

BIOMASS AS A SOURCE OF RENEWABLE ENERGY

Abstract

The work highlights the biomass importance in renewable energy production unit. It can provide greater economic expansion and thereby increase the province Net/Gross productivity. The application of biomass in the field of pharmaceutical and other related industries are increasing in the drastic manner. The utilization of biomass in different sectors directly increase the productivity and socio-economic well-being of the nation. The chapter highlights the main classification of biomass and the benefits that is obtained from products derived from biomass. The challenges are also addressed to create a knowhow in the fabrication sectors of biomass for renewable energy. Modern bioenergy systems are used in different sections of the world to reduce the cost and to get effective energy output. Recommendations for the use of biomass energy need necessary for the safe use of renewable energy. This enables the authority to frame international action plans for the efficient use of eco-clean energy resource for the future generations. In this chapter, recommendations for improving the current bioenergy systems are made, and some new consequences for the use and trends of bioenergy products are highlighted.

Keywords: bioenergy; pharmaceutical; productivity; renewable

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I. INTRODUCTION

Biomass referred to all the matter existing in the biosphere, whether of plant or animal origin. Biomass can be put to use for copious ground, such as producing heat, electricity, and biofuels. Due to the broad utilization of biomass worldwide, mainly because it can be obtained as a outgrowth of many industrial and agricultural processes, biomass represents a heighten renewable energy source with high growth prospective [12]. Finding renewable energy sources is need of the hour. Renewable energies are generated from the various renewable sources, which can be replenished on period. Renewable energy sources such as geothermal, solar, wind, biomass and hydroelectric power are being more widely employed in the various countries. Renewable energy sources, on the other hand, are the only real answer to the world's mounting issues [17]. Renewable energy sources producing 22% of global energy production in 2012 seemed unthinkable only a decade ago. It's not only for transportation and industrial equipment that economies need a steady supply of energy as in International Energy Agency and Bank, 2014. With the utilization of renewable energy, greenhouse gas emissions may be drastically reduced. They are expected to last for as long as possible since they are derived from continual energy flows in our environment. Renewable energy sources must be infinite and supply environmental products and act of assistance in an ecologically supportable manner if they are to be really sustainable. Even though most renewable energy sources are weather-dependent and hence need elaborate design and planning before they can be put into practice, there are still a number of challenges associated with their implementation.

As the population is increasing at a rapid stride, we now find ourselves in a locale wherocities are using a lengthen amount of renewable energy [3]. In order for renewable energy sources to be long-term sustainable, they must also be capable of combating climate change. At this juncture, biomass, hydropower, geothermal, solar, wind, and ocean power are the self-renewing energy sources or renewable energies. Renewable energy resources appear to be the one of the most efficient and productive solutions, intimate relatedness between renewable energy and sustainable development. Mainly, focussing on acid drizzle, stratospheric ozone exhaustion and the greenhouse effect are the main effects of use of non-renewable energy [16].

II. SOURCES OF BIOMASS

The universal energy capability of virgin biomass is very large. It is estimated that world's standing earthbound biomass carbon, which is used as an energy resource is roughly 100 times the world's annual energy consumption. The largest source of standing terrestrial biomass carbon is forest biomass, which contain about 80 to 90% of total biomass carbon [18]. The scheme of using renewable energy as biomass as a preference for fossil fuel is not new. Here are some common types of biomass and their uses: Wood and Wood Residues: Wood from trees and wood processing residues, like sawdust and wood chips, can be burned directly to generate heat or converted into biofuels like wood pellets or ethanol for transportation and electricity generation.

Agricultural Residues as crop residues like straw, corn stover, and sugarcane bagasse can be used as biomass to generate heat and electricity or processed into biofuels [2]. Animal Waste: Manure from livestock and poultry can be used for biogas production through

anaerobic dissolution, which involves the disintegration of biotic matter by bacteria in the absence of oxygen, resulting in the proffering of methane-rich biogas [1]. Energy Crops: Some crops, like switchgrass and willow, are specifically grown for their high biomass yield and energy content. They can be used for direct combustion or to produce biofuels [5]. Algae: Algae can be cultivated and processed to produce biofuels. For the third origination of feedstock for the manufacture of biofuels such bioethanol, biodiesel, biogas, and organic hydrogen, algae are being used [4] (Fig.1).

