Educational Administration: Theory and Practice
2024,30(1), 3954-3958
ISSN:2148-2403
https://kuey.net/

Research Article

Assessing The Impact Of Biofuels On Human Rights: Addressing Concerns Related To The Right To Food And Water In India

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Citation: Ms. Senali Trivedi ,et.al (2024), Assessing The Impact Of Biofuels On Human Rights: Addressing Concerns Related To The Right To Food And Water In India ,Educational Administration: Theory and Practice, 30(1), 3954-3958
Doi: 10.53555/kuey.v30i1.7700

ARTICLE INFO

ABSTRACT

Green growth development is the practise of lowering pollution emissions and increasing productivity levels while promoting economic growth. Although utilization of renewable energy is "green," it may not promote green economic development because of scientific constraints. Because fossil fuels are so energy dense, societies and infrastructure have evolved around them, and because innovation and change take time, they will continue to dominate energy supply for some time. Nonetheless, new energy sources must be deployed on a scale comparable to the industrial revolution. Without decisive action, CO2 emissions from energy will more than double by 2050. The food price has recently increased. The biofuels, which are produced from the edible components like sugarcane and corn, has been increases. Biodiversity involves complex ecosystems whose loss cannot be reversed by technical advancements; it belongs to environmental deterioration. This article examines the connection between biofuels and Human Rights in the context with bio-resources conservation, environmental quality, land, food, water etc. Researchers have examined how the production of biofuel affects the rights to food and water, which are essential for human survival and the basic needs of the human body.

Keywords: Renewable energy, Climate Change, Green Growth, Sustainable Development, Bio-energy, Biofuel, Biomass, Energy efficiency

1. Introduction:

The rising global energy demand highlights Bio-energy as a promising sustainable energy source. Renewable energy aims to promote development of economic, improvement in energy security, expanding access, and to mitigate climate related change. By utilizing renewable energy, sustainable development ensures affordable, reliable, and modern energy for all. Bio-energy is widely accepted as a climate change mitigation strategy due to its lack of pollution and carbon dioxide emissions, making it a viable alternative to fossil fuels. Biofuels are gaining popularity for reducing reliance on imported fossil fuels and enhancing energy self-sufficiency. However, high production costs limit large-scale commercial biofuel production. Efficient and cost-effective methods are needed to commercialize biomass-based biofuels. Biofuels and Bio-energy are considered sustainable options for reducing carbon emissions, providing ecosystem services, and decreasing fossil fuel reliance. Consequently, global Bio-energy output is expected to increase significantly in the upcoming years.
The impact of increased Bio-energy production on global ecosystems and biodiversity is still uncertain. High-yield crops often have greater biodiversity impacts than low-yield crops. Second-generation Bio-energy crops, derived from biomass sources like forestry waste, are expected to have less impact on biodiversity compared to first-generation crops, which compete with food production. Using residual biomass can partially meet Bio-energy demand, reducing harm to natural ecosystems. However, Bio-energy production alters land use directly and indirectly, and refineries near natural ecosystems already have an impact. The growing Bio-energy sector increases land demand for feedstock, necessitating significant land-use changes.

Tropical biodiversity is often viewed as a global resource, with host countries acting as custodians. Researchers study the effects of increased biofuel production on invasion processes, agricultural and aquatic ecosystems, and the use of nitrogen- and phosphorus-rich fertilizers and pesticides. Factors driving the conversion of natural ecosystems to agriculture increased agricultural product demand, limited agricultural land, and farmland loss due to degradation and urban growth. Global factors, such as population growth, rising wealth in countries like China and India (increasing meat consumption and grain demand), and emphasis on biofuels as petroleum alternatives, influence local land-use decisions.

