldwide problems have led to the choice of sustainable development in the current situation. In the electricity industry, one of the most important green sources is renewable energy, such as biomass[5].

The technique used by MNRE to provide subsidies is based on co-generation and biomass gasification generation. The biomass potential of India is identified state by state in this study. The different types of biomass found in India, as well as their conversion methods, are briefly discussed. The scope, potential, and situation of biomass power deployment in India were addressed in this article. It is stated that India has a policy of giving subsidies for biomass electricity. With strategic strategy and program, the Indian government has concentrated on the deployment and development of biomass energy, which is a significant part of this communication.

India's biomass resources are enormous

Biomass is described as a bio residue produced by water-based vegetation, forest or organic waste, agricultural production waste, or trash from the agro- or food-processing industries. In India, many biomass resources are accessible in various forms. Grass, woody plants, fruits, vegetables, manures, and aquatic plants are only a few examples of how they are categorized in nature. Algae and Jatropha are currently utilized in the production of bio-diesel[6]. Agricultural crop residue, energy plantation, and municipal and industrial waste are the three main sources of biomass energy. The different classifications of biomass available in India are shown in Figure 2.

Residue of agricultural crop

Because India has such a large agricultural land area, it produces a lot of residue. These residues have the potential to be used as a biomass feedstock for energy production. Agricultural residue refers to all organic components generated as a by-product of the processing harvesting of agricultural crops[7]. There are two types of agricultural residues: main and secondary residues. Field based or primary residue is that which is acquired in the field at the time of yield, while processing based or secondary residue is that which is assembled during processing. Primary residues include rice straw, sugar cane tops, and bagasse, while secondary residues include rice husk and bagasse. Animal feed, fertilizers, and other products are made from primary residues. As a result, its energy use potential is limited. Secondary residues, on the other hand, are abundant at the yielding site and may be confined as an energy source.

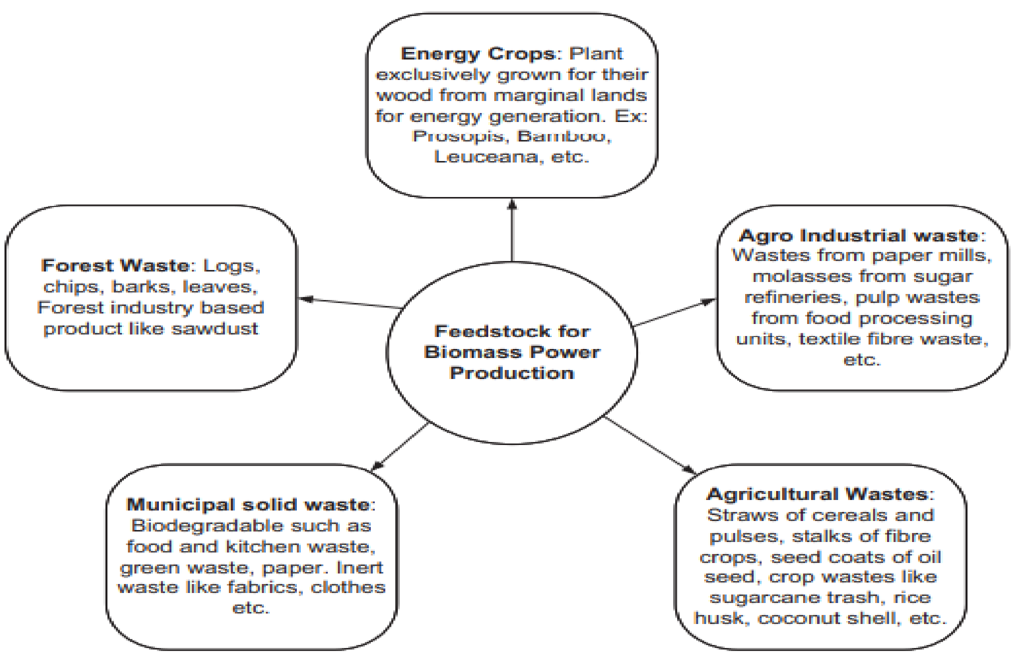

Figure 2: Illustrate the diagram shows the classification of available biomass resources in India

Agricultural feed-stocks-energy plantation

Cattle and animals thrive on a big scale in India due to the vast population's reliance on agriculture. As a result, many types of biomass potential are available in Indian communities. Corn, sugarcane, cereals, pulses, rubber, and other crops have all been utilized to generate biomass power. Dry and wet biomass are residues from crop collected as biomass for energy use. These crops are distinguished by a number of characteristics that allow them to be considered as biomass potential, such as calorific value, moisture content, carbon proportion, ash content, and so on[8]. These characteristics are important for converting both wet and dry biomass into usable energy.

