

# ***RENEWABLE ENERGY***

***FOR***

***HAITI***



***A CONCEPT WHOSE TIME HAS  
ARRIVED!***

**26 June 2007**

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## VISION:

By 2010, 100% of Digicel Haiti and Fonkoze diesel fuel requirements will be met by Haitian produced biodiesel using locally grown non-edible feedstock without supplanting any food crops and without modification to existing diesel engines.

## GOALS:

1. Develop a reliable biodiesel supply chain in Haiti that will meet Digicel and Fonkoze requirements.
2. Reduce the cost of power generation in rural areas of Haiti.
3. Energize the rural economy with an emphasis on domestic agriculture without reducing food production.
4. Improve the Haitian environment by reducing emissions, preventing erosion, and lessening the reliance on imported fossil fuels and locally produced charcoal.

## OPPORTUNITY:

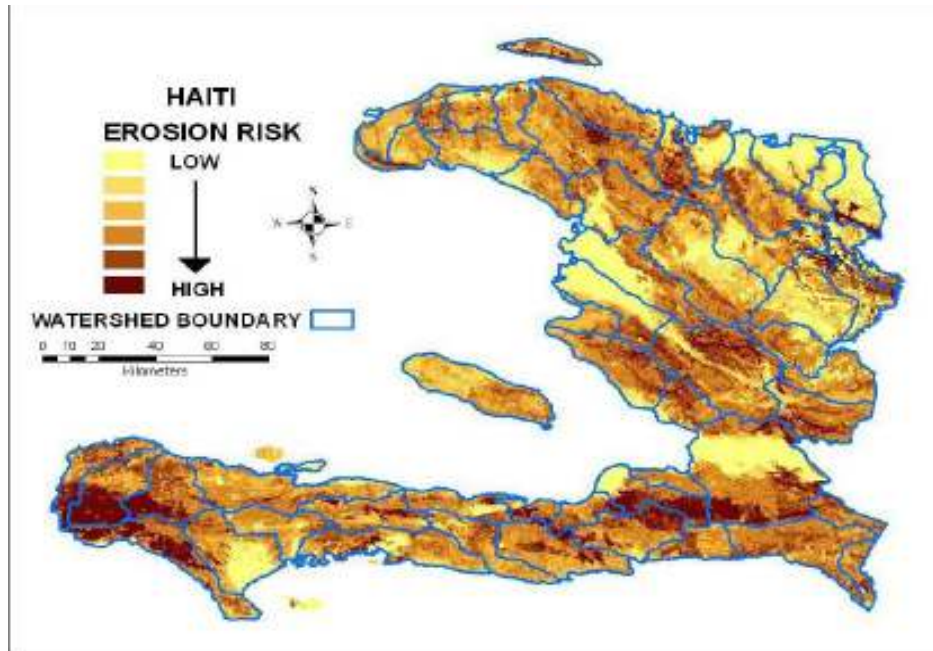
Diesel fuel is the largest of the imported petroleum products, accounting for over 48% of Haiti's imported energy expenses. Fonkoze, the largest microfinance organization in Haiti and Digicel, the largest mobile phone company, alone use over 250,000 gallons of diesel fuel each month for stationary power generation across Haiti.

