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Powder Kegs and the Biofuel Jam

Hungry? A lot of people might be if we keep filling our gas tanks instead of our bellies. So what are we as a planet going to do about it? This paper will explore the conundrum that exists surrounding the conversion of food products (notably corn) for use as fuel (typically ethanol and vegetable oil). Bio-fuels are attractive in areas where there is a surplus of food stuffs. They are undeniably renewable and locally produced. Both of these are advantages, especially in a country like the United States of America. The US agricultural system has a tremendous production capacity for producing food, so much so that obesity, rather than starvation, is the major food-related health concern. Few countries in the world are blessed with the agricultural production of the United States. One example is India, whose food and fuel needs are increasing. Is there a way to keep the advantages of bio-fuels without the attendant disadvantages? The intention here is to explore some of the possibilities, note the advantages and pitfalls of bio-fuels and examine the impact that the use of bio-fuels might have on a typical, although hypothetical, family in India. The lessons gleaned from this exploration may be of use not only in India but also here in the United States, where the food surplus is large but not infinite.

The fundamental idea of bio-fuels is to use plant materials to replace petroleum derived fuels. To this end there are two major classes of bio-fuels. One class is the use plant materials, often corn or sugar cane to produce ethanol as a gasoline substitute. The other class has petroleum diesel replaced by vegetable oils, which are usually derived from corn or soy beans. The idea of biofuels has been around longer than most people realize. Olives have been cultivated and pressed for their oil for at least three millennia. One of the principle uses of the olive oil was for oil lamps. In 1900, at the World Exhibition in Paris, France Rudolf Diesel presented his internal-combustion engine that was run on only peanut oil. When Diesel was first making the engine he envisioned that it would only be run on vegetable oils. To his mind vegetable oils represented an “inexhaustible” resource available everywhere there were farms. Farming was a mature technology with surpluses unimaginable prior to the industrial revolution, while in Diesel’s day the petroleum industry was still rather new and highly localized.

Likewise, Henry Ford expected his cars to run on the corn derived ethanol. He succeeded in this in 1908 with one of his Model T engines. Ford built an ethanol production plant in the Midwest and also established a partnership with Standard Oil to sell his ethanol. In 1920 ethanol made 25% of all of Standard’s oil sales. Somewhere around the 1940's Ford was forced to shut down the ethanol production plant because the petroleum companies saw the threat of bio-fuels and began producing petro-diesel instead. By the mid 40's bio-fuels were basically non-existent. By 1970 the United States and much of the world had became dependent on foreign oil.

Recently bio-fuels have reentered the picture. Curiously they are often viewed as an “emerging” technology despite their long history. In 1989, Dr. Thomas Reed developed a method of turning used vegetable oil into bio-fuels. He tested his fuel in Denver, Colorado’s public transportation buses. In 1997 Joshua Tickell drove his van over 10,000 miles around the United States using nothing but used vegetable oil. (*From the Fryer to the Fuel Tank: Complete Guide to Using Vegetable Oil as an Alternative Fuel)*

In recent years the development of bio-fuels has become increasingly important around the world. For example, in India the quality of life is going up and consequently so is their demand for fuel. Rightly or wrongly, energy consumption is a measure of affluence and therefore of status. One needs only consider that the larger your car or the more cars that you own, the higher your status in your world.

Think about a typical high school student in the United States who owns a car or a parent who owns a Hummer or two. Although, status seeking also has its far-reaching implications as in the story below:

> *There was a woman who bought a **vacuum cleaner**. Her name was Mrs. Jones & up until then, she, like all of her neighbors, had kept her house spotlessly clean by using a broom & mop. But the vacuum cleaner did it faster & better, & soon Mrs. Jones was the envy of all the other housewives in town-so they bought vacuum cleaners too.*
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> *The vacuum cleaner business was so brisk, in fact, that the company that made them opened a branch factory in the town. The factory used a lot of electricity, of course, & so did the women with their vacuum cleaners, so the local electric power company had to put up a big new plant to keep them all running. In its furnaces the power plant burned coal & out of its chimneys, black smoke poured day & night, blanketing the town with soot & making all the floors dirtier than ever. Still by working twice as hard & twice as long, the women of the town were able to keep their floors almost as clean as they had been before Mrs. Jones ever bought a vacuum cleaner in the first place. (Attributed to Robert Heinlein)*

Automobile pollution in India has risen about eight times over the past two decades and contributes about 70 percent of the country's total air pollution. In 1999, India released hundreds of millions of tons of carbon emissions and is ranked fifth behind the United States, China, Russia, and Japan. The country's future is expected to have an increase of carbon emissions due to increased vehicle usage. One way to slow or even reverse this increasing pollution is to create more energy-efficient vehicles. However, that requires redesigning engines. It makes sense to many people that the redesign should include the ability to maximize the potential of bio-fuels. At the time of the United States "energy crisis" in the 1970's automakers were forced to create more efficient vehicles. In addition to economic demands, laws were passed mandating improved fuel efficiency. The government of India has most likely been pressured to introduce some kind of alternative fuel to the country's petroleum fuel economy. This pressure comes from several sources. The economic root stems from the increasing cost and decreasing supplies of petroleum fuels. There is also the pressure for national pride to be independent of external sources of oil. Finally, there is concern from conservationists and others concerned about pollution and air quality. Therefore, one avenue of exploration is for India to grow its own fuel. But then we are back to the question of food or fuel?

One plant that can be used to make alternative fuel is jatropha and it may be a way out of the "food or fuel" conundrum. The jatropha plant is a natural irritant to humans because inside of the plant there is a milky sap, making it useless as a food source. Jatropha can be used for making bio-diesel. Jatropha, despite being a poisonous plant, can grow almost most anywhere because it doesn't need much water. In fact, it can live for three years without water. Thus this non-edible oilseed can grow in places where other crops, especially food crops like corn, rice, or sugarcane, cannot be grown. Sugarcane and rice are India's two main exports, not counting cloth goods and manufacturing. Furthermore, jatropha, which is a legume, can be growing without using nitrogen fertilizers.

