VIABILITY OF BIOFUELS IN INDIA

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1. ABSTRACT

The viability of biofuel as an energy source has gained a significant amount of attention in India due to various reasons such as rural development and a green environment. The feasibility of biofuel is calculated by testing and examining the availability of biomass resources and their conversion technologies and their efficiency in the generation of energy. This study gives us a comprehensive viability analysis of biomass utilization for energy production in the context of the Indian market. The research uses a multidimensional approach that adds up several factors such as technical and economic factors, and environmental and social factors to give the feasibility and sustainability of biofuel and its energy systems. The results show insights into the favorable utilization of biofuel resources and technology pathways that should maximize the energy efficiency of the Indian biofuel market.

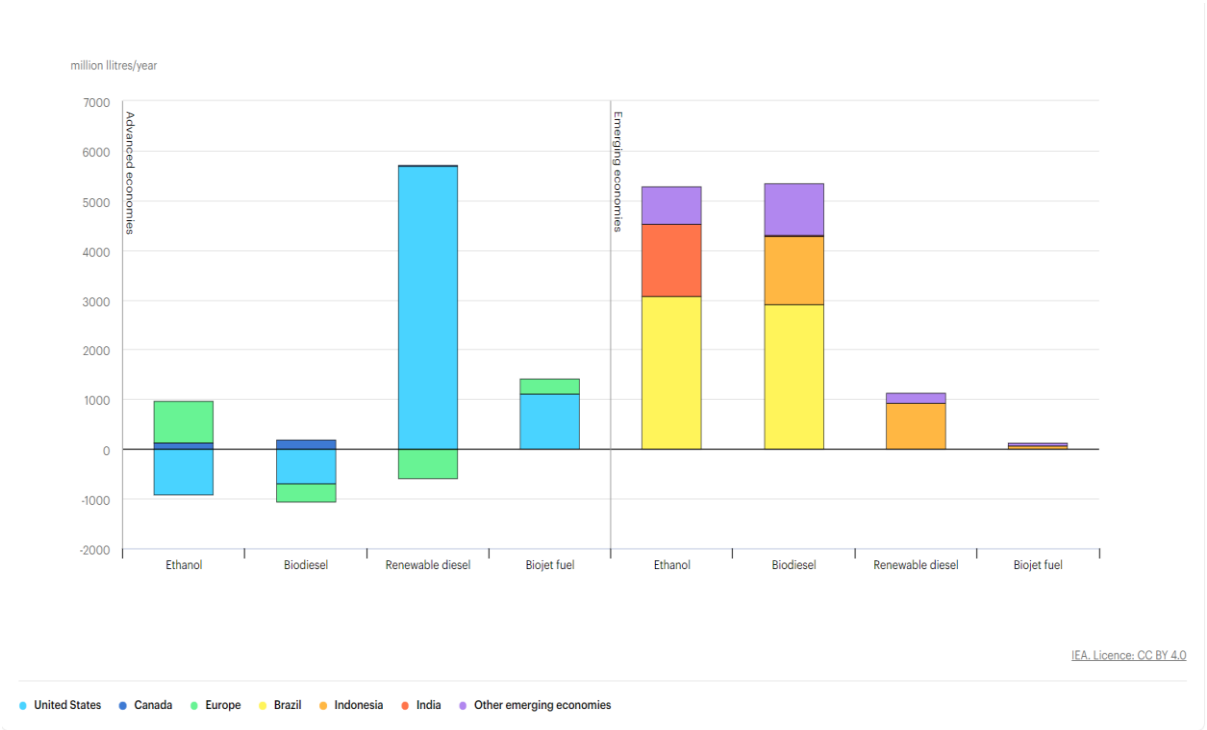
2. INTRODUCTION

Climate Change is one of the biggest hurdles that mankind needs to solve. At a time, which is marked by an upsurge in energy demands with the constantly depleting fossil fuel reserves, and the imperative to transition towards more sustainable energy sources, the spotlight has increasingly turned towards biofuels as a solution for rural areas and secondary energy requirements. As societies strive to reduce their carbon footprint and secure a reliable energy future, the viability of biofuels stands at the forefront of scientific, economic, and environmental discourse. Biofuels, which are derived from organic materials, have gained significant attention due to their potential to alleviate greenhouse gas emissions, enhance security, and revitalize rural economies. However, as with any transformative attempt, a comprehensive viability analysis is crucial to assess the true potential and resolve the complexities they present.