Large amounts of different biomass wastes are accessible in India, making biomass waste a viable fuel for biomass power generation. Bio-chemical and thermo-chemical conversion processes may be used to transform these wastes into energy fuels known as bio-fuels. Industrial wastes and wastewaters: Water and soil contamination are caused by sewage and other pollutants. Dumping may have severe consequences. Organic matter seeps into ground water or escapes to surface waterways through organic decomposition of wastes on land, spawning pollution that causes health issues and fish death. Black liquor from the paper and pulp industry, milk processing facilities, breweries, the vegetable packing business, and animal dung are all examples of discharges.

- Food sector wastes: Hotel, restaurant, and community kitchens generate a lot of waste, such as vegetable flay, stale food (e.g. uneaten bread, rice, veggies, etc.), and fruit and vegetable rejections from the dish washer. Similarly, the confectionery business generates a significant quantity of trash. Fruit and vegetable scrap, nonstandard food, pulp and fiber produced from sugar and starch extraction, filter sludge, and other solid wastes are generated by these businesses. All of these solid wastes may be used to generate biogas via anaerobic digestion. Typically, these wastes are disposed of in landfills. Fruit and vegetable waste, meat washing waste, poultry and fish cleaning waste, and wine making waste are all examples of liquid waste.
- Animal wastes: Organic matter, moisture, and ash make up the majority of animal manure. Animal dung may decompose in either an aerobic or anaerobic setting. CO_2 and stable organic molecules are generated under aerobic circumstances, whereas additional CH_4 is produced under anaerobic ones. India has a high potential for CH_4 generation owing to the increased output of animal dung, which allows for a large energy potential.
- Municipal solid trash: Each year, thousands of tons of residential garbage are collected, the overwhelming majority of which is dumped on open fields. Paper and plastic make up the majority of municipal solid trash in India, accounting for 80% of total MSW. Anaerobic digestion or indirect combustion may both be used to transform municipal solid waste into electricity. Natural decomposition produces methane and carbon dioxide in a 1:1 ratio on waste sites. These gases are extracted from the stored material, swabbed, and cleaned before being fed into IC engines or gas turbines for energy generation. In a high-rate biomass digester, the organic fractional portion of MSW may be stabilized anaerobically to produce biogas for steam and power production.

- Sewage: Comparable to other livestock manure, sewage is however a source of biomass energy. Using the anaerobic digestion process to produce biogas, energy may be extracted from sewage.

Biomass energy conversion technologies

Different feedstocks are accessible for conversion to bio-fuels including for power generating purposes, as shown by India's biomass potential. The kind and amount of biomass feedstock, as well as the environment and economic circumstances, all influence biomass conversion processes. Biomass is converted to energy utilizing two major process technologies: thermochemical and biochemical/biological. Mechanical extraction, such as rapeseed methyl ester bio-diesel, is the third method for generating energy from biomass. Pyrolysis, biomass gasification, combustion, and liquefaction are the thermal conversion processes.

Thermochemical transformation

The thermo-chemical biomass is converted is accomplished via three major processes: combustion, gasification, and pyrolysis.

- Combustion

Combustion processes of burning biomass in air to transform the chemical energy contained in biomass towards heat, mechanical power, and electricity via various processes and equipment such as furnaces, stoves, steam turbines, boilers, and so on. Although any kind of biomass may be burned, combustion is only practical for biomass with a moisture level of less than 50%, unless the biomass is pre-dried. Biomass with a high humidity is more adapted to biological conversion.

- Gasification

Gasification is the partial oxidation of biomass at extreme heat, usually in the region of 800–900 LC, to produce a combustible gas mixture. The gas generated has a low calorific value (CV) and may be immediately burned or utilized as a fuel for gas engines and gas turbines. This generated gas may be utilized as a feedstock (syngas) in the manufacture of compounds such as methanol.

- Pyrolysis

Pyrolysis is the process of converting biomass into liquid, solid, and gaseous components in the absence of oxygen. If flashing pyrolysis is utilized, pyrolysis may be used to create bio-oil, allowing for an efficiency of up to 80% in the conversion of biomass to bio-crude. The bio-oil may be utilized in engines and turbines, and it is also being explored as a feedstock for refineries. However, certain issues need to be resolved, such as corrosiveness and low thermal stability. For only certain applications, upgrading bio-oils by reducing the oxygen content and eliminating alkalis via hydrogenation and catalytic cracking of the oil may be needed.

