



Biofuels as Promising Substitute for high Carbon Energy Source

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The demand for energy is rising, but fossil fuels are no longer viable. Wind and solar power have become significant in India's renewable energy portfolio. Biofuels, derived from renewable biomass, offer a strategic advantage for sustainable development and energy security. The National Policy on Biofuels (NPB) 2018 aims to augment biofuel generation and build a sustainable ecosystem. *Jatropha curcas* is identified as a key non-edible feedstock for biodiesel production. Access to affordable and clean energy is essential for health, development, and well-being.

"Nature Runs on Sunlight.

Nature uses only the energy it needs.

Nature fits form to function.

Nature recycles everything.

Nature rewards cooperation.

Nature banks on Diversity.

Nature demands local expertise.

Nature curbs exercises from within.

Nature taps the power of limits."

Benyus, J (1997).

The demand for energy is rising, but the supply of the same can no longer be fossil fuels. Wind energy has emerged as a symbol of India's transition to cleaner and more ecologically friendly power generation. Solar power generation has improved rural energy access in India to a large extent in recent decades. The exponential increase in solar installation and its becoming a dominant force in the energy sector has attracted its place as a significant

one in the renewable portfolio of the country.

Rising developmental activities and, at the same time, rising populations attract equally rising energy demands. However, the source of conventional energy that the world depends on presently is causing more harm than good. Hence, alternative sources of energy that help mitigate and adapt to the challenges of climate change, biodiversity loss and pollution are areas that need serious attention. If biodiversity conservation, adapting to climate change, and the control of pollution are the ways for well-being of all the nations and people, alternate energy that departs from the polluting and global warming conventional fuels has to be discarded, and alternatives have to be found out and sustainably exploited and used. Energy plays a necessary role in the economic growth of any country, and the current energy supplies in the world are unsustainable from environmental, economic, and societal standpoints. Nations all over the world have initiated the use of alternative sources of energy so that the energy, livelihood and health are secured besides mitigating the global warming gases like carbon dioxide and methane, etc.

In a large and developing country like India, which is equally vulnerable to energy insecurity, climate change, large population, ill health, and poverty, the demands for energy and the challenges of the supply of the same are becoming enormous. India needs to generate more energy. In this regard, biofuels have emerged as an ideal choice to meet

these requirements. Huge investments in research and subsidies for production are the rule in most of the developed countries.

India started its biofuel initiative in 2003. This initiative differs from that of the other nations in its choice of raw material for biofuel production—molasses for bioethanol and nonedible oil for biodiesel. Cyclicity of sugar, molasses, and ethanol production resulted in a fuel ethanol program that suffered from inconsistent production and supply. Availability of molasses, high cost, availability of land, choice of non-native crops, yield, and market price have been major impediments to biodiesel implementation. However, a coherent, consistent, and committed policy with long-term vision can sustain India's biofuel effort. This will provide energy security, economic growth, and prosperity and ensure a higher quality of life for India. Ministry of Petroleum and Natural Gas envisages that the Government of India emphasises realising energy security of the country by reducing import dependence on fossil fuels. The growing concern about the import dependence of fossil fuels in tandem with environmental pollution issues has driven the need for alternative fuels that have superior environmental benefits and are economically competitive with fossil fuels. This has prompted a strategic role for biofuels in the Indian energy basket. Sources of biofuel, such as agriculture and forest residue, Municipal Solid Waste (MSW), cow dung, etc., when properly used, will reduce dependence on imports of crude oil, achieve foreign exchange savings, provide better remuneration for the farmers with a view to double their income, address growing environmental issues owing to the use of fossil fuels and burning of biomass/ waste, address challenges of waste management/agri-residue management in line with the Swachh Bharat Abhiyan, and promote the 'Make in India' campaign.