3. Literature Review

Ashwini Kumar Choubey, the Hon'ble Minister of State, Ministry of Environment, Forests and Climate Change, Govt of India. '**Biofuel can play a key role in India's transition to clean energy and facilitate net zero goals. The automotive industry has been making efforts to bring down emissions, and biofuel and ethanol blending will augment this action.**'

NEW DELHI (Reuters) - India's state-run fuel retailers are increasing their ethanol storage capacity by 51% as the nation targets to double the biofuel's blending with gasoline to 20% by 2025, a director at the country's top refiner Indian Oil Corp said. India is the world's 3RD biggest oil importer and relies on foreign suppliers to meet more than 80% of its demand. Prime Minister Modi has pledged to achieve net-zero carbon emissions by 2070 and is encouraging industries to switch to cleaner options including biofuels to cut their carbon footprint. India is close to achieving its target of 10% ethanol blended gasoline in this fiscal year ending March 31, SSV Ramkumar said in an energy conference. Last year, India brought forward its target of selling 20% ethanol blended fuel across the country by five years to 2025, with sales beginning in some parts of the country from April 2023.



Biofuel demand growth by fuel and region, 2022-2024 (IEA)

India's federal finance ministry has proposed a 2-rupee tax for one Liter on unblended petrol starting in October. State-run companies Indian Oil Corp, Hindustan Petroleum Corp, and Bharat Petroleum Corp own storage to hold 178 million Liters of ethanol. “With current capacity, about 4.30 billion Liters of ethanol can be handled annually considering 15 days of coverage period. With tankage of 446.4 million Liters by 2025, about 10.6 billion Liters of ethanol can be handled annually," Ramakumar said.

Field surveys conducted by ICRISAT in Ibrahimbad, Medak district, Andhra Pradesh in 2008 under the National Agricultural Innovation Project (NAIP) revealed that the cost of inputs (fertilizer and imputed cost of irrigation) in the cultivation of sugarcane was Rs. 6691 ha-1 compared to 1948 ha-1 for sweet sorghum. Sugarcane cultivation requires higher amounts of scarce resources such as irrigation water and fertilizers which are highly subsidized. It requires nearly 160-180 ha cm of irrigation water while sweet sorghum is cultivated under rainfed conditions.

Table 3. Crop-wise distribution of input subsidies per hectare in India (2000-01).

Crop	Fertilizer subsidy to total subsidy (%)	Electricity & canal subsidy to total subsidy (%)	Subsidy of crop area (₹ha^{-1})
Paddy	31.43	31.01	3587
Sugarcane	5.51	4.95	6099
Sorghum	3.55	1.01	839
Maize	2.64	1.87	1634
Total (billion ₹)	138.0	366.40	

Source: Acharya and Jogi (2004).

Additionally, the crop-wise estimates of input subsidies per hectare during 2000-01 show that sugarcane had the highest input subsidy of Rs.6099 ha-1 while sorghum had the lowest at 839 ha-1. The difference in irrigation subsidy provided to sugarcane was Rs.1444 ha-1 relative to sorghum.

Strategies for biofuel production

Bioeconomy of biofuels and policy recommendations:

Bioeconomy is crucial for a low-carbon economy. The switch towards bioeconomy will depend on the technological development of a variety of activities; therefore, will be dependent on the accessibility of sustainable feedstocks.

Risk mitigation strategies on biofuel processing:

Fossil fuel consumption is a significant contributor to greenhouse gas emission levels. Greenhouse gases produced by the combustion of biofuels are significantly lower than those of traditional fuels.

Advances, prospects, challenges, and opportunities for the thermal application of biofuel:

The only biofuels that are used in engines are biodiesel and bioethanol. Partially bioethanol was used in engines driven by gasoline as a blending component. It can be used in Otto cycle engines. It blends with gasoline up to 10% and higher in modern engines as compared to gasoline on the same engine efficiency.

