Future Fuel with Seeds of Change
An Alternative to One of Our Most Precious Commodities - Oil

An Overview by Green Investment Services
Our dependence on oil is responsible for many of the greatest environmental, health and security problems our world faces today. Finding a way to ease our dependence on oil, presents one of the paramount challenges of our age.

Industrialization has resulted in untold environmental damage to our planet’s well being. Global climatic change, caused by the un-restricted use of fossil fuels, is the biggest market failure we have ever seen.

The developed world, with their complex capital markets have been the main culprits for the last two centuries. However, most recently, China and India are hot on the heels of their western counterparts, pursuing a reckless course down the carbon emission disaster highway.

Capitalism was an alien concept for the vast Chinese nation during the best part of the twentieth century, but over the last decade or so, they have embraced it wholeheartedly.

Similar to the Americans, they are industrializing their country on a grand scale, and regrettably they are doing so, with careless abandon towards our planet’s health.

“We live in a planet where oil acquisition and consumption dominate the course of international politics…”

If the Chinese continue to challenge America’s relentless appetite for carbon based energy, and in coalition with the western world, fail to adopt large scale alternative carbon free energy sources, we as a planet face global climatic change which will invariably lead to a catastrophe of biblical proportions. Simply put however, it does not have to be this way; science and technology have already discovered and produced suitable alternatives to carbon based energy. Hydro-electric, Nuclear, Solar and Wind Power are to name but a few.

But in terms of fuelling the planet’s transportation requirements, taking into account production infrastructure and distribution networks, do we currently have a viable alternative to Light Sweet and Brent Crude?

We certainly have and it is called bio-diesel, and one extremely special plant in particular that can produce this carbon neutral fuel type, without depleting the world’s feed stock supplies, namely - Jatropha Curcas L.
WHAT IS BIO-DIESEL?

Depending on the production feedstock, bio-diesel is a fuel type which varies in colour between golden and dark brown. It is produced from new and used vegetable oils which are filtered and treated to produce fatty acid methyl-esters. It is the most valuable form of renewable energy that can be used directly in existing, unmodified diesel engines.

There are two types of bio-diesel, first generation and second generation. The latter is produced from non-food feed stocks such as Jatropha Curcas L and Castor, the former is produced from traditional feed stocks such as soybeans, maize and palm oil.

METHODS OF PRODUCTION

The three primary methods of bio-diesel production are:

- Base Catalyzed Transesterification.
- Direct Acid Catalyzed Transesterification.
- Conversion of the Oil to its Fatty Acids & then to Bio-diesel.

All three processes are relatively simple and require no unusually toxic substances.

<table>
<thead>
<tr>
<th>Biodiesel v Diesel Emissions</th>
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<tr>
<td>Carbon Monoxide</td>
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<td>Hydrocarbons</td>
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<td>Particulates</td>
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<td>Nitrous Oxides</td>
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<td>Mutagenicity</td>
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SOME IMPORTANT FACTS:

- It is not a petroleum-based fuel, this means that using it will reduce our dependency on OPEC oil.
- It is produced domestically, which means it will create jobs and contribute to local economies.
- It is non-toxic, bio-degradable and essentially free of sulphur and aromatics.
- It has no waste or dangerous by-products, all end products can be easily sold or re-used to produce more biodiesel.
- It is safe to handle and transport because it is far less combustible than regular petroleum diesel.
- It has better lubricity than regular petroleum diesel and because of this it can extend the life of a diesel engine.
- It has a positive carbon dioxide balance, therefore it is environmentally friendly.
Global Market

The global markets for bio-diesel are entering a period of rapid, transitional growth, creating both uncertainty and opportunity. The first generation bio-diesel markets in Europe and the US have reached impressive bio-diesel production capacity levels, but remain constrained by feedstock availability.

The most important development over the last several years has been the shift in global bio-diesel patterns. Five years ago, Europe was the dominant player in the bio-diesel market, accounting for approximately 83% of the global installed capacity and 93% of world bio-diesel production and consumption. However, by 2009 Europe’s share had declined to approximately 46%, with North America and Asia accounting for 23% and 19% respectively of world bio-diesel capacity.

Today, bio-diesel feedstock markets world-wide are in transition from increasingly expensive first generation feed stocks such as soy, rapeseed and palm oil to alternative, lower cost, non-food feed stocks. As a result, a surge in demand for alternative non-food feed stocks is driving new growth opportunities in the sector with the general trend towards larger Bio-diesel plants.

However, over the medium-term, the market overall is expected to be flat as a consequence of:

- The ongoing Fuel versus Food Debate
- Rising Raw Material Prices
- The World Economic Down Turn

"Bio-diesel is the most common bio-fuel in Europe with Germany and France leading the chase for a cleaner and environmentally friendly planet..."
Jatropha Curcas L is a deciduous tree which is native to Central America, but has however become naturalised in many tropical and sub-tropical areas, including India, Africa and North America.

The botanic name Jatropha is derived from Greek “Jatras”, which translates to Doctor, and “Trophe” which means nutrition. The tree grows up to three metres in height, and because of this harvesting is not a difficult task.

It originates from the Caribbean and was spread as a valuable hedge plant to Africa and Asia by Portuguese traders. The durable tree is resistant to drought and pesticides and produces seeds containing between 30% and 40% non-edible oil.

When the seeds are crushed and processed, the resulting oil can be used in standard diesel engines, while the residue (Press Cake) can be converted into biomass feed stock to power electricity plants. The residual Press Cake can also be used as a fertilizer because of its high nitrogen, phosphorous and potassium content.