Besides being a necessity for the developmental activities, household energy is increasingly vital for maintaining good health. Cheap, low-cost and fair household energy is a prerequisite for many of the developing countries, including India. However, unaffordable and inadequate household energy presents adverse consequences that are amplified by poverty and a changing climate. To date, the connections between energy, socioeconomic disadvantage, and well-being are generally underappreciated, and household

Ministry of Information and Broadcasting
Government of India

KEY CABINET DECISIONS

09th August, 2024

Pradhan Mantri JI-VAN Yojana

Boosting Advanced Biofuels

- Implementation timeline extended by **5 years**, until 2028-29
- Financial support to **Advanced Biofuel Projects** using lignocellulosic biomass and other renewable feedstock



energy connection with climate change is under-researched. Availability of a large surplus of biomass and other waste available in the country, energy recovery from these resources is a viable solution in many aspects. Biofuel is unique as it provides several social and environmental benefits apart from providing clean fuels.

Our civilisation is a practical model on fossil fuels. Fossil fuels are necessary for all the activities today, including the food we eat. Finding the alternative of fossil fuels, tapping the hydro-electricals and biomasses will go a long way. Biomass fuels, hydrogen fuels, solar powers and windmills adorning the vehicles, factories, homes and all the institutions will be challenges that demand our attention. Elaborate and extensive damming of the rivers for hydroelectricity shall cause unprecedented environmental and social conflicts. It would again lead into the production of a totally new nature. Wars will be fought not only between the countries but also within the nation itself over the issues of the sites of installing the hydropower potential sites just like the wars that happened on the sites of oil sources. Hence, our surest way to reduce the differences and to allow the coexistence of all of us is to allow the coexistence of different sources of energy alternatives as well as

conventional sources and technologies with newer insights and innovations so that the coexistence of them takes care of the sustainable development and inheriting a safe and a secure future. The need for the conservation and maintenance of the diverse sources of energy in our country also arises from the fact that the newer sources and mode of production established and developed in some institutions and regions are not well adapted to the other regions. The sources and mode of production of energy that look good in some places may not work well in some other places. Hence, designing technologies for the diversity and affordability or accessibility is said to be more difficult than sending satellites. The introduction of expensive solar cookers, solar lamps, and hydrogen fuels where there is no infrastructure for repairing is an uphill task. In this respect, biofuels may be more useful.

Till the 18th century the major source of energy was the solar power captured by plant biomass. Though solar energy is the 'mother' of all other forms of renewable energy, the primary source of food energy for all multicellular organisms is biomass. The energy needed to till the land and do the agriculture came from the food consumed by animals or laborers. The energy to make grasses into food came from wood. India, being one of the fastest

growing major economies in the world, our development objectives need to be focused on economic growth, equity and human well-being. Renewable energy resources are indigenous, non-polluting and virtually inexhaustible and our country is endowed with abundant renewable energy resources. Hence the use of renewable resources should be promoted and accelerated in all possible ways. Our energy security would be susceptible to all wrongs if alternative fuels are developed and promoted based on indigenously produced renewable feedstock. Biofuels shall surely bring a ray of hope in providing energy security. Availability of a large surplus of biomass and other waste available in the country, energy recovery from these resources is a viable solution in many aspects. Biofuel is unique as it



SOME FACTS ABOUT BIOFUELS

Biofuels	Liquid or gaseous fuels produced from biomass resources and used in place of, or in addition to, diesel, petrol or other fossil fuels for transport, stationary, portable and other applications;
Biomass resources	The biodegradable fraction of products, wastes and residues from agriculture, forestry and related industries as well as the biodegradable fraction of industrial and municipal wastes.
Bio-ethanol	Ethanol produced from biomass such as sugar-containing materials, like sugarcane, sugar beet, sweet sorghum, etc.; starch-containing materials such as corn, cassava, algae, etc.; and cellulosic materials such as bagasse, wood waste, agricultural and forestry residues, etc.
Biodiesel	A methyl or ethyl ester of fatty acids produced from vegetable oils, both edible and non-edible, or animal fat of diesel quality.

provides several social and environmental benefits apart from providing clean fuels.

Alternative fuels, as a substitute to the 'traditional' fuel, are expected to yield significant energy security and environmental benefits to nations. Coined in the late 1980s, biofuels are renewable fuels generally derived from biomass and primarily used for motive, thermal and power generation, with quality specifications in accordance with the International Standards. They are majorly derived from agricultural crops such as corn, soybeans and sugarcane, or from biomass resources such as agricultural, wood, animal and municipal wastes. These are also considered to be the first-generation biofuels. The two most common biofuels used in the transport sector, i.e., ethanol and biodiesel, are ecofriendly and can be used as substitutes for gasoline and diesel or are blended with them so that greenhouse gas emissions can be reduced and thus help in the improvement of ambient air and water quality.

