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Algae biofuel will takeover jatropha soon

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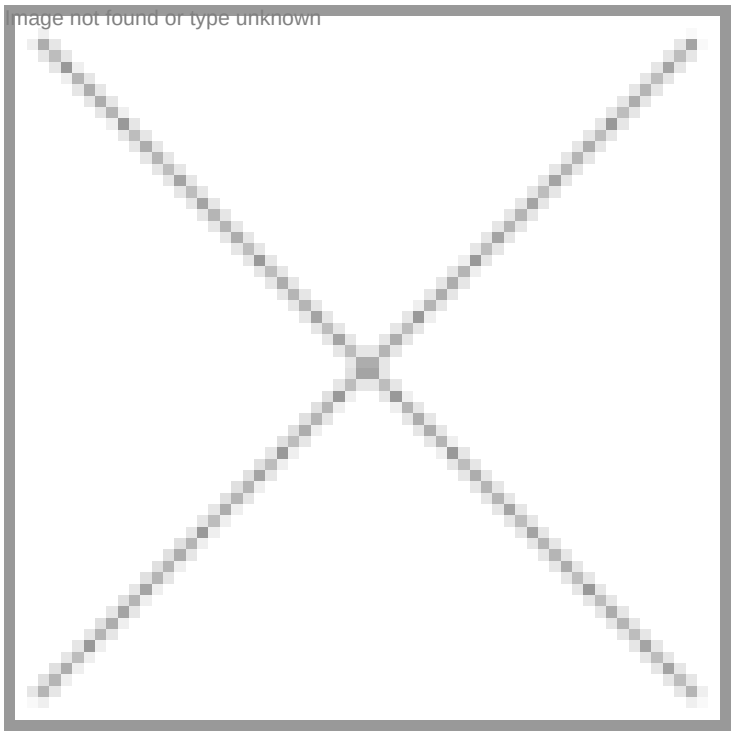

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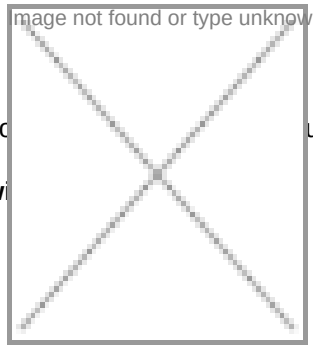

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Worldwide energy demand — particularly for transportation-based fuels — contin-ues to rise. As per International Energy Agency's World Energy Outlook, if usage of energy continues in the same way, then the world will run out of all energy reserves by 2099. Again, if the energy consumption rate for all other countries reaches the level o un out of energy by 2048.

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According to Oil and Gas Journal estimates, worldwide energy reserves at the beginning of 2004, were 1.27 trillion barrels of oil and 6,100 trillion cubic feet of natural gas. At today's consumption rate of 85 million barrels per day, the oil reserves will perish much sooner than expected. More than 100 billion gallons of fossil fuel is consumed by the US alone. The US currently imports approximately two-thirds of its petroleum; 60 percent of which is used for producing transportation fuel. Because of this depleting oil resources and the concern over climate change, biofuels such as biodiesel and bioethanol, have attracted attention in the past several years.

European Union has been the leader in biodiesel production, followed by the US. Several other countries like Brazil, Argentina, China, Indonesia and Malaysia are expanding their production capacities. Around 10 billion liters of biodiesel were produced in 2007 — an 11-fold increase since 2000. The global biodiesel market is estimated to reach 37 billion gallons by

2016; with an average annual growth of 42 percent.

Sources of Biofuels
Currently, many types of vegetable oils like soybean oil, palm oil, sunflower oil, rapeseed oil, waste cooking oil, animal fats are extensively used for biodiesel production. Food crops like maize, corn, sugarcane are extensively used for bioethanol production. This has not only led to greater debate on ethical issue like food versus fuel, but also on the extensive use of water for crops. Because of these problems, other non-edible oil resources like jatropha, pongamia, castor, are now gaining attention as alternate biodiesel crops.

Although substantial investment has been done in jatropha, results have not been encouraging, commercially. Now, globally, it has been demonstrated that algae can be a potential source of both biodiesel and bioethanol, as it does not compete with food; and can be grown in waste water or saline water.