Parameter Values

Total No. of Plants	163
Annual Energy Cost Savings (In Rs. Lakhs)	787
Annual CO2 Savings (In Tons)	9587
Annual Bio-manure Production (In Tons)	32582
Direct Employment (Man-days)	63438
In-Direct Employment (Man-days)	56894

Source: mnre.gov.in

4. ANALYSIS

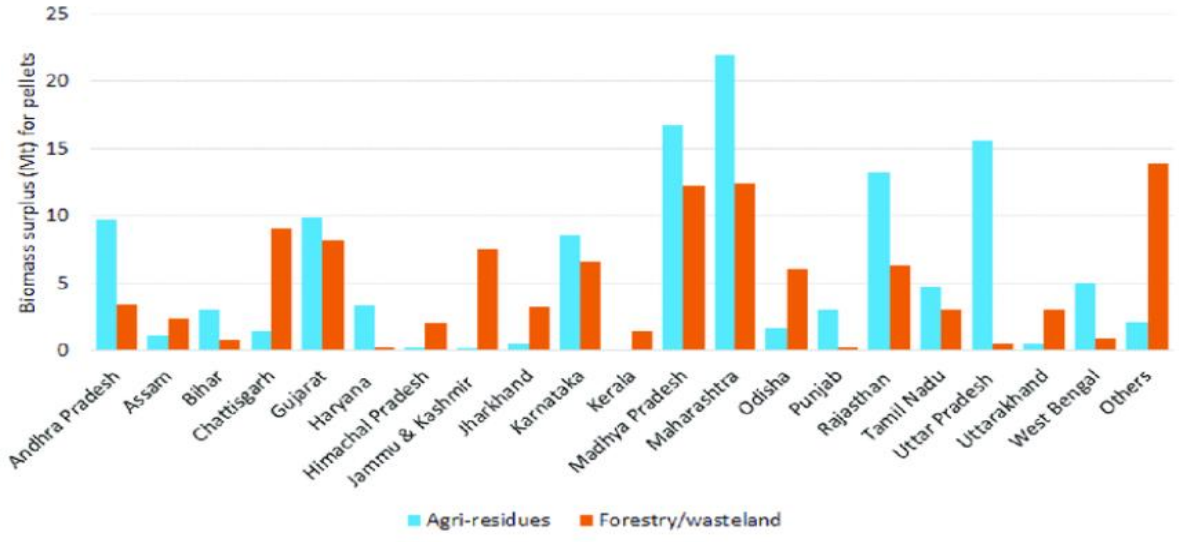
In the current world where there is a huge amount of dependence on Conventional sources of energy, the world is looking for alternate sources of energy to meet the needs of consumption. Biofuel is one of the non-conventional sources of energy that can fulfil the excess energy needs of India. As the farmers are harvesting one or more than one (usually two or three) crop in an individual year, the biofuel production differs from state to state and farmer to farmer as well as crop to crop. According to the data available on the website of the Ministry of New and Renewable Energy of the Government of India, the current availability of biofuel in India is estimated at about 750 MMT per annum and surplus biofuel availability at about 230 MMT per annum. About 32% of the total primary energy use in the country is still derived from biofuel and more than 70% of the country's population depends upon it for its energy needs. As of 31.10.2022, a total capacity of 10205.61 MW has been installed in the Biofuel Power and Cogeneration Sector. The installed capacity of biofuel IPP is 1871.11MW and the installed capacity of bagasse cogeneration is 7562.45MW whereas the installed capacity of non-bagasse cogeneration is 772.05MW.

Among the states in India, the top five states with the highest average biofuel production are Punjab with 98.06 tonnes followed by Kerala with 93.65 tonnes and Karnataka with 54.70 tonnes. Rounding off the list of top 5 states with the highest average biofuel production are Haryana with 32.58 tonnes and Gujarat with 27.96 tonnes. This study amounts to the average biofuel production in India, which totals 20.13 MT.

