Walking the Tightrope

Researchers and enterprises attempt to strike a balance between a lucrative global biofuels market and national food security

By Eliot Benman

Courtesy New Nile Co – Red Sea Project

In 2008, amidst soaring global food prices, protests and riots broke out across the developing world. In Egypt, several people were killed during scuffles in bread lines due to shortages. In Mahalla al-Kobra, in northern Egypt, a teenager was shot dead during clashes between protesters and police.

From 2006 to 2008 food prices rose by an average 75% according to the World Bank. The factors that contributed to the price increases and resulting social unrest are debatable, but many experts identified the rapidly expanding global biofuels industry as a main culprit, pointing to the diversion of food crops and arable land to fuel production.

Due to concerns over food security and various logistic hurdles, the many attempts at introducing a biofuel industry to Egypt have run aground. Though biofuels cannot compete with heavily subsidized petrol in the Egyptian market, enterprises looking to tap into lucrative biofuel crop markets in the EU and elsewhere continue to search for a sustainable biofuel production scheme.

Biofuels were once hailed as the holy grail of global warming solutions. Several types of biofuel can be produced using renewable resources such as vegetable oil, plant material and even garbage. Biogas is produced through the breakdown of biological waste and is commonly used for heating. Biodiesel is derived from animal fats or vegetable oil and is used in diesel engines. Corn, sorghum, potatoes, wheat, sugar cane and even cornstalks and vegetable waste are used to produce ethanol, which can be used as a fuel when combined with gasoline.

All have the advantage of producing less carbon emissions than fossil fuels and are derived from renewable resources.

In the aftermath of the 2007–2008 food crisis and resulting riots, however, experts are reassessing the role that biofuels should play in combating global warming and securing the world's energy supply. In 2007, UN special rapporteur on the right to food, Jean Ziegler, went so far as to condemn the use of arable land to produce biofuel as a crime against humanity.

Although the extent of biofuel's impact on food prices is the subject of heated debate, the issue is of particular concern in Egypt, where arable land is scarce and food security has become increasingly tenuous in recent decades. While the agricultural sector accounts for about 13% of GDP, Egypt imports 40% of its food supply, including many grain commodities that are used globally to produce biofuels.

"Traditional biofuels in Egypt will not work. You need to take an innovative approach," says Tamer Nassar, Managing Director of New Nile Company, a conglomerate involving Houston-based Energy Allied International, The Seawater Foundation and Global Seawater. The company's own innovative approach is the Red Sea Project, which, pending government approval, aims to create an artificial, managed seawater ecosystem on Egypt's Red Sea coast in which both seafood and biofuels will be cultivated.

"If you tell the government you are going to take arable land to produce sugar beets and then take that molasses and produce fuel, their response will be: "You want to produce biofuel and we have people starving," Nassar says.

MONEY GROWN ON TREES

Several companies, however, are doing exactly that, raising concern over a biofuel gold rush in which Egyptian companies will cash in on the EU market while ignoring the food security issues at home.

In an effort to reduce greenhouse gas emissions, many countries around the world have established mandates for biofuel use. This has created a demand for biofuel crops that domestic production will eventually be unable to supply without serious damage to domestic food security.

In addition to a carbon trading market, which will push industries to search for alternatives to fossil fuels, the EU has also implemented a mandate calling for 10% of energy to be supplied by renewable energy sources such as biofuels by 2020, creating a potentially lucrative market for nearby agricultural economies, such as Egypt.

In response, several companies have set aside concerns of the potentially negative effect on the nation's food supply. State company, the Egyptian Sugar and Integrated Industries Company (SIIC) plans to open a sugar-based jet fuel plant in 2012 in proximity to the company's already existing sugar factory.

Egyptian PetroChemicals Holding Company (ECHEM) intends to build a bioethanol plant in Kafr El Sheikh using sugar beet molasses as feedstock. ECHEM informed *Business Today* that the plant's impact on food supply will be negligible as the sugar used to produce the molasses is recycled waste left over from exports that would be disposed of if not used. Furthermore, the plant is intended to meet global environmental standards. Not only does the plant produce a carbon neutral fuel, but it is also designed to limit carbon emissions in line with the Kyoto Protocol's Certified Emission Reduction carbon credit scheme.