Future population and economic growth will lead to higher than expected energy needs. The IEA estimates that by 2040, energy consumption will have increased by 17% to 50% from 2012 levels, reaching approximately 15,629 and 20,039 million tonnes of oil equivalent. Since coal, oil, and gas accounted for 82% of all primary energy consumption in 2012, gathering these demands at the current rate of fossil fuel exploitation is likely to result in increases in the global atmospheric temperature of over 3.6 °C by 2100 compared to pre-industrial levels, causing widespread adverse changes in ecological communities and raising the risk of species extinction.[1]

2. Research Methodology

A comprehensive evaluation of biomass availability for Bio-energy production and its bearing on achieving Sustainable Development Goals (SDGs) was carried out through a two-step process. Initially, a pre-existing scoring framework was utilized and further developed to analyse the reported connections within the available literature on biomass supply chains and SDGs, focusing on specific SDG targets and the characteristics of these associations where they were identified. Additionally, relevant collected works was reviewed to identify and assess the prevalence and nature of these interconnections between biomass supply chains and SDGs in real-world scenarios.

3. Rationale of Biofuel and its Relationship to Human Rights

India made its first substantial liquid biofuels policy move with the Ethanol Blending Programme in 2003, mandating a five-percent ethanol blend in gasoline for nine states and four union territories. In 2006, the requirement expanded to the entire nation. The 2009 Biofuel Policy was more aggressive, setting a target of a 20% blending rate for both ethanol and biodiesel by 2017. The 2009 regulation also expanded the use of sugarcane juice for ethanol production beyond molasses-based ethanol manufacturing.

The advancement of biofuels must not come at the expense of fundamental human rights, encompassing access to food, healthcare, and clean water. Biofuels should prioritize environmental sustainability and actively contribute to an overall reduction in greenhouse gas emissions. Additionally, they should adhere to principles of fair trade, ensuring that the advantages and drawbacks of biofuel production are distributed equitably. It is crucial to ensure that benefits are not solely enjoyed by developed nations while the burdens disproportionately impact inferior states. If these five principles are upheld, contingent on critical considerations such as absolute cost and the availability of superior alternatives, there exists a responsibility to pursue the development of such biofuels.

4. Their Interconnected Role of Biofuel and Right to have a food

Increased biofuel production will significantly impact biodiversity, defined as the variety of species per unit area. Habitat destruction, invasive species, and pollution from fertilizers and pesticides will harm biodiversity. Bio-energy, produced by converting organic matter into fuel, can come from biomass or waste-to-energy processes. Among renewable energy sources, Bio-energy requires the most land, highlighting land rights' importance. Bio-energy production, often linked with agriculture and forestry, shares associated risks like deforestation and water access issues.

4.1. Production of Biofuels and Food Security

The promptly rising global populace and expanding use of biofuels, which increases the worsened food and fuel shortages. Biofuels have significant environmental advantages over traditional energy sources in many ways, in addition to offering energy security, employment opportunities, economic growth, and social security. However, the rapid promotion of biofuels resulted in a sharp polarisation of public and policymaker opinion. Food prices rose due to the production of biofuels from food crops like corn, which raised significant moral and dietary concerns. Growing crops for fuel required the use of resources such as land, water, and energy that were also needed to produce food for human consumption.[2]

Food and fuel shortages were made worse by the rapidly expanding global population and rising use of biofuels, which increased demand for both. In addition to providing energy security, jobs, economic growth, and social

[1] IEA, Renewable 2021 Biofuels, https://www.iea.org (Last visited on July 28th, 2023)

[2] P. Murali et.al., *An Economic Analysis of Biofuel Production and Food Security in India,* SUGAR TECH., 18., 447-456, (2016), (Last visited on July 26th, 2023)

security, biofuels have significant environmental advantages over conventional energy sources in many ways. However, the quick promotion of biofuels led to strong polarisation of opinion among the public and policymakers. Food amounts increased as an upshot of the production of biofuels using food crops like corn, which generated serious ethical and nutritional issues. Land, water, and energy resources were wasted when growing crops for fuel, which were necessary to produce food for human consumption.[3] Experts noted that it not only disregarded the need to limit the usage of fossil fuels and land usage, but it also made the world's malnutrition crisis worse. While some thought viewed biofuel as a crucial step in the battle against climate change, others criticised them as a threat to food security and, as a result, a major obstacle to achieving the millennium development goal related to ending poverty.[4]