It takes two years for a Jatropha sapling to begin producing seeds, and they can produce seeds for up to forty years. The tree can thrive on the poorest of soils although for optimum oil yields, it prefers soil with a high alkaline content fertilised with magnesium, sulphur and calcium.

Jatropha is good at preventing soil erosion and its leaves can act as a wonderful soil enriching mulch. The tree has a high saponification value, making it an excellent substrate for soap-making.

It is considered a second generation bio-fuel because it can be produced more sustainably than earlier alternative bio-fuels based on corn or other crops that require large areas of farmland and energy to produce.

Because its CO2 emissions are almost zero, as an energy crop it contains all the requisites to be eligible within the Clean Development Mechanism. In relation to carbon credits, it has recently been estimated that one hectare of the tree could result in CO2 emissions reductions of ten tonnes per year.

"On a lifecycle basis, biodiesel reduces carbon dioxide by 78% compared to petroleum diesel…"
The bark produces a blue dye which can be used for colouring cloth and fishing nets. In China a varnish is prepared by boiling the tree’s oil with iron oxide, and in England, the tree’s oil is used for wool spinning. Medicinally, the tree contains alkaloids known as Jatrophone which is believed to contain anti-cancerous properties.

Traditionally, the tree’s nuts were used in folk remedies around the world, and as such it earned the nickname “The Physic Nut”.

As a direct substitute for crude oil and other types of fossil fuels, Jatropha Oil has three major advantages over other first and second generation bio-fuels:

- It is Renewable
- It is Environmentally Friendly
- It Helps to Alleviate Third World Poverty

Dismissed by generations of tropical farmers as a poisonous weed, suitable only as a hedgerow, this remarkable plant’s potential to reduce hunger and to combat climate change is rapidly gaining momentum.

Most recently, wide scale commercial interest coupled with corporate investor participation, has led many to believe that this plant offers all the benefits of bio-fuels without the pitfalls.

For example, the food versus fuel debate is non-applicable as the plant’s durability allows it to grow in marginal lands that are not suitable for feed stock cultivation.

Furthermore, the technology to run transport and power generation on Jatropha Oil already exists. Indeed, both New Zealand and Continental Airlines recently conducted a series of test flights using a jet fuel - Jatropha Oil mix, and the results were highly positive. The Lola entry into the 2007 Le Mans 24-hour race was also powered by a Jatropha oil blend.

“In the future, energy will be derived from all plant matter, including grasses and wood. By using every part of the plant, carbon footprints will drop dramatically……”
Jatropha Curcas L

After the first five years the typical annual yield is 3.5Kg of nuts.

Jatropha trees are productive for up to forty years.

2,200 trees can be planted per hectare. One hectare should yield approximately 7 tonnes of seeds per year.

The oil pressed from 4kg of seeds is needed to make 1 Litre of Bio-diesel.

One hectare should yield around 2.2 to 2.7 tonnes of Oil.

91% Plus of the oil can be extracted with Cold Pressing.

Press Cake left after the oil is pressed from the seeds can be composted and used as a High Grade Organic Manure.

The trees require one-tenth less water than palm trees.

It has a higher yield potential than Soy or Rapeseed and requires less fertilizer.

“Solving the food versus fuel conflict is the holy grail of the bio-fuel industry, with companies such as Shell re-investing heavily into second generation bio-fuels.....”
KEY STRATEGIES TO A SUCCESSFUL JATROPHA COMMERCIAL INVESTMENT

- Choose the best location for the project.
- Formulate the best business plan.
- Acquire the best planting / stock material.
- Adopt the best practices in Jatropha agronomy.
- Scale operations & organize strategies as per local conditions.
- Apply intercropping operational strategies for couple oils as per local conditions.
- Become socially responsible, environmentally & carbon positive.
- Map global biofuel blending specifications & demand for Jatropha oil.
- Utilize all bio-waste & seed cake.
- Evaluate risk of Jatropha project for long term forecasting.

QUESTIONS TO ASK A PRIVATE RETAIL INVESTMENT PROGRAMME

- What happens if my trees die, or are ravaged by disease or an act of God?
- Who buys the end product?
- Does the investment benefit local populations?
- What is the background of the programme managers?
- What happens if the programme managers go bankrupt?
- Is there a due diligence pack available?
- Are the plantations in politically stable jurisdictions?
- Can I liquidate the investment at any time during its duration?
- Are there any management charges?
- What costs are incurred when I liquidate the investment?

“Even Bob Geldof has stamped his cachet on Jatropha, by becoming a special advisor to Helius Energy - A British company developing the use of Jatropha as an alternative to fossil fuels……”
Almost overnight, the previously unloved Jatropha Curcas L has become an agricultural and economic celebrity, with the discovery that it may well be the ideal bio-fuel crop and an alternative to fossil fuels for a world dangerously dependant on oil supplies yet deeply concerned by the effects of global warming.

Quite simply, Goldman Sachs rarely get it wrong, and when they stated in their Food, Feed and Fuels Report in 2007, that Jatropha was one of the most efficient bio-fuels, they’ve seen both the corporate and investment world start to take this plant rather more seriously.

Indeed, there are now wide scale nurseries and plantations under cultivation globally, with a strong emphasis on genetic enhancement and domestication. Once this particular scientific approach has conducted its course, led by D1 Oils and SG Biofuels Inc, unleashing the potential of Jatropha Curcas L could well be the world’s enduring legacy for the 21st Century.

In the final analysis we may just have found the planet’s most cost effective, profitable and environmentally friendly alternative to hydrocarbon based fuels. Thus holding the greatest short and long term promise above all others.

Conclusion

“World demand for energy (from whatever source) is forecast to rise by 65% between now and 2030, and we all know the world supply of crude oil will run out by 2052.”