Cost of Energy in Haiti, 2003

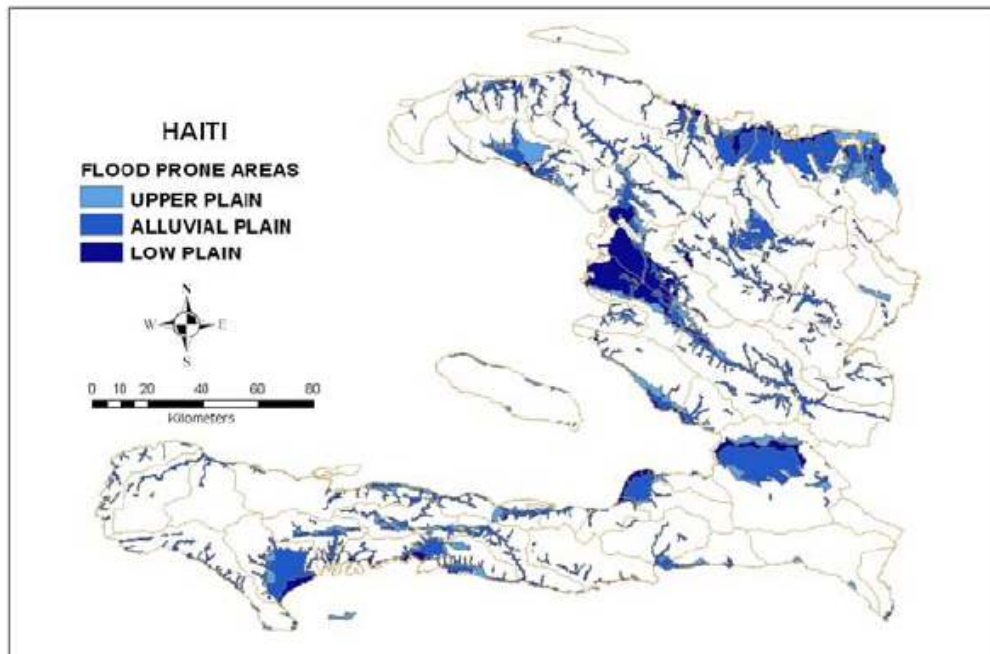
Sources	National Consumption (MT)	Percent (%)	Price/ton (US\$)	Value (US\$)	Percent (%)
Fuelwood	401,355	36	100	40,135,500	9
Charcoal	207,000	18	300	62,100,000	14
Gasoline	118,650	10	1,050	124,582,500	27
Kerosene	76,220	7	750	57,165,000	13
Diesel	321,300	29	523.6	168,232,680	37

\*Source: Bureau of Mines and Energy (BME), 2005.

Haiti's energy requirements are being met by imported petroleum products or locally produced charcoal and fuel wood. As a result Haiti is over 98% deforested which contributes to erosion problems and creates the potential for massive flooding and loss of life.



Source: Derived in part from interpretation of SPOT XS satellite images (1998)



Source: Adapted from Guillard (2005)

Clearly, there exists an urgent need and ready market for biodiesel fuel that can be produced locally in an environmentally friendly manner and does not reduce edible food production.

## POTENTIAL SOLUTION:

Fortunately, there is a plant that is native to Haiti, *Jatropha curcas* (gwo medsiyon) that has the potential to replace a significant portion of Haiti's diesel requirements and reduce erosion at the same time. In fact, Ericsson ([www.ericsson.com](http://www.ericsson.com)) the Swedish telecommunication equipment manufacture along with the GSMA and Idea Cellular just announced a program in India using biodiesel to power their rural cell site generators. ([www.communicationsdirectnews.com/do.php/100/24915](http://www.communicationsdirectnews.com/do.php/100/24915)) Initially they are using fish oil and used cooking oil to produce biodiesel while they wait for the *Jatropha curcas* supply to increase sufficiently to produce the necessary pure plant oil (PPO).



*Jatropha Curcas* is cultivated extensively for PPO as feedstock for biodiesel fuel production in India and Africa as well as a number of Caribbean nations. PPO is also being used without any processing for lamps and stoves in Africa. Once planted, *Jatropha curcas* requires little moisture, grows in poor soil conditions, is excellent for erosion control and animals, including goats and cows won't eat it after it is three months old.

It can be grown on plantations, 1,000 to 2,500 plants per hectare or as a living fence with a 1,000 plants per km where soil fertility conditions are optimum for food crops.

*Jatropha curcas* begins bearing seeds within 9 months, reaches commercial productivity in three years and lives for up to 50 years. Seed yields after 5 years range from 6 to 12 tons per hectare depending on growing conditions with PPO content being 35% by net weight.



Creation of boundary markers with living fences, such as this fence made of Gommier and *Jatropha curcas*, is a common practice in Haiti.