Developing nations like Guatemala, Brazil, Thailand, India, Argentina, Paraguay, the Philippines, Colombia, and Malaysia are increasing biofuel production due to rising global demand. However, this leads to environmental, land, and labor rights violations, particularly affecting poor rural populations due to structural injustices and lack of regulation. India, in advancing a 20% ethanol blending mandate using bioethanol from sugarcane and food grains, risks exacerbating food insecurity and underfeeding. India should utilize biotechnology to convert starch and sugar into high-quality protein at an affordable scale, rather than using food as fuel.[5]

The Central Government recently amended the National Biofuels Policy-2022[6], advancing the deadline for blending 20% ethanol into gasoline from 2030 to 2025–2026.[7] According to official reasoning, expanding the range of feedstocks for biofuel production will promote "Atmanirbhar Bharat" and bolster the Prime Minister's vision of India achieving energy independence by 2047."[8]

4.2. Affordability of Food Price

The debate over the impact of biofuel production on food security lies at the heart of the "food vs. fuel" controversy. The FAO projects that by 2050, the global population will reach 9.1 billion people.[9] Based on certain reviews, the competition for the resources like land, water etc. Production of first-generation biofuel causes food prices increase. Futures trading signals higher prices ahead, expected to persist in encouraging increased biofuel production as an alternative to fossil fuels. Food prices and inflation have risen globally as a result of this, as well as droughts and animal diseases. Increased demand for biofuels has driven up prices for corn and soybeans, as well as for substitute crops, while also raising the cost of livestock feed due to incentives favouring the shift away from other crops.

The government has prioritized food-based feedstocks for the new ethanol-blending target, arguing it is a "strategic requirement" given grain surpluses and technological availability. This contrasts with the 2018 National Policy on Biofuels, which emphasized grasses, algae, cellulosic materials like bagasse and farm residue, and rice, wheat, and corn straw.[10]

India, the world's largest importer of oil, aims ambitiously to produce biofuels from resources such as corn, sugarcane, rice, and other crops, with plans to blend 20% ethanol into gasoline and diesel by 2025. This initiative has faced criticism for potentially compromising food security in favor of reducing oil import costs. In response to soaring crude oil prices, the Centre has accelerated the deadline for achieving 20% ethanol blending from 2025 to 2030. Ethanol does not pollute the environment. Therefore, as part of its commitments under the 2015 Paris climate change accord, India aims to utilize green fuel to achieve a 33 to 35% reduction in carbon emissions by 2030.[11]

On the contrary, experts argue that the government's aggressive push for ethanol is redirecting food grains intended for the needy to biofuel manufacturers at discounted rates. This occurs amidst wealthy countries revisiting their biofuel policies, restricting grain diversion to fuel producers due to escalating food grain prices and environmental concerns about deforestation.

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[3]IEA, IRENA., Global Bio-energy Supply and Demand Projections: A Working Paper for REmap 2030., GCB Bio-energy 2014, 5, 88. https://www.irena.org, (Last visited on July 28th, 2023)

[4] Karabee Das, et.al., *A comparative study of the land required for food and cooking fuel in rural India*, AGRICULTURAL SYSTEMS, Volume 176, (2019), (Last visited on July 27th, 2023)

[5] BUSINESSLINE, *Why burning food as fuel is a bad idea for India, https://www.thehindubusinessline.com* , (Last visited on July 18th, 2023)

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[8] DOWNTOEARTH, *Making India energy-independent by 2047, https://www.downtoearth.org.in* , (Last visited on July 16th ,2023)

[9] FAO, "How to Feed the Word in 2050", http://www.fao.org, (Last visited on July 20th ,2023)

[10] PRESS INFORMATION BUREAU, https://pib.gov.in, (Last visited on July 22nd , 2023)

