

Dumpong Biofuels

Creating opportunity for farmers through biodiesel

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Community based Biodiesel production begins in Ghana



Dumpong Biofuels, in collaboration with the Dumpong Pineapple Growers Cooperative, has begun producing biodiesel in Ghana from palm kernel oil. On July 2, 2007, a team from Dumpong Biofuels assembled a simple processor to convert locally produced palm kernel oil into biodiesel, a substitute for imported petroleum diesel fuel. Biodiesel can be made from any vegetable oil crop by a process called transesterification which removes the glycerin molecule from the oil creating fatty acid methyl esters. Biodiesel is more environmentally friendly than petroleum diesel and significantly reduces exhaust emissions.





The biodiesel processor was built on the farm of Frank Aidoo, one of the members, and president of the Dumpong Pineapple Growers, in Dumpong located in Eastern Region. The processor comprises two 55 gallon steel drums welded together with an electric heating element screwed through one opening. Additional piping and a small electric pump were added to pump palm kernel oil and a solution of methanol with potassium hydroxide into the processor, then circulate the mixture and finally pump the biodiesel into a washing tank.

The processor was built over two days and production began immediately. Over the next three days 550 liters of golden biodiesel was produced that has already been used to power a generator and to fuel the farm's vehicles. After the palm oil is processed into biodiesel it is washed to remove any impurities or unconverted reagents. It is then ready to be used as a substitute for diesel fuel. Due to the solvency quality of biodiesel it must initially be blended with diesel fuel as it works to clean the fuel system of the vehicle. Fuel filters will need to be changed at the start but biodiesel will actually clean the fuel system to make the vehicle perform more efficiently. Biodiesel can be mixed with diesel fuel in any proportion and there is no modification to the engine to use this fuel.

The palm kernel oil was sourced from a neighboring village where palm kernel nuts are cracked to extract the palm nut. The palm nut is then crushed and boiled over a fire of palm kernel husks to separate the palm oil, which is then gathered and stored. The palm oil used for biodiesel is not further refined.





- Some biodiesel will be used to power a generator that currently pumps water for a small sachet water (bottling) plant that provides clean drinking water. Frank plans to use this new fuel source to allow him to pump water to a storage tank in the nearby village to eliminate the current practice of sourcing water from a nearby stream.
- Dumpong Biofuels strategy is to take advantage of locally available oilseed crops, to included jatropha and sunflower seed as well, to convert into an environmentally renewable and sustainable fuel to be used locally to replace imported and dirty diesel fuel. The cost for making biodiesel is approximately 25% less than the current price for diesel fuel. By working with community based palm oil processors and with local labor this project brings additional income to and quality of life improvements to the local villages.

Initial Project

This project is designed as a demonstration to show that biodiesel fuel can be manufactured efficiently at the local farmers' cooperative level and used to increase farm revenue, reduce operating costs, and improve industrial emissions and rural health. Along with practical instruction, this project also seeks to educate the general public about environmental sustainability practices.

- The goal of this project is to build a very small biodiesel refinery on a farm, and educate the members of the local farmers' cooperative about biodiesel, how to build their own processor and how to handle and use biodiesel as a petroleum substitute. Due to the minimal economic infrastructure in Ghana rather than developing central distribution mechanisms it would be most efficient to develop local and regional pockets of development that are self dependent. By empowering the farmer with less expensive power, economic development can be driven from the farm to villages and factories in small but efficient steps.



Ghana



Project Funding Request

Ghana Project		
Approximate Costs - Phase 1		
	Per Person	Team
Transportation and transfers	\$2,000	
Hotels - 7 Night @\$80	\$560	
Meals	\$350	
Incidentals	\$200	
	\$3,110	\$12,440
Car rental - 1 week (Fuel)		\$400
Equipment		
Processor components	\$1,000	
Wash Tank Components	\$100	
Chemicals - Local		
Methanol - 55 gal drum (4)	\$1,000	
KOH - 50 lb bag (2)	\$200	
Palm Oil (1,000 gallons)	\$2,000	
Operating Equipment		
Titration (Lab) Equipment	\$100	
Titration Supplies	\$50	
Add't equipment	\$50	
Hand tools to be left behind	\$100	
Operating Manuals	\$50	
Total Operating Costs		\$4,650
Subtotal		\$17,490
Administrative Expense 10%		\$1,749
Total expenses		\$19,239

We looked for funding to cover the cost of flying over 4 team members AND the initial micro-loan for one farmer.

Having no experience in fund raising or soliciting funds, we were unsuccessful in getting outside financing and funded this project ourselves.

We have created a loan structure for the farmer to reimburse us as he is able, but frankly don't expect to see the money.

Initial Analysis

Assuming a micro-loan, or grant, of \$2,500 per installation, which would include enough supplies to process 1,000 gallons of biodiesel (200 gallons of methanol and 100 pounds of KOH), with projected savings of \$1.30 per gallon, each installation would break even in less than 6 months if one batch was brewed each week or in 3 months if two batches were processed each week.



Breakeven Business Model				
Initial Funded Capacity - Gals	1,000			
Cost of Equipment (Capital)				
Processor	\$1,000			
Other Equipment	\$400			
Total Capital Cost	\$1,400			
Initial Supplies				
KOH - 50 lb bag (@\$100) (to make 500/gal)	\$200	2	\$100	50 lb bag
Methanol - 55 gal drum (4)	\$800	4	\$200	55 gal drum
Total Startup Supplies	\$1,000			
Initial Investment	\$2,400			
Working Capital				
Palm Oil (wholesale gals)	\$1,500	1000	\$1.50	Gallon
Total Start Up Costs	\$3,900			
Production Costs				
Palm Oil	\$1,500			
Methanol & KOH	\$1,000			
Total Production Costs	\$2,500			
Petro Diesel Equivalent	\$3,800	1,000	\$3.80	Gallon
Biodiesel Cost	\$2,500	1,000	\$2.50	Gallon
Gross Savings	\$1,300		\$1.30	Gallon
Total Initial Investment	\$3,900			
Net Project Costs	\$2,600			
Farmer funded substitution for Petro diesel	\$2,500			
Breakeven Analysis				
Batch Size	50			
# Batches per week	2			
Savings per gallon	\$1.30			
Savings per Batch	\$65.00			
# of batches to breakeven (Initial/Saving)	22			
# of gallons to breakeven	1,077			
# of weeks to breakeven	11			
Additional funds needed to breakeven				
Initial production capability (gals)	1,000			
Additional gallons to produce (gals)	77			
Production cost per gallon	\$1.00			
Additional Funding to Breakeven	\$77			
Additional Weeks to Breakeven	1			

The pineapple farm







Siting the processor and components on the platform



Assembling parts

Welding 55 gallons drums into processor



Electrician hooking up heating element



Bringing in the Palm kernel oil



Processing

- Our initial expectation was that we would be using drums of refined palm kernel oil and therefore used the base amount of NaOH – 5.5 grams/liter
- The first batch made biodiesel and glycerin but almost a quarter of the processor was filled with gel.
- We then did test batches for each new barrel of oil before mixing the methoxide.



Washing

- Bubble versus mist
- We tried bubble washing to not require electricity, but there was not enough pressure to create a fog
- We tried bubble washing but there were no white barrels so you couldn't see what was going on or the levels



Washing solution

- We ended up using a tote with four airstones to wash and washed two batches at a time so as to not cause to vigorous bubbling
- The tote was tipped towards the valve to allow better drainage without loosing biodiesel
- Biodiesel was drawn off using a pump from above



Finished Biodiesel



The Dumpong Biofuels Team



Processing Palm Kernel Oil





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