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BIODIESEL AS A PATHWAY TO ECONOMIC EMPOWERMENT: HOW RENEWABLE ENERGY CAN ALLEVIATE POVERTY IN DEVELOPING REGIONS

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A potential solution to the dual issues of energy sustainability and poverty reduction is biodiesel. Biodiesel is a renewable fuel that is derived from organic materials such as vegetable and animal fats. It is substantially less harmful than petroleum diesel, reducing greenhouse gas emissions by up to 78%. The reduction in emissions fosters environmental improvements in regions that significantly rely on diesel fuel and assist in combating climate change. Furthermore, by fostering local entrepreneurship and creating job opportunities, biodiesel manufacturing can contribute to economic growth in underdeveloped areas. The National Biodiesel Board estimates that the production of biodiesel creates \$8 billion in wages annually and supports around 64,000 employments (National Biodiesel Board, 2022). Local communities in underdeveloped countries can improve their economic stability and access new revenue

streams by establishing facilities for producing biodiesel. This change promotes long-term economic growth via local investment and business growth in addition to offering immediate employment opportunities. Therefore, biodiesel stands out as an achievable strategy for promoting local development and economic resilience in addition to providing sustainable energy and alleviating the widespread problem of poverty.



Figure 1: Food versus Fuel, March 27, 2014 (Sources: <https://epthinktank.eu/2014/03/27/food-versus-fuel>)

Understanding Biodiesel

Transesterification of vegetable oils, animal fats, or other lipid-rich feedstocks produces biodiesel, a renewable and environmentally friendly alternative to conventional fossil fuels. Fatty acid methyl esters (FAME) and glycerol are produced through the reaction of the feedstock with an alcohol, typically methanol or ethanol, in the presence of a catalyst (Demirbas, 2021). Biodiesel aids to improve air quality and less risks to the public's health because it is biodegradable and emits significantly fewer carbon monoxide, sulphur oxides, and particulate matter than petroleum diesel. Furthermore, the energy content of biodiesel is comparable to that of petroleum diesel, making it a viable replacement in a variety of applications, such as industrial and transportation. Additionally, by reducing reliance on imported fossil fuels, the usage of local biodiesel can improve national energy security and stabilize fuel costs. Biodiesel provides a strategic advantage by using domestically sourced feedstocks, which may expand local agricultural economies. Consequently, it assists rural development as the demand for cleaner energy alternatives develops globally. Therefore, biodiesel is essential to the transition towards a sustainable and resilient energy future because it not only solves environmental issues but also supports energy independence.

Biodiesel Production Creates Economic Opportunities

Beyond the immediate fuel market, the production of biodiesel offers a variety of economic opportunities that have a significant positive impact on local and regional economies.

Significant employment opportunities are created by the construction of biodiesel production facilities, especially in rural areas. For instance, each biodiesel plant can sustain a large number of jobs in a variety of industries, such as the manufacture, distribution, and cultivation of feedstock. The biodiesel production can support agricultural economies by increasing demand for feedstocks like animal fats, canola, and soybeans, giving farmers new sources of income and encouraging them to invest in agricultural technology. By diversifying sources of revenue, the local procurement of these feedstocks improves regional economic resilience while also enhancing rural economies. Additionally, the production of biodiesel encourages the growth of cooperatives and small businesses, giving local business owners the opportunity to produce biofuel and other associated activities. This decentralized strategy promotes local company expansion and economic self-sufficiency. Communities can profit economically from higher agriculture revenue, job developments, and economic stability when biodiesel production is integrated into regional economies.

“Biodiesel presents as a renewable energy source”

This highlight is significant for economic advantages since biodiesel presents as a renewable energy source.