[11]THE FEDERAL, *"Will India's biofuel push threaten food security? A look at 'real' cost of green fuels", https://thefederal.com* , (Last visited on July 24th, 2023)

5. Potential effect of biofuel production on right to water

In attempt to produce enough first-generation biofuels, or those made from edible biomass like maize and sugarcane, large agricultural areas are needed. Food production suffers as a result, more land is cleared, and agricultural production and harvesting produce more pollution. Microalgae production methods as a substitute that are less harmful to the environment. It is necessary to evaluate the potential effects of microalgae production systems in comparison to
The study reviewed first-generation biofuels and compared their environmental impacts, which directly or indirectly affect biodiversity.

5.1. Environmental Pollution in depleted water sources

Environmental issues have problem with biofuel crops, food crops, gardens, and lawns all face. Third-generation biofuels are made from microorganisms such as algae, such as Butanol. Microorganisms such as algae can be produced for the manufacture of butanol on land and water unsuitable for food production, decreasing the load on already depleting water sources. Fertilizers accelerate the growth of these plants, yet they can harm the environment, potentially posing a significant pollution threat to freshwater sources with increased biofuel production. One downside is that the fertilizers used in the development of such crops pollute the environment. Algae require a large amount of water in order to grow to their full potential.
Nitrogen and phosphorus are prevalent in fertilizers. While they promote rapid and vigorous crop growth, their excessive presence due to overuse or improper application can leach into regional watersheds, including lakes, rivers, streams, and aquifers. This influx of chemicals into the water system can lead to severe environmental consequences. A high temperature might cause the water level to evaporate, impeding growth.
Growing substantial quantities of algae requires increased fertilizer application on water. Moreover, the production of fertilizers requires energy and generates significant volumes of carbon dioxide, thereby compromising the carbon-neutral status of algal biofuel when considering the entire process. Because algal monocultures are vulnerable to pests and pathogens, crop protection is a major obstacle to algal sustainability. Currently, the biofuel from algae production charges are significantly higher than that of fossil fuels. There are various types of algae found in the Earth's layer, but their oil production varies significantly.

5.2. Requirement of huge quantity of water for biofuel production

The amount of water required by biofuel crops will vary depending on the crop being substituted and where it is cultivated. In the Pacific and Mountain regions, corn consumes less water than soybeans, however, the opposite holds true in the southern and northern regions of India. Consequently, agrarians switching from soybeans to corn will increase water usage in some areas and decrease it in others.

The effort to produce sufficient corn-based ethanol to meet federal alternative energy standards is already placing pressure on fresh water supplies in the Great Plains and central Southwest.[12] Agrarian researchers are focusing on corn's relatively high water consumption and exploring ways to genetically modify crops to require less water. They are also carefully planning which biofuel crops to cultivate in specific regions to mitigate this issue. However, large-scale biofuel production, particularly in arid regions, will need to compete for limited water resources with drinking water and agricultural needs.
Another critical concern is how biofuel production could drive agricultural expansion into currently less cultivated areas. Expanding agricultural lands, especially in dry western regions, could significantly impact water availability. Additionally, water is essential for all biofuel facilities to convert biological materials into fuel. While the amount of water needed in the biorefining process is relatively small compared to the water used to grow ethanol-producing plants, the localized concentration of water use in biorefineries can have significant local consequences.

5.3. Agricultural sector expansion

The greater profitability of biofuel crops may result in agricultural border development. However, the demand for biofuels has resulted in a global increase in agricultural commodity prices, which may provide additional push to expand the agricultural frontier. The growing drive to expand the agricultural frontier will have a variety of consequences for water use. First, it will very certainly increase the consumption of water for irrigation, except in locations where agricultural crops can be grown using rainwater. Second, in many situations, it will result in the conversion of natural regions into agricultural areas.
Even if natural area expansion is prevented by intensifying production on existing agricultural land, there may be an impact on water use. First, increasing production may necessitate (more) irrigation water. Second, an increase in inputs such as fertilizer and pesticides required to boost productivity may result in increased (ground)water contamination.