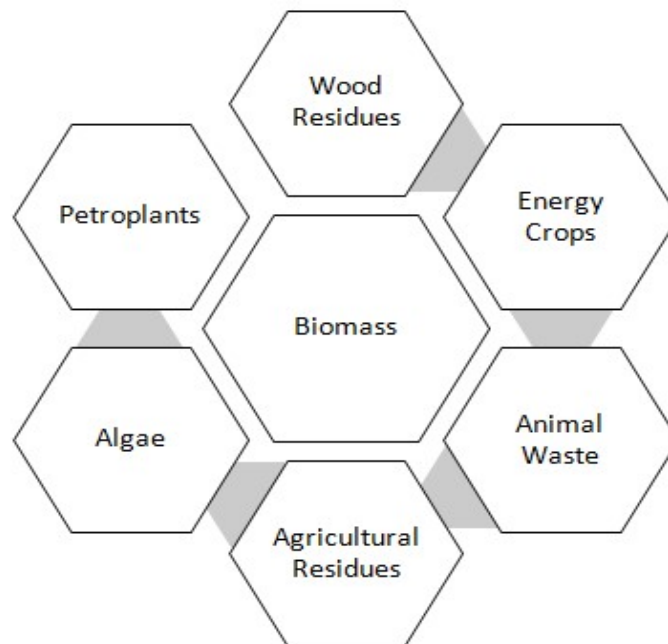


Figure1: Categorical approaches in Sources of Biomass

III. BENEFITS OF BIOMASS

Biomass waste is particularly of interest in obtaining a fuel to run different appliances based on the efficiency of biomass. Many utilities of biomass can help especially the agricultural waste can be used other than fossil fuel to make the green fuel productivity [19]. The different benefits of biomass include the following addressed points in chapter.

Renewable as a biomass can be replenished over time, making it a sustainable energy source when managed properly. The carbon neutral that is the carbon dioxide (CO₂) emitted throughout biomass ignition is abruptly equal to the volume engrossed by plants during their growth, making it a carbon-neutral energy source in theory. However, carbon neutrality depends on responsible land use and sustainable practices.

Next benefit includes the waste reduction by utilizing agricultural residues and organic waste for energy helps reduce waste disposal issues and potential environmental impacts. For the local economic development biomass energy projects can stimulate local economies by creating jobs and reducing dependence on fossil fuels [15].

Biomass can be transfigured into various structure of energy which includes, Bioenergy: Biomass can be pre-owned to induce heat and electricity straightly through

processes like combustion or gasification. Biomass power plants burn organic materials to generate steam, which drives turbines connected to electricity generators.

Biofuels: Biomass can be processed to create liquid biofuels like bioethanol and biodiesel. These can be used as substitutes for traditional fossil fuels in vehicles, power plants, and other applications.

Biogas: Through anaerobic digestion, organic matter can be broken down by microorganisms to produce biogas, which primarily consists of methane. Biogas can be utilized for electricity generation or as a direct fuel for cooking and heating.

Biochar: Biomass can be heated in a low-oxygen environment to produce biochar, which is a steady form of carbon that can be used as a humus alteration to enhance soil fertility and carbon seclusion.

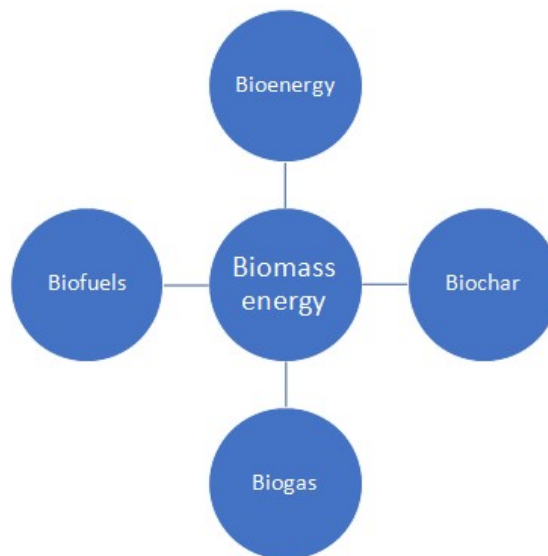


Figure 2: Various Forms of Biomass

Benefits of Biomass as Renewable Energy can reduce the Greenhouse Gas Emissions (GGH): Biomass energy can help reduce greenhouse gas emanations, as the carbon dioxide delivered ij the course of its combustion is offset by the carbon dioxide taken up by the growing plants. This makes it a relatively carbon-neutral energy source [20].

The waste reduction by using bioenergy can be organic waste materials, diverting them from landfills and potentially reducing the environmental impact of waste disposal [8]. This is considered as an ecofriendly approach in modern biomass energy systems (Fig.2).

Energy Security is also considered, as the use of biomass as a renewable energy provenance can enhance energy solidness by diminishing dependence on fossil fuels, which are frequently subject to levy fluctuations and geopolitical uncertainties[11]. Biomass energy production can provide economic opportunities in rural areas, promoting job creation and regional development.

IV. MODERN BIOENERGY SYSTEMS

Biomass, an organic substance that contains carbon that plants consume during photosynthesis, is used to create bioenergy. The carbon is produced during combustion and released back into the atmosphere when this biomass is utilized to generate energy. Modern bioenergy is a nearly emission-free fuel because as more biomass is produced, an equivalent quantity of carbon is absorbed into the atmosphere. With a contribution of nearly 6% to the world's energy supply and 55% of all renewable energy, it is the greatest source of renewable energy worldwide [7]. Energy situation, especially in rural areas, could potentially be enhanced by converting energy sources into "efficient bioenergy" systems. Traditional biomass energy sources have a number of detrimental social and environmental consequences. Fuelwood gathering is time-consuming and labour-intensive, and it is typically done by women in least developed nations. This is closely related to gender equity issues and puts more burdens on women [13].

