Technological, economics, and policy issues relating to biofuels.

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Introduction

With the goal of determining the technological level of maturity and societal readiness for a sustainable transition toward a biobased economy, this chapter evaluates biofuels from the perspectives of technology, economics, and politics. The analysis in this chapter demonstrates how there are several competing biofuel technologies that differ in terms of feedstocks, refining processes, and, most significantly, technoeconomic performance and environmental impacts. This assessment is based on Geels' (2002) sociotechnical transition theory. We make a distinction between first- and next-generation biofuels and suggest a broad evaluation of their manufacturing processes. We also offer the Integrated Biorefinery, a fresh industrial idea that aims to meet the rising societal need for eco-friendly goods and energy sources. We evaluate the effects that biofuel development and policies can have while analyzing the socioeconomic concerns associated to the production of biofuels [1].

Hydrotreating studies have been undertaken on the effects of temperature, pressure, catalyst loading, and reaction time at molecular level. The best hydrotreating chemicals are fatty acid methyl/ethyl esters due to their high biofuel output and moderate upgrading conditions (290 °C, 10% catalyst loading). Methyl stearate may produce 61.6% biofuel with 100% selectivity to alkanes under ideal circumstances at 290 °C and 30% catalyst loading. The hardest molecules to upgrade are fatty acids, which need to be hydrotreated at temperatures over 310 °C with at least 30% catalyst loading to prevent the production of unconverted fatty acids, fatty aldehydes, and fatty alcohols. Unwanted products frequently contain C30+ heavy esters, which are thought to have originated from the esterification of fatty acids and fatty alcohols in low temperatures [2].

Green energy, such as biofuel and waste energy, can have a big impact on the environment. The impact of biofuel and waste energy production on environmental deterioration is examined in this article along with the contribution of natural resources and financial development in 14 APEX countries from 1990 to 2017. To obtain solid and trustworthy results, numerous second-generation econometric techniques have been used. The following are the results of a survey conducted by the National Institute of Standards and Technology (NIST) on the use of standardized terminology in the field of information technology. The findings also indicate a positive correlation between the dependent variable, or environmental deterioration, and economic development, natural resource development, and financial development [3].

Energy is viewed by macroeconomics as an input that is crucial to economic growth and has an impact on the growth process. Energy strengthens the links between social justice, environmental sustainability, and economic growth. It also boosts clean energy investment, lowers emissions, and smooths out economic growth. Traditional energy sources, however, continue to dominate the trend of public energy consumption. Many countries use fossil fuels like coal and oil, which generate large amounts of greenhouse gases (GHG) and hasten climate change in order to meet the needs of the production system and boost economic growth (Azam et al., 2021). A global danger to development and the environment is climate change (Naqvi et al., 2021). Global economic growth is driving up energy consumption, which is bad for the planet's sustainability and bearing [4].

The pace of the hunt for alternative fuels has picked up due to ongoing environmental degradation, oil market volatility, and the underwhelming performance of fossil-based (FB) fuels in compression ignition engines. The exponential growth in the world's population, enhanced agricultural, commercial, and manufacturing activities, increased farming and other food production and utilisation endeavours, the production of agricultural waste, the use of renewable fuels, and the emission of toxic gases are all contributing factors. It has never been more important to convert affordable, easily accessible, and environmentally friendly agricultural waste into biofuels. Biofuels are fuels made from discarded lignocellulosic biomass that are renewable, biodegradable, affordable, and environmentally benign. Agriculture waste conversion into biofuel improves waste management while not compromising food security [5].

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