Conversion of natural chemicals

Fermentation and biomass gasification are the two major processes utilized, with a third process produced by mechanical extraction/chemical conversion being used less often.

- Fermentation

Fermentation is widely utilized commercially to generate ethanol from sugar crops (such as sugar cane and sugar beet) and starch crops in a variety of nations (e.g. maize, wheat). The biomass is crushed down, and enzymes convert the starch to sugars, which yeast subsequently converts to ethanol. Distillation is an energy-intensive stage in the ethanol production process, with 1000 kg of dry maize yielding approximately 450 l of ethanol. The solid waste from this procedure may be fed to cattle, and the bagasse from sugar cane can be utilized for further gasification or as a fuel for boilers.

- Anaerobic digestion is a kind of digestion that occurs in the absence of oxygen

Organic matter is immediately transformed to a gas called biogas during anaerobic digestion. It is mostly composed of methane and carbon dioxide, with minor amounts of other gases including hydrogen sulfate. Bacteria transform biomass in an anaerobic environment, producing a gas with an energy content of 20–40% of the feedstock's lower heating value.

LITERATURE REVIEW

Subhes C. Bhattacharyya studied India is home to a quarter of the population of the global total who do not have access to electricity, and approximately 40% of those who do not have access to modern energy. Despite a number of efforts and regulations aimed at assisting low-income families, this scenario persists. The administration, alarmed by the severity of the issue, has lately launched an ambitious rural electrification initiative. This article examines India's energy access issue and argues that, due to the low penetration of electricity in the poor's energy mix, rural electrification by itself is difficult to address the problem[9].

Shonali Pachauri et al. studied India and China are both in the midst of an energy transformation. Through the study of both aggregate data and nationally representative household surveys, this article analyzes the home energy transitions in different countries. In many ways, the two nations are diametrically opposed. In aggregate, China's residential energy usage is double that of India. Furthermore, in China, virtually all homes have access to electricity, while in India, almost half of rural families and 10% of urban households do not. In comparison to urban Indian homes, urban Chinese households get a higher proportion of their total energy from liquid fuels and grids (77 percent) (65 percent). Nonetheless, Indians get a somewhat higher share of their total household energy requirements from liquid and grid sources than Chinese with similar incomes at every income level. Despite these disparities, the countries' energy consumption patterns and the variables affecting a transition to modern energy are comparable. Urban homes in both countries use a disproportionately high percentage of commercial energy and are considerably further advanced in the transition to modern energy than rural households. However, because of a continuing reliance on inefficient solid fuels, which account for approximately 85 percent of rural household energy requirements in both nations, overall energy consumption in rural homes surpasses that in urban households. In addition to urbanization, income, energy costs, energy access, and local fuel supply are also important drivers of the shift in both countries[10].

DISCUSSIONS

In India, agencies and businesses are experimenting with converting various waste biomass to energy and reporting positive results. MNRE displayed a massive amount of installed capacity and excess biomass data. Thermo-chemical and bio-chemical technologies are now being utilized to transform biomass into energy. The kind of biomass conversion technology used is determined by the form of energy needed, such as heat, mechanical, or electrical energy; pyrolysis, fermentation, and mechanical extraction create liquid fuels appropriate for use as transportation fuels, and so on. Syngas was created via the gasification of biomass. Different biomass power generating plants have been built in various Indian states to meet the country's energy needs via biomass gasification.

CONCLUSION

A thorough examination of biomass resources and possibilities has been provided. It may be stated that India has a great potential for exploring existing biomass and converting it to electricity. In India, there are many resources in a broad range of forms of biomass. Waste biomass may be obtained from a variety of sources, including agricultural waste, food waste, and large-scale industrial wastewaters, indicating a shift to non-conventional energy sources. Bagasse cogeneration, which utilizes sugar mill waste to generate electricity, is also used by the states. In India, a number of power generating projects based on gasification-based cogeneration rural electrification facilities have already shown to be effective. These plants have not only addressed the rural electrification issue for distant communities, where infrastructure expenses for traditional electricity might have been very expensive, but they have also reduced the cost of power production. The government's main goal in giving subsidies or financial aid is to promote the use of non-conventional energy sources, which aids in the nation's long-term growth.

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