Indian Scenario
Due to limited domestic crude oil reserves, India imports around 70 percent of crude oil. India's biofuels program is centered on bioethanol from sugarcane molasses and biodesel from non-edible crops. The Government of India approved the National Policy on Biofuels in December 2009, which envisages an ambitious plans.

Drawbacks of Jatropha
The Government of India's Biofuels Committee submitted a report in April 2003, in which it found that jatropha curcas is the most suitable species for biodiesel, because of several advantages like:

? Ability to grow in degraded wasteland having low rainfall of 200 mm/year.
? Easy to plant, grow and collect, without fencing.
? It is possible to integrate jatropha plantation with social forestry and poverty alleviation.
? Byproducts can be used for manure and biogas production.
? Average planting density of 2,500 trees/ha, with average oil contents of 30-35 percent, average seed production 3.75 tons/ha, average oil yield of 1200 kg/ha.

It was estimated that by 2012, nearly 13.38 million tons of biodiesel will be produced using nearly 13.4 million hectare of land across India. But the target for jatropha, a non-native plant, could not be achieved because of several constraints:
? Land has been an emotional issue in India. Unavailability of large stretch of land, issues related to ownership rights, complexities in land holding laws are creating issues.
? Long gestation period of up to five-to-six years. The marginal farmers cannot wait for such a long period. Most of the farmers feel that jatropha cultivation is not rewarding.
? Initial inputs of fertilizer, irrigation, pesticides and labor cost for pruning are very high.
? Variation in seed yield, oil contents and price structure.

Besides government agencies, several large and small private sector players have entered jatropha cultivation projects, but many of them closed down due to several factors.

Advantage Algae
Algae offer a variety of approaches starting from carbon dioxide capture from the source, and converting it not only to biodiesel and bioethanol, but also various other valuable products. Algae require less land areas for growth; can be cultivated in waste, brackish or saline water. They can be grown in a wide range of temperatures and varied environmental conditions. For the production of one million gallon/year of biodiesel, specialized algae will require less than 100 acres of land; where as jatropha needs 4,500 acres and soybean requires 16,000 acres of land.

Till date, about 4,600 crore ($1 billion) has been spent for developing algal biofuel. A large number of companies and venture capitalists have invested heavily in algal biodiesel projects.

In 2010, the US Department of Energy announced about 3.7 crore ($80 million) in funding for research in algae-based biofuels. Exxon Mobil and Synthetic Genomics have announced a massive investment of about 2,700 crore ($600 million) for Algae Biofuel Project.

One of the major focuses of the present US administration is to be self-reliant on oil production, from strategic point of view. Thus, as per the US Naval Task Force on Energy, by 2012, all ships and aircraft on demo group are to be certified to run on 50 percent biofuel blend. By 2016, each ship will contain full load of biofuels.

The US and EU are leading investors in biofuels. Since the investments are huge, the companies operating in these regions have kept the production facilities completely confidential. Huge investments have gone into strain improvements program,

photo bioreactor designs and intellectual property rights (IPRs).

In the long run, these overseas companies will develop production technology and business models, then license the production technology to developing countries at a high price, making biofuel production from algae, economically unviable.

Thus, efforts are being initiated to set up algal biorefineries, to get multiple products from the same strain of algae. The biofuel industries in the US have already set up an algal biomass organization and their counterpart in Europe has set up a similar body.

Besides using algae for biofuel, they are being used as food, feed, fertilizers. Marine algal extracts like agar, carerageen and alginates are extensively used in ice-cream, toothpaste, medicines, beauty products, soap, shampoo, textile printing, beer refining, juice, chocolate making, flavored milk, meet processing, packaging, bakery products, pet foods, sanitary napkins, air freshener, tissue culture media and a large number of other industries. Today, marine algae market is valued at about 320 crore ($7 billion).

Realizing the huge potential of algae in the future, the author has developed and implemented the “First All India Coordinated Project on Large Scale Algae Cultivation in India”, with the help of the Department of Science & Technology, Government of India.

A major initiative has been adopted at the international level through “Asian Network for Using Algae as a CO2 Sink”, comprising researchers from 10 different nations led by South Korea. The author represents India in this vital group. The investment in algal biofuels is growing rapidly. But we need the right combination, right people and right approach to make it a success. Algae biofuel is soon heading to be a booming industry. Now is the time to act, and the Indian government and industries have to take note.