Case Studies of Biodiesel Production

Case studies reviewing the biodiesel production in different areas demonstrate its remarkable effects on enhancing the economy and mitigating poverty. By incorporating the production of biodiesel into the local economy, Brazil's National Biodiesel Program (PNPB) has significantly changed rural communities. The requirement by the PNPB that biodiesel production incorporate a minimum of 5% feedstock from family farms has played a significant role in increasing the income and employment opportunities for smallholder farmers (Brazilian Ministry of Mines and Energy, 2020). Rural communities have benefited greatly from the requirement, as agricultural income and job prospects have increased significantly. For example, the state of Pará has benefited economically much from local biodiesel production,

which has assisted in lowering poverty rates and raising living standards for many households (World Bank, 2022). Similarly, Iowa in the United States has used biodiesel production to support rural economic development. The biodiesel industry in the state of Iowa has developed to be a vital part of the agricultural economy, enhancing local economic resilience and farm revenues while employing thousands of people (Iowa Renewable Fuels Association, 2021). These case studies demonstrate how the production of biodiesel can result in significant economic advantages by boosting local incomes, generating job opportunities, and promoting agricultural development. The social implications are also notable because these economic gains result in improved living standards and lower rates of poverty in the communities impacted.

Challenges of Biodiesel Production

Despite its advantages, the application of biodiesel presents several important challenges that need to be overcome to fully achieve its potential. The high investment cost of biodiesel-producing equipment and facilities is one of the main challenges. Smaller manufacturers or new entrants into the market may be discouraged by the high capital costs associated with establishing production facilities and ensuring regulatory compliance. The manufacture of biodiesel requires specific technical expertise, which can be a

challenge in areas lacking technical training programs or qualified personnel. Accessing markets can be challenging for biodiesel producers since they must deal with complex supply chains and existing fossil fuel industries, which can have an impact on their profitability and capacity to penetrate new markets. Furthermore, biodiesel feedstock-related agricultural and environmental issues need to be carefully addressed. If feedstocks like soybeans oil, corn oil or palm oil aren't cultivated responsibly, it can result in deforestation, a decline in biodiversity, and degradation of soil. Furthermore, the production of feedstock on a large scale could compete with food crops for resources and land, which could affect food prices and security. In order to guarantee that the biodiesel production remains equally economically and environmentally feasible, it is necessary to address these problems through coordinated attempts by improving technological innovation, creating supporting regulations and adopting sustainable farming practices.

Policy of Biodiesel

The advancement of biodiesel projects and their capacity to reduce poverty have been greatly enhanced by effective policies and initiatives. A supporting policy framework is exemplified by the Renewable Fuel Standard (RFS) in the United States, which provides financial incentives for the

biodiesel production and mandates the use of renewable fuels. This approach has stimulated industry expansion, resulting in job creation and a boost to rural economies. Similarly, Brazil's National Biodiesel Program (PNPB) successfully raises rural incomes and reduces poverty by integrating smallholder farmers into the biodiesel supply chain. These policies serve as illustrations of how effective government assistance can promote economic growth and the biodiesel industry. To further improve the effects of biodiesel, several policy suggestions have been proposed. The first way to reduce entry barriers for small-scale producers and encourage investment is to raise subsidies and tax incentives for biodiesel production. Second, the implementation of technical and educational training programs will create the infrastructure and knowledge required to support biodiesel projects, especially in developing nations. Lastly, the implementation of sustainability certification programs for biodiesel feedstocks may effectively resolve environmental issues and guarantee environmentally responsible manufacturing methods, thereby augmenting the overall feasibility of biodiesel as a sustainable energy alternative. These measures may stimulate the biodiesel sector, promote economic expansion, and aid in alleviating poverty.

Conclusion

As a powerful instrument for reducing poverty, biodiesel presents a diverse strategy for resolving issues related to the economy and environment. Biodiesel is a renewable energy source that not only enhances air quality and lowers greenhouse gas emissions, but it also offers significant economic prospects in underserved rural areas. The establishment of biodiesel manufacturing plants enhances local agricultural economies, stimulates economic growth, and assists small businesses, all of which contribute to measurable increases in revenue and stability of the economy. Policymakers may improve the impact of biodiesel on economic development and poverty reduction by setting supportive legislation, offering technical training, and maintaining sustainable practices. Biodiesel is ultimately a strategic element of a holistic strategy to sustainable development, bringing energy innovation and socioeconomic advancement together to build a more resilient and equitable future.

References