Meanwhile, researchers and enterprises' continued quest for a profitable yet sustainable production scheme that avoids the use of food crops has proven an exercise in frustration. While traditional sources of biofuels threaten to push up food prices, alternatives have come up against various logistic and administrative hurdles.

Despite the many failed attempts, experts point to several promising solutions.

In the past few years, the plant Jatropha has been the focus of research after successful low-cost projects were carried out in other countries such as Ghana and India. The Egyptian climate is well-suited for Jatropha plantation. Because the plant grows well in desert environments and can be irrigated using wastewater, it serves the double purpose of afforesting arid lands. More importantly, Jatropha and the oil it produces are inedible, meaning that its plantation, if carried out on otherwise uncultivable land, does not take away from the food supply.

As global oil prices peaked in 2007 and early 2008, enterprises began to take notice of the potential of Jatropha-based biofuels as a cost effective alternative to be sold to the European market, explains Ahmed Nassar, General Manager of Cairo-based research firm Engineering Research and Consulting Company.

"In Europe they want to have 10% renewable fuels by 2020, so the company wanted to plant [Jatropha], refine it in Alexandria and produce biodiesel for Europe," he says of a feasibility study carried out for a client in 2008.

> "We are just going haphazardly and without a vision. To get a real project going, we need to have a vision, we need to have a plan and we need to have funds."

The production of biodiesel from Jatropha is a simple and inexpensive process and building refineries requires little capital.

"You press the seeds and then you treat the Jatropha oil using ethanol then you carry out a cycling process to produce biodiesel and glycerol, a by-product. It's simple, it only requires a small refinery," he says. "For producing 5,000 tons per year, equipment costs alone for the refinery were expected to be only $130,000 (LE 785,350)."

Several plots of desert land were selected along the Cairo–Alexandria highway for plantation, but like many other Jatropha plantation schemes in Egypt, the client's project failed to materialize, in this case due to a significant drop in oil prices. Several small-scale Jatropha biofuel projects have been carried out in recent years, including several pilot plantations implemented by the Ministry of Agriculture, but none have resulted in a large-scale project.

One of the biggest challenges confronting the development of a Jatropha-based biofuel industry is the lack of infrastructure to transport the wastewater.

"[Investors] would have to build wastewater pipelines," says Ahmed Nassar. "When we talked to the Ministry of Agriculture, this is what the client accepted, that he will do the infrastructure."

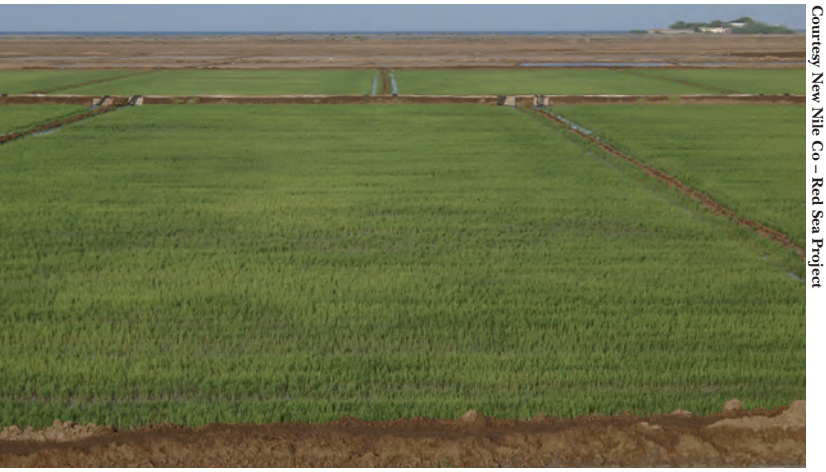
This creates a major disincentive for investors, according to Tamer Nassar of New Nile Co. The company's efforts to introduce a biofuel industry to Egypt began as a Jatropha plantation project in cooperation with the Ministry of Petroleum and the Ministry of Irrigation and Water.

"We worked together to try to develop this project, but it didn't take off because Egypt does not have the requisite resources to be able to put together a large scale Jatropha project," Tamer Nassar recalls.

"The large plots of marginal land are not situated in proximity to the large sources of gray water. An investor is not going to establish it [the infrastructure]. It's suicide."