Does this make jatropha the perfect solution? There are problems. Though jatropha, as stated previously, doesn't require much water, it still requires some. Clean water is a scarce commodity in India. The Ganges River is so polluted that it is unsafe for anything, including agricultural use. The water in that one river is so polluted that it is 300 times more polluted than the level safe for bathing. It is also about 2500 times more unsafe for drinking water than the recommended safe level, making it one of the most polluted rivers in the world. There is raw sewage, cattle refuse, and even dead bodies floating in this river and many of the other rivers in India. So for now jatropha is faced with a water issue, but even at that, its minimal requirements for fertilizers can help the water pollution or at least not add to it. It

should be pointed out that the water problems need to be solved for India's agricultural production whether jatropha is grown or not, and the water problems should not be an excuse to stop the exploration of the use of jatropha.

It is important to understand that subsistence farmers do not need jatropha themselves because very few of them drive automobiles. Part of the bio-fuel effort will be to have subsistence farmers grow a cash crop. Part of encouraging farmers to make the switch will be to convince them that if they grow jatropha with farmland that is not in use, they will be able to sell it for bio-fuels. This use of jatropha will take some pressure off of the corn markets. With less corn being used for fuel, the people of India will have more corn for themselves to eat.

Jatropha, as stated before, is poisonous, which means if farmers couldn't sell the crop because of problems with the roads, the factory, etc, they couldn't eat it. So if this plant and plan is going to get off the ground they are going to need help from the government. This isn't as far fetched as it sounds. In fact in the United States of America, ethanol production and usage wouldn't have progressed as far as it has if our government hadn't stepped in and helped, even encouraged, the farmers to grow more corn via tax incentives and the like.

India is already working with the jatropha plant, so there is good chance they will grow more for themselves with the land they are not using. If they use the jatropha plant for bio-fuels then there is less need for corn, which can now be used to feed people. However, India's market is very varied. India has seventeen official languages, six major religions, and the ethnic diversity of India is unimaginably wide. So, the consumer's preferences will be very different in the different areas of consumers. The middle class of India is big and expanding. Many of them speak English and are well educated. Even the local stocks in India are up, but the wages in India are low. So any changes will have to accommodate this diversity that is India.

How would the growing of jatropha impact a typical, although hypothetical, farm family? Our family of six lives is made up of a father, who is 42, a mother, who is considerably younger than the father at 28, and four children, whose ages range from the oldest boy at twelve and the youngest girl at just two. The children, three boys and a girl, are the only ones who have made it past infancy. Three other children (two boys and a girl) died shortly after birth. Our family is larger than most in a country where the average woman has an average of 2.81 children survive to adulthood. They are a family of farmers with all except the youngest tending the fields. Our family lives below the poverty line in Rajasthan, an Indian state in the northwestern part of the country near the eastern border of Pakistan, along NH 15 a few miles south of the city of Bikaner, which is about 300 miles away from New Delhi. This region is currently growing millet. It has very little other agricultural activity due to its arid nature. Our family is one of the numerous families in India that practice subsistence farming, which means that they are producing only enough food for them to eat.

Our family, in exchange for growing jatropha, is going to receive tax breaks which encourage independent farmers to grow jatropha without having them sacrifice their ability to feed themselves and their families. These tax incentives are going to be greater in the beginning than after a few growing seasons as the family gains footing in the world of biodiesel. These breaks would be good considering that even if three of the four children and the mother worked the highest paying jobs (female harvester and child sower respectively) the children would make 36.57 Indian rupees or 0.79 United States Dollars (USD) each per day and the mother would make 49.69 Indian rupees or 1.07 USD per day. This translates to 13,164 rupees or 282.60 USD per child per year and 13,348.05 rupees or 390.55 USD for the mother per year, for a total income for 52,840.05 rupees or 1,250.35 USD without taxes. Fortunately the members of our team aren't the only ones who think that tax incentives for growing jatropha are a good idea.

The Indian government and the country's states are promoting the jatropha plant for cultivation, which would increase biodiesel production in India. Dr. A.P.J. Abdul Kalam, the president of India, highlights the importance of jatropha plantations and has planted jatropha seedlings in Rashtrapati Bhavan. Besides jatropha, the Andhra Pradesh state government has proposed a biodiesel policy to plant 1.5 million acres worth of oil-bearing trees in the next four years. A risk fund of 2.0 billion Indian rupees (or about 50 million USD) is being created, which would support small farmers who have up to five acres of land. A biodiesel board has also been proposed. They would monitor and promote the development and production of jatropha cultivation and biodiesel production. The government is also firm in their hope to encourage contract farming for the buyback of jatropha seeds. The buyback price will be determined by the quantity and quality of the product.

In 2005, an Indian state's government planted about 80 million jatropha saplings and hopes to start 350 jatropha nurseries. The state of Andhra Pardesh's government has even set up a separate government to use wasteland for jatropha cultivation. They're developing a plan that will involve major oil companies, like the India Oil Corporation (IOC) and Reliance Industries. This could make the state of Andhra Pradesh the biggest producer of biodiesel. Around four and half million acres would be used for biodiesel plantations and would guarantee a major use of micro-irrigation in the state. All this could have the potential to change both the economy and the landscape of India.

How can we help? In the United States we can continue to work to reduce our dependence on petroleum products. In addition we can further our efforts in bio-fuel production, usage and research. Working together we can help to solve the world's dependence on non-renewable resources and in turn, worldwide hunger.

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