[12] Kapoor, et.al, *The impact of particle size of cellulosic residue and solid loadings on enzymatic hydrolysis with a mass balance,*. Fuel, 245, (Last visited on July 24th, 2023)

5.4. Adverse Effects of Microalgae Farming Techniques

Microalgae

Microalgae systems exert less pressure on biodiversity per unit of fuel produced compared to first-generation biofuels, largely due to reduced impacts on water use especially if water is recycled, land use and pesticide application. Additional technological and production techniques, such as increasing productivity per square foot, situating near industrial CO2 sources and wastewater treatment facilities, recycling nutrients and water, and using waste products for energy production internally, would encourage to reduce carbon emissions. Collectively pollution can be decreased through improved energy efficiencies, resurge of water and recycling of nutrients. Microalgal systems have a great impending to contribute to the sustainable satiation of the world's energy needs.[13]

Producing algae-based biodiesel faces challenges and uncertainties. Economic research identifies cost and expense as significant threats. Algae compete with other biomass sources, and their commercial acceptance remains uncertain. Algae's conversion of CO2 to carbonic acid can lead to uncontrolled pH increases, affecting the growth medium's ionization. Large algal blooms might hinder sunlight penetration, posing additional challenges.[14]

There are limited Information available on the demand for and research into algae biofuel. However, further research is needed to assess the effectiveness of algal biofuel in aircraft, equipment, vehicles and other applications. The production of algal biofuel involves multiple complex stages before it can be used as fuel. This process is laborious and challenging. Generating significant quantities of algae requires increased fertilizer usage, which in turn consumes substantial energy and emits significant amounts of carbon dioxide, impacting the overall carbon neutrality of algal biofuel. Algae require abundant water for growth, necessitating access to ample water sources. However, high temperatures can lead to water evaporation, which can hinder algae growth.

6. Conclusion:

The development of biofuels significantly impacts water use and availability. Increased demand for irrigation to grow biofuel crops accelerates groundwater depletion. Higher water consumption in ethanol production also negatively affects water availability. Indirectly, expanding agricultural land for biofuel crops, driven by rising crop prices, leads to environmental consequences such as watershed protection loss. Biofuel feedstock production requires land, often leading to habitat loss, reduced biodiversity, and increased risks for threatened species. As maize production shifts to biofuels, marginal or abandoned farms must be utilized, despite economic incentives to plant on these lands. Gene therapy may create feedstocks tolerant of harsh conditions, potentially reducing biodiversity to a few species that can survive in challenging environments.

There is no "best" biofuel feedstock; a resilient industry requires diverse resources with varying water needs, farming intensity, transportation costs, energy yields, and carbon debt. Sustainable biofuel production demands improved fuel efficiency and alternatives to internal combustion engines. Millions of metric tonnes of biomass will be needed to meet advanced biofuel benchmarks by 2030.[15] Biofuel production pressures existing land uses, especially in productive areas, necessitating a thorough analysis of costs and benefits. Recent studies consider energy costs of cultivation, harvesting, conversion, and transportation, along with the fuel's energy content. Government support for sustainable supply chains, entrepreneurship, and incentives is crucial. Policies mandating biofuel blending with conventional fuel and subsidies can promote the industry in India, but a strong long-term strategy and significant research on advanced feedstocks are needed. Large-scale agricultural production, including biofuels, faces issues like deforestation, soil and water contamination, air pollution, and poor working conditions, leading to health problems for the rural poor. These issues may worsen in developing countries due to rising biofuel demand. Structural injustices and lack of regulation in mass production agricultural plantations violate rights to the environment, land, and labor, disproportionately affecting poor rural populations. This study examines the right to food and water, fundamental human needs overlooked due to India's extensive biofuel production and lack of effective policy.

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[14] PRO MFG MEDIA. *The Current Status and Key Challenges For Biofuel in India,* https://promfgmedia.com, (Last visited on August 9th, 2023)

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