As the biofuels are derived from renewable bio-mass resources and, therefore, provide a strategic advantage to promote sustainable development and to supplement conventional energy sources in meeting the rapidly increasing requirements for transportation fuels associated with high economic growth, as well as in meeting the energy needs of India's vast rural population. Biofuels can increasingly satisfy these energy needs in an environmentally benign and cost-effective manner and help reduce dependence on malignant imports of fossil fuels and thereby provide a higher degree of national energy security. Energy security

and environmental concerns have been strongly responsible for the growth of biofuels around the globe. A good number of market mechanisms, incentives, and subsidies have already accelerated this growth by putting an end to the initial inertia. Developing countries are promoting the growth of the biofuels with an additional view that biofuels are the potential means to stimulate rural development and create opportunities for jobs.

Many developed countries pursue aggressive policies for encouraging the production and use of biofuels. There are strong apprehensions that as more and more land is brought under biofuel crops, food prices would increase substantially, affecting poor consumers, particularly those from low-income net food-importing countries. However, the use of the biofuels and the way India is promoting biofuels is different from the current international approaches so that the promotion of biofuels does not lead to food insecurity. In India biofuels are based on non-food feedstock to be raised on degraded or wastelands that are not suited to agriculture. The use of biofuels in India is not new. *Jatropha* oil has been in use in rural areas for quite a few decades in diesel generators and engines. *Jatropha* seed oil can be used without refining directly in the diesel engines.

Considering all the options available among nonedible tree-bearing oil (TBO) seeds, *Jatropha curcas* L. has been identified as the most suitable seed. Seeds from the *Jatropha curcas* plant are used for the production of bio-fuels, a crucial part of India's plan to attain energy sustainability. *Jatropha* has the unique potential, provided proper incentives

and directions are formulated and implemented by the stakeholders, including the farmers, scientists and policymakers. The total requirement of the biodiesel in our country is projected today to be very high. With the positive and increasingly successful performance of the domestic automobile industry, which is catching up with the global competitors, the market for biodiesel is emerging. This indicates that the total coverage of the land of our country as of today by the fuel-yielding plants, which stands at 5000 km² is going to be increased and made more efficient and farmer friendly. Having said that, the active participation of local communities and private entrepreneurs can sustain the programme only in the short term. Hence, a good long-term strategy at our disposal must be our priority. Considering the potential of biodiesel production in India, there is an urgent need to undertake research by the public sector and private partners and incentivise the local farmers, restoration practitioners and all the stockholders to achieve a higher yield of feedstock.

Some interesting features of *Jatropha* as a viable option for biofuels are:

1. *Jatropha* can be grown in arid zones (20 cm rainfall) as well as in higher rainfall zones and even on land with thin soil cover.
2. It is a quick-yielding species and can grow well in degraded landscapes.
3. It can be a good plantation material for eco-restoration in all types of wastelands.
4. It is highly resistant to pests and diseases.
5. It attracts pollinators like honey bees, which in turn will be useful for apiculture and honey production.
6. It can sequester atmospheric carbon and assists in the process of building up total soil carbon.
7. The seed cakes made from *Jatropha* are good manure as they are rich in nitrogen.
8. It adapts easily in low-fertility soil, and alkalinity does not affect it much.