Average Yields & Growing Conditions (MT/Ha)

<u>Year</u>	<u>Dry</u>			<u>Wet/Irrigated</u>		
	<u>Low</u>	<u>Normal</u>	<u>High</u>	<u>Low</u>	<u>Normal</u>	<u>High</u>
1	0.10	0.25	0.40	0.75	1.25	2.50
2	0.50	1.00	1.50	1.00	1.50	3.00
3	0.75	1.25	1.75	4.25	5.00	5.00
4	0.90	1.75	2.25	5.25	6.25	8.00
5	1.10	2.00	2.75	5.25	8.00	12.50

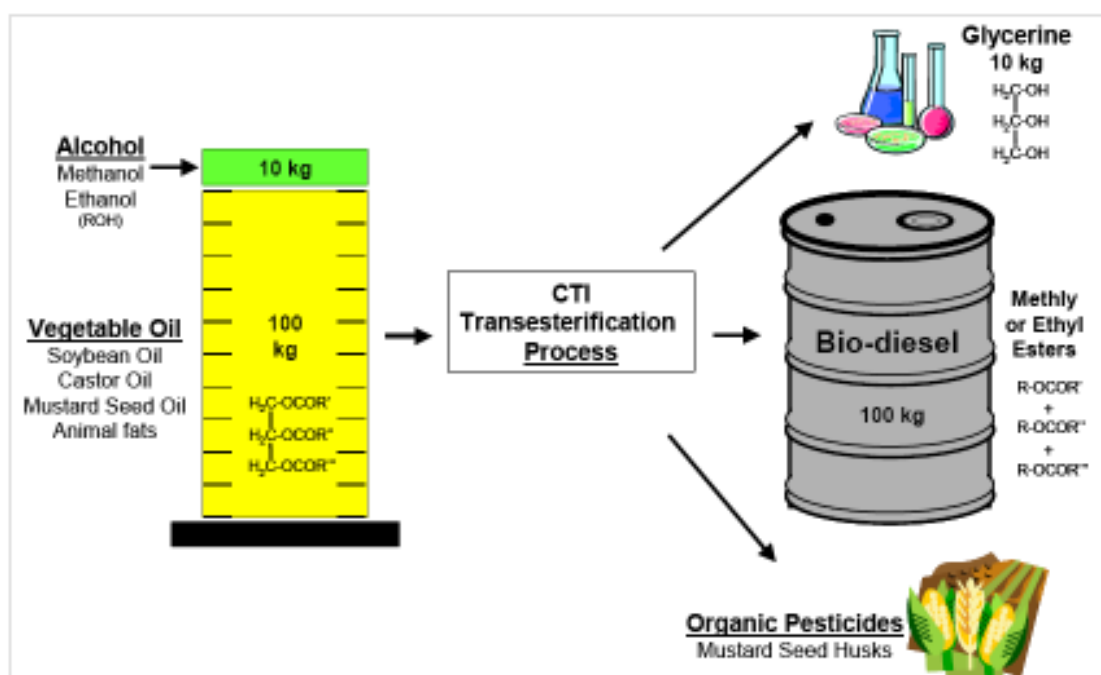
Source: CTI BioFuels

By way of comparison, the favorite for feedstock in Europe is rapeseed which is produced at 1 MT/Ha and in the US soybeans are used which produce only 0.375 MT/Ha.

PPO extraction is accomplished by pressing the sun dried seeds, either by hand, or more effectively by a mechanical process. The resulting seed cake can then be returned to the seed grower or sold as fertilizer, whose nitrogen content is comparable to chicken manure.

### BIODIESEL PRODUCTION:

PPO can then be transformed into biodiesel by a process called transesterification: a relatively simple chemical process that combines PPO with alcohol and a catalyst and produces biodiesel and glycerin, the latter of which can be sold for soap production.



Source: CTI Biofuels

Methanol is readily available in Haiti from sugar cane and either sodium or potassium hydroxide is needed as a catalyst. And because the process takes place at low temperature, 60 C or less and low pressure no special facilities are required.

The University of Illinois Waste Management and Research Center (WMRC) has a transportable 40 gal biodiesel production facility that they take to high schools where students produce biodiesel from previously used cooking oil.