The average surplus biofuel produced in India is around 6.47MT. The top 5 states with the highest average surplus biofuel produced are Karnataka, Punjab, Andhra Pradesh, Gujarat, and Meghalaya. Karnataka has the highest average surplus biofuel with 48.42 tonnes followed by Punjab with 34.84 tonnes and Andhra Pradesh with 12.30 tonnes. The final two states Gujarat with 11.17 tonnes and Meghalaya with 9.74 tonnes come in 4th and 5th place in the surplus production of biofuel.

The average production of biofuel in India is 20.13MT and the average surplus biofuel production is 6.47MT whereas the average biofuel utilization is only 13.66MT which is close to 51% of the average production and surplus combined. The top 5 states with the highest biofuel utilization are Kerala, Punjab, Haryana, Tamil Nadu, and Gujarat. Kerala utilizes its

biofuel the most with 88.99 tonnes utilized of the 93.65 tonnes produced. The next two states are Punjab with 63.22 tonnes utilized of the 98.06 tonnes produced and Haryana with 28.42 tonnes utilized of the 32.58 produced. Rounding off the list is Tamil Nadu with 23.72 tonnes utilized of the 26.17 tonnes produced and Gujarat with 16.78 tonnes utilized of the 27.96 tonnes produced.



State-wise biomass surplus for biomass pellets in India

Source: Research gate

5. Result

As seen from the above analysis we can conclude that Biofuel has the potential to become one of the dependable sources of energy in future which can be used as an alternate energy source with solar and wind energy systems to create a green and eco-friendly environment. The states with the highest percentage share of utilization of biofuel are the states of Goa and Tripura with 100% utilization of the 6.16 tonnes and 4.00 tonnes respectively produced and utilized. The next highest percentage share of utilization is the state of Arunachal Pradesh with the percentage of 93.07% utilized of the 6.97 tonnes produced. This shows that the smaller states utilize the most biofuel produced. Hence the same can be done for the larger states with the help of a proper system. The Government of India and the Ministry of New and Renewable Energy are also taking several steps and implementing several policies such as Biogas-based Power Generation and Thermal Energy Program (BPGTP).

The Programme Implementing Agencies (PIAs) of the BPGTP will take the help of Panchayati Raj/ Local Bodies (LBs) as overarching Institutions allowing need-based interventions under the community development program in rural areas as well as areas to cover Northeastern Areas, Forest Fringe Villages, in large population concentration of SC/ ST communities including in tribal areas.

Future Scope

1. Feedstock Development: Efforts should be made to identify and develop more efficient and sustainable feedstock sources for biofuel production. This includes non-food crops, algae, waste biomass, and lignocellulosic materials.

2. Improved Conversion Technologies: Such as enzymatic hydrolysis and thermochemical processes, can lead to higher biofuel yields and more efficient production processes.

3. Aviation and Marine Biofuels: Research is being done in the aviation and maritime industries to incorporate Biofuels so that they can reduce the carbon footprint.

4. Biofuel Blending: Advanced biofuels can be blended with traditional fossil fuels to create cleaner-burning blends. For example, ethanol can be blended with gasoline, and biodiesel can be blended with diesel.

5. Policy Support and Incentives: Government support through policies, incentives, research and development, and adoption can encourage biofuels as a part of a broader strategy to reduce greenhouse gas emissions and achieve energy security.

In conclusion, Biofuels ought to grow in the following years provided there is continued research, innovation, and collaboration across multiple disciplines. As the world strives for a sustainable and carbon-neutral energy landscape, biofuels are poised to play a significant role in achieving these goals.

References

1. https://oar.icrisat.org/6520/1/WPS_34.pdf
2. https://www.sciencedirect.com/science/article/abs/pii/S0016236123013030
3. **https://www.carandbike.com/news/india-increasing-ethanol-storage-targets-20-blended-gasoline-by-2025-2805641**
4. https://energy.economictimes.indiatimes.com/news/renewable/world-biofuel-day-2023-siam-international-meet-highlights-role-of-biofuels-in-sustainable-mobility/102604740
5. **https://mnre.gov.in/bio-energy/current-status**