Overuse of natural resources, particularly wood fuel for heating, cooking, and lighting, has a number of unfavourable consequences, including deforestation, erosion, soil degradation, and supply of water. Traditional biomass fuels make up the greatest portion of all energy uses in developing nations, where they can account for up to 95% of total national energy consumption. China and India, which have the fastest-growing economies in Asia, have been at the spearhead of transforming conservative biomass into "efficient bioenergy" [10]. Utilizing effective biomass technologies, such as gasification, better charcoal, biofuels, and improved cooking stoves (ICS), reduces the production of harmful gases, which in turn lowers inward air pollution. In the Purepecha region of Michoacan state, Mexico, the use of modified Patsari cookstoves reduced the 48-hour average kitchen concentrations of carbon monoxide (CO) and fine particulate matter by 66% and 67%, respectively [14]. Similar to this, installing biomass-based regionalize power generating systems in rural India benefits consumers by providing them with chances to exercise local control over the power supply, improving power equality, and lowering greenhouse gas emissions.

V. CHALLENGES AND CONCERNS OF BIOMASS

Biomass mechanics for upgrading rural framework and village capability are key aspects in developing countries. Most developing countries pivot heavily on biomass for their energy entail and India is no exception. An appraised 220 million tons of non-fodder agriculture remnant are produced every year in the country [9]. Many challenges and concerns regarding biomass utilization are addressed in this chapter. This include, Land Use and Competition in the production of biomass may compete with food manufacture or guide to deforestation if not managed sustainably. It is essential to strike a balance between biomass production and other land uses.

Next challenge is concerned with the emission variability and the combustion of biomass can still emit pollutants and particulates, impacting air quality. Advanced technologies and emission control measures are necessary to minimize these effects. Sustainability and Resource Management: To ensure the deep-rooted usability of biomass as a renewable energy source, proper resource management, and sustainable harvesting practices are essential. Energy Density of biomass typically has a lower energy density than fossil fuels, which may require large-scale storage and transportation infrastructure [21] (Fig.3).

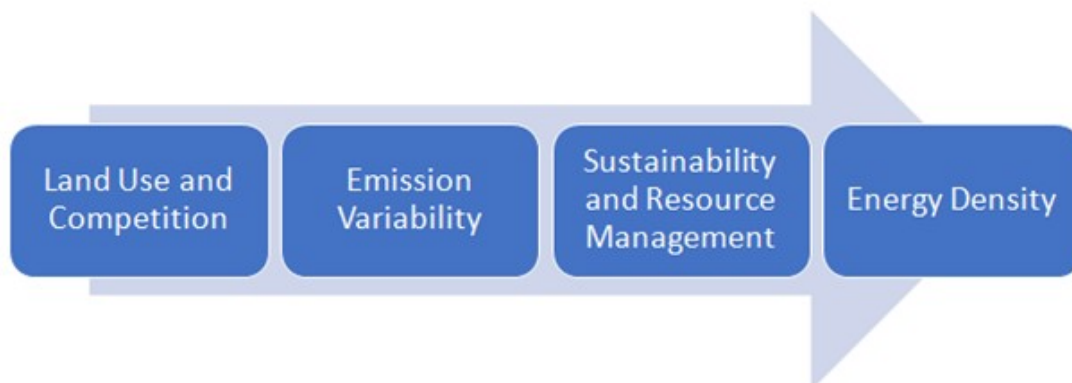


Figure 3: Different Challenges in Biomass Production

In conclusion, biomass has the possibility to play a outstanding role in the transformable to a more sustainable energy network. However, its success depends on responsible sourcing, technological advancements, and a comprehensive approach to address environmental and social concerns associated with its production and use. Biomass has appreciable possibilities as a renewable energy source, as there are many barriers like evolution of biomass-based energy, inclusively the coincident use of biomass and exploitation [6]. Forest fires and illegal logging has significant impact on loss of biomass sources. Covid 19 pandemic has created a drastic change in global economy, minimize global energy insistence, impede the expansion of renewable energy preference [22].

Both organic and inorganic substances are creating a bloom in the community. The need of the hour is to eliminate them and derive useful products out of it. It has wider solicitation in thermo-chemical reformation; physico-chemical transmogrification and bio-chemical reconstruction from the industry point of view.

VI. RECOMMENDATIONS FOR SUSTAINABLE BIOMASS

The use of biomass as a part of green passage is fully in consonance with the UN suggestions. The biomass which is drained sustainably can have consequential consequences for the cosmos, climate and mankind of India. The following recommendations are addressed;

- Robust emphasis is placed on the safeguarding of nature usefulness, local sections and indigenous people.
- International certification system needs to be introduced that a massive part of forest, wood and biomass sectors already has embodied in the supply chain.
- Ensure climate sustainability for biomass.
- Requirements ensure cost-effective control measures.
- Provide an electric energy and restore fossil fuel-derived creations [23]

Thus, the energy, social, and environmental advantages of biomass energy in general, and forestry in particular, much surpass those of using fossil fuels. According to the findings,

even individual methods have benefits and drawbacks, but additional study is required to identify a successful amalgamation of the currently used approaches.

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