### **BIODIESEL CHARACTERISTICS:**

The WMRC reports that biodiesel can be run safely and efficiently in all diesel engines without modification. They operate a diesel truck which has over 150,000 kms on the engine and the Guinness book of World Records lists a German truck at 1.25 million kms with the original engine, both of which operate on biodiesel. The problems that have been reported in the past when running biodiesel have occurred for three reasons:

1. Biodiesel, methyl ester, is used as a ‘green solvent’ and as such not only cleans diesel injectors but the entire fuel system including storage tanks so any previous contamination will be loosened and that could clog filters and the fuel system.
2. Petroleum based diesel fuel ‘jells’ at low temperature and must be heated to continue to flow. Biodiesel jells at a slightly higher temperature, but since low temperatures never happen in Haiti, this will not be a problem.
3. The biodiesel production process does not consistently meet the ASTM biodiesel specifications.

From an environmental standpoint, according to the US Environmental Protection Agency (EPA):

- Biodiesel burns up to 75% cleaner than petroleum based diesel;
- Biodiesel reduces unburned hydrocarbons by 67%, carbon monoxide emission by 48% and particulate matter in exhaust fumes by 47%;
- Sulphur dioxide emissions are completely eliminated;
- No additional CO<sub>2</sub> is added to the atmosphere.

## ECONOMICS:

The availability of a reliable source of feedstock that is priced low enough to make biodiesel competitive with petroleum based diesel, provides a fair return to the farmer and does not displace food production is the key to a successful biodiesel program.

As Dr. Marc Portnoff of the Center for Advanced Fuels at Carnegie Mellon and principle author of the biofuels section of the USAID Environmental Vulnerability Report in Haiti wrote “While the biodiesel process is a relatively simple industrial process, it still adds another layer of technology and infrastructure requirements. If Haiti had a strong oil-seed crop agricultural sector, these added requirements would not be such a barrier, but without a secure source of plant oil, biodiesel economics are not promising.” And at the same time, Anil Anchan, Ericsson Project Manager for the Idea Cellular biodiesel effort said, “For our project it is essential that we can ensure that a quality and constant supply of biodiesel is available for operation of base stations and without an abundant or at least a secured guaranteed source of raw material biodiesel production at this scale would not be viable.”

For this reason and at this stage of the project development, this paper focuses on developing a reliable supply chain. Attached as Appendix A, you will find a proposal from Jatropha Nursery, which addresses these issues and lays out a plan for developing a reliable supply of feedstock. Jatropha Nursery is being proposed by Partner for People & Place ([www.peopleandplace.org](http://www.peopleandplace.org)), a US non-profit organization that has been working in Terrier Rouge since 2003.

I’ve been talking with groups of investors planning to build large biodiesel plants, but neither has broken ground nor do they have a reliable source of feedstock.

There are also a number large biodiesel plant manufacturers including Capital Technologies International Biofuels ([www.ctibiofuels.com](http://www.ctibiofuels.com)) and Greenline Industries ([www.greenlineindustrie.com](http://www.greenlineindustrie.com)) whose products are in the multi-million dollar range and produce 9 million gallons per year. There are also small manufacturers such as West East Biofuels who produce 500L batch product in the \$65,000 range.



## **POLICY CONSIDERATIONS:**

- Biofuel Tax Policy
- Government Land Availability
- Non-diversion of food stocks and productive land capability
- Possible assistance from Brazil as they lead MINUSTAH, the United Nations Stabilization Mission in Haiti
- Possible cross border cooperation with the Dominican Republic

## **NEXT STEPS:**

- **Assess** the Jatropha Nursery proposal from **Partner for People & Place** in Terrier Rouge. They estimate \$40,000 will be required to reach sustainability. Appendix A
- **Evaluate** ways in which Fonkoze's 100,000+ clients might participate in the revival of the rural economy by growing jatropha in safe and effective ways without reducing food production.
- **Research** organizations that are planning to build biodiesel production facilities and the potential of partnerships or cooperative agreements.
- **Investigate** the feasibility of small scale biodiesel production facility.

Comments & Suggestions,

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