The National Policy on Biofuels (NPB) 2018 was adopted in India to augment the generation



Source: The Tamil Nadu Agricultural University (TNAU)

Jatropha curcas farming

of biofuels and to build a sustainable biofuel ecosystem. According to the 'National Biofuel Policy', the Government of India aims to meet 20 per cent of the country's diesel demand with fuel derived from plants. This will require setting aside 140,000 square kilometres of land—a momentous task and a momentous opportunity. The government presently is implementing an ethanol-blending program and considering initiatives in the form of mandates for biodiesel. Such strategies, accompanied by the rising population and growing energy demand from the transport sector, make the biofuel market a promising field of opportunities. The Biodiesel Blending Programme (BBP) got affected due to a lack of sufficient feedstock coupled with an 18 per cent Goods and Services Tax (GST) effective from 1 July 2017. The policy's objective is to reduce the import of petroleum products by fostering domestic biofuel production. The NPB got amended in 2022 and advanced the deadline to reach the blending target of 20 per cent bioethanol in petrol from 2030 to 2025-26. The amendment also envisages making additional feedstocks eligible for the production of biofuels. The higher funding and incentives will play a good role in catching the potentials of biofuels in India.

Promoting the use and making the public aware of the use and the growth of the biofuels shall surely make the provisions for the lowering of environmental loads. This will indeed be very efficient. The effects of the use of biofuels shall also surely include the reduction in the emission of the harmful greenhouse gases and thereby be helpful in reducing the global warming. Biodiesel, being nontoxic, emits less carbon monoxide and 100 per

cent less sulphur dioxide emissions with no unburnt hydrocarbons; it will be an attractive source of energy for polluted cities.

The planning and the implementation of low-carbon development in the transport sector in the developing countries and the world at large is a paramount task for every government in every country today. In the present globalised world, transportation and the transport sectors play a pivotal role in the macro- as well as microeconomical activities. Transport plays a very important role in the survival of the nations and the continents. From developmental activities to disaster management, transport plays a big role. And at the same time transport and transportation activities require and shall require a major share of the energy produce. Hence developing countries in order to efficiently conduct their activities must rely on low carbon, cheaper, easily accessible and available sources of energy that can be used, exploited, and generated sustainably. The Indian roads and the ports today are becoming great global attractants that attract investments from outside and inside alike.

The prospect of biofuels as a transport alternative fuel is promising. The transport sector occupies one of the largest energy-consuming sectors in every country of the world. A part of this energy demand, if it is supplied by the ecofriendly biofuels, much of the problem of pollution, such as acid rainfall, harmful tropospheric ozone formation, and release of the global-warming gases, shall be reduced.

Challenges of biofuels in the striving to explore further:

1. Intensive research and development to standardise and increase the efficiency of the biofuels.
2. Proper transfer and induction of newer technologies regarding the biofuel production.
3. Mainstreaming the importance, acceptance and adoption of the biofuels.
4. Cooperative work must be promoted between the farmers and growers as institutions, both educational and financial.
5. Sustainable production of the high-quality biofuel feedstocks through intense and active local communities.
6. Proper utilisation of the end products.
7. Special creation of the grants for undergoing research in the locally available resources for the production of the biofuels.
8. Strict maintenance of the achievable high standard and quality. This must be strictly enforced, implemented and audited in a timely manner.
9. Participation from all the states and,
10. Awareness and capacity building must be given a good share of priority, as until and unless people are not aware of the importance and significance the sustainability of the process, project and propagation will not last long.

Human welfare and energy have this obligatory relationship now. And there is no bias in terms of the energy need. We must move or should be intelligent enough to have basic energy as a fundamental right of all of us. To have a clean environment, better sanitation, better health, and a well-secured and well-informed society, the primary requirement has always been easily assessable, affordable and equitably distributed energy. No energy, no food and no health and no development. We need practical and sustainable solutions for the energy demands to be met. Shrinking crude oil, warming globe and increasing energy demands may surely be adapted, provided we seek and promote organic solutions for a systemic resolution of issues. □

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The infographic features a green background with a central illustration of a green oil barrel with a green leaf sprout growing from the top. A yellow oil drop is falling from the barrel. The text is in white and yellow. At the top left, it says 'Ministry of Information and Broadcasting, Government of India'. Below that, it reads 'KEY CABINET DECISIONS' and '09th August, 2024'. The main title is 'Pradhan Mantri JI-VAN Yojana' with the subtitle 'Boosting Advanced Biofuels'. Under 'Objectives:', there are three bullet points: 'Providing remunerative income to farmers for their agriculture residue', 'Addressing environmental pollution', and 'Creating employment opportunities and contributing to India's energy security and self-reliance'.