Bioenergy climate change mitigation strategies on biomass.

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Introduction

Bioenergy is biomass-derived energy or biofuel. Biomass is any organic material that has absorbed sunlight and stored it as chemical energy. Examples include wood, energy crops, and waste from woods, yards, and farms. Some people use the terms biomass and biofuel interchangeably since biomass (for example, wood logs) may be used as a fuel. The term biomass usually refers to the biological raw material that is utilised to create the fuel. The word "biofuel" is most commonly associated with liquid or gaseous transportation fuels. The US Energy Information Administration follows this naming scheme (EIA) [1].

The IPCC defines bioenergy as a renewable energy source (Intergovernmental Panel on Climate Change). According to studies, using forest biomass for energy is not carbon neutral.

Biomass

The most popular biomass energy source nowadays is wood and wood wastes. Wood can be burnt straight or processed into pellet fuel or other types of fuel. Other plants that may be used as fuel include maize, switchgrass, miscanthus, and bamboo. The most frequent waste feedstocks are wood waste, agricultural waste, municipal solid waste, and manufacturing waste. To convert raw biomass to higher-grade fuels, a variety of techniques, loosely classified as thermal, chemical, or biochemical, can be used.

Thermal conversion techniques transform biomass into a better and more practical fuel by relying on heat as the primary mechanism. Torrefaction, pyrolysis, and gasification are the three primary options, which are distinguished primarily by the amount to which the chemical processes involved are permitted to continue (mainly controlled by the availability of oxygen and conversion temperature) [2].

Many chemical transformations, such as the Fischer-Tropsch synthesis, are based on well-established coal-based methods. Biomass, like coal, may be turned into a variety of commercial chemicals.

Many of the biochemical mechanisms that have evolved in nature to break down the molecules that make up biomass may be exploited. The conversion is usually carried out by microorganisms. Anaerobic digestion, fermentation, and composting are the three processes [3].

Biofuel

Based on the source of biomass, biofuels are classified broadly into two major categories:

First-generation: Biofuels are made from food sources grown on arable lands, such as sugarcane and corn. Sugars present in this biomass are fermented to produce bioethanol, an alcohol fuel which serves as an additive to gasoline, or in a fuel cell to produce electricity. Bioethanol is made by fermentation, mostly from carbohydrates produced in sugar or starch crops such as corn, sugarcane, or sweet sorghum. Bioethanol is widely used In the United States and Brazil, respectively. Biodiesel is the most popular biofuel in Europe, and it is made from oils such as rapeseed or sugar beets [4].

Non-food biomass sources such as perennial energy crops and agricultural residues/waste are used in second-generation biofuels. The feedstock for the fuels is either cultivated on fertile land as by-products of the primary crop or is planted on marginal land. Waste from industry, agriculture, forestry, and homes may also be utilised to make second-generation biofuels, which can be produced by anaerobic digestion, gasification, or direct burning. Cellulosic biomass, which comes from non-food sources like trees and grasses, is being explored as an ethanol feedstock, and biodiesel may be made from leftovers food products like vegetable oils and animal fats.

Power production compared to other renewables

It is necessary to know the appropriate surface power production densities in order to determine land usage requirements for various types of power generation. The average lifespan surface power densities for biomass, wind, hydro, and solar power generation, according to Vaclav Smil, are accordingly (power in the form of heat for biomass, and electricity for wind, hydro and solar). The land used by all supporting infrastructure and manufacturing is included in the lifecycle surface power density [5].

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