TWO BIRDS, ONE STONE

Instead New Nile Co turned to a more ambitious approach. The **Integrated Seawater Agriculture System (ISAS)** combines various aquaculture and agriculture methods into



Courtesy New Nile Co – Red Sea Project

Coastal seawater agriculture has been successfully implemented in other countries; New Nile Co adds biofuel to the mix.

one large-scale project. The planned Red Sea Project, to be located west of Gebel El Zeit, in between the Red Sea cities of Hurghada and Ras Ghareb, utilizes idle, arid coastal land and seawater, creating an artificial seawater ecosystem in which biofuels and seafood will be cultivated.

The project is based on research by Carl Hodges, founding director and chairman of the Environmental Research Laboratory at the University of Arizona. Hodges spent 25 years conducting research into shrimp farming, high-efficiency solar energy systems, controlled environment agriculture systems, and biospheric systems. Using his research, he successfully carried out the successful implementation of seawater farms in Eritrea.

Creating coastal seawater ecosystems is not unprecedented. New Nile Co introduces the novelty of integrating biofuel crops into the ecosystem. After first introducing seawater to the arid coastal lands through canals, shrimp and fish will be cultivated along with shellfish which will act as filters to clean the water. As an integrated ecosystem, the area will be self-fertilizing, solving a problem that continues to limit the environmental value of biofuels — the production of fertilizers which produces large quantities of carbon dioxide.

As the ecosystem develops, a wetland habitat will emerge in which a host of organisms will be introduced including mangrove forests and the oil-rich plant Salicornia. The wood of mangrove trees and Salicornia oil can both be used as biofuels, which will be exported to the European market. By combining biofuel and food crop into one integrated production system, the project strengthens food security rather than degrading it.

The project is to be carefully managed by a team of experts to maximize production and maintain the health of the ecosystem.

Egypt was quickly identified as an ideal spot for implementing the ISAS, not only because Egypt possesses the necessary resources, but also because the project addresses so many of the countries developmental challenges.

"Egypt needs jobs […] it needs to address food security issues, it needs to address issues of the degradation of arable land," says Tamer Nassar, explaining why Egypt was chosen. "Egypt's existing arable land today is being depleted due to sterilization. Those are the needs."

"Egypt has abundant agricultural labor, Egypt has abundant desert land, Egypt has abundant access to seawater, because Egypt has 30,000 kilometers of shoreline," he continues. "So when we marry these together, Egypt seemed like the obvious choice."

New Nile Co estimates the value of the Red Sea Project at several hundred million US dollars, with a production rate of hundreds of thousands of tons of biofuels and food. According to the company's website, the ambitious project also aims to create over 6,500 permanent employment opportunities and an additional 65,000 indirect employment opportunities.

In order to introduce investors to such a novel concept, implementation will begin with a 20,000 hectare demonstration project. When the project expands to 50,000 hectares, as intended, New Nile Co will look into building a biofuel production plant on-site. Until sufficient production levels are reached, however, the raw materials could be sold to the vegetable oil-hungry processing plants of Europe.

The plan for the Red Sea Project was enthusiastically received by the Ministry of Agriculture, says Tamer Nassar. The Ministry presented the plan to the National Centre for the Planning of State Land Uses on New Nile Co's behalf. However, the project's momentum was interrupted by the political unrest and high ministerial turnover rate of 2011.

"The new ministers coming in are more focused in putting out fires than investor projects," says Tamer Nassar. "It will definitely affect the development of biofuels in Egypt for the short term.

FINDING A COMMON VISION

As the Red Sea Project demonstrates, the potential of biofuels lies in the remarkable diversity of sources. At the Faculty of Engineering at Cairo University, researchers are looking into a wide variety of biofuel sources and production methods.

Ahmed Refa'at, a lecturer and researcher in chemical engineering at Cairo University, is currently conducting studies into the use of used cooking oil as a biodiesel. In addition, he is working on developing nano-catalysts to speed up the biodiesel production process and the use of a microwave as an alternative to the conventional reactors.

What is lacking, says Refa'at is a common vision and coordinated effort from stakeholders and the government that will unite the many disparate efforts. The biofuel industry concerns not only enterprises looking to capitalize on the thriving global market, but those government agencies concerned with energy security, the environment, freshwater scarcity, food security and arable land depletion.

"We are just going haphazardly and without a vision," says Refa'at. "To get a real project going, we need to have a vision, we need to have a plan and we need to have funds." bt