THE ROLE OF BIOMASS ENERGY IN SUSTAINABLE DEVELOPMENT AND ITS CONTRIBUTION TO ENVIRONMENTAL SUSTAINABILITY GOALS

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**Abstract**

As one of the main components of sustainable development models, bioenergy has the potential to create innovative and environmentally friendly alternatives in energy production as a means of supporting economic growth and making significant contributions to achieving biological survival goals. Biomass energy plays a critical role in achieving sustainable development and contributes significantly to environmental sustainability goals. As a prominent source of energy production in developed countries, biomass is derived from various biological sources such as agricultural residues, wood chips, animal wastes and energy crops. In a developed nation, approximately 342 million tons of biomass are utilized annually, fulfilling around 5% of the energy demand. This includes the use of corn grain for ethanol and wood or wood residues for heat and electricity. By increasing biomass production threefold, the country could generate an estimated 60 billion gallons of low greenhouse gas emission liquid fuel, all while still satisfying the future needs for food, animal feed, fiber, traditional forestry products, and exports. Untapped biomass resources have the capability to significantly expand the nation's bioeconomy, potentially adding around 350 million tons of additional biomass annually, in addition to current levels. In a fully developed market in the future, sources like energy crops could supply more than 400 million tons of biomass each year. However, the analysis emphasizes sustainability, considering possible impacts on soil, air, and water quality, while also ensuring the protection of biodiversity. The technological processes used to convert biomass into energy include various methods such as incineration, pyrolysis, gasification and anaerobic digestion. The environmental benefits of biomass, such as its carbon neutrality and potential to reduce fossil fuel dependency, as well as its ability to provide energy access in rural areas and stimulate local economies, are important components of this study. Furthermore, the capacity of biomass to meet rural energy needs in developing countries and to make it more efficient through modern biomass technologies is a key focus of this study. In conclusion, it is emphasized that in order to fully realize the potential of biomass to achieve sustainable development goals, environmental and economic challenges need to be addressed in collaboration with managers, scientists and industry.

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