AN ALTERNATIVE ENERGY

FOR THE

DOMINICAN REPUBLIC

(Gueric Boucard, TEXAROME INC.)

PART ONE

JUNE 2005

I. INTRODUCTION.

We are currently in the midst of an alarming energy crisis worldwide. The price of fossil fuels is at an all-time high. Apparently, this is due not only to a supply shortage, but to severe under-capacities in Refining worldwide.

The good news is that, it is much easier to find alternative energies (fuels) for Central Electric Power Plants, than automobiles and trucks.

The reason is that the switch to an alternative fuel in the world of Electric Power Generation is not nearly as traumatic a change for the Power Industry and for the world economy.

For instance, in the case of automobiles and trucks, the switch from Gasoline to Ethanol, Propane, Hydrogen, or electricity to power vehicles, requires retrofitting millions upon millions of engines and carburetors. It also requires re-tooling the entire automobile industry worldwide; and possibly bankrupting entire sectors of industry in favor of new ones. Political leaders and the private sector alike should take note of the magnitude of such an operation.

By comparison, building new centralized power plants to take advantage of a cheap energy source such as nuclear, petroleum, coal, natural gas, wind, solar, hydro, or biomass is no more than a matter of CHOICE. Nothing and nobody will need to be hurt

or put out of business. Our interest is to objectively clarify the main aspects of this important decision in order to demonstrate how simple the issue actually is.

One must always remember, that compared to individual entrepreneurs, small private companies, and even large public corporations, a Nation like the Dominican Republic is a rich financial entity. The government can build whatever Power Plant it needs to address the mounting energy crisis if it presents itself as politically and economically favorable.

II. THE IMPORTANCE OF AN IMMEDIATE DECISION

The power production process

Power production is actually simpler than it seems. The following is a flow chart, which shows the energy as it changes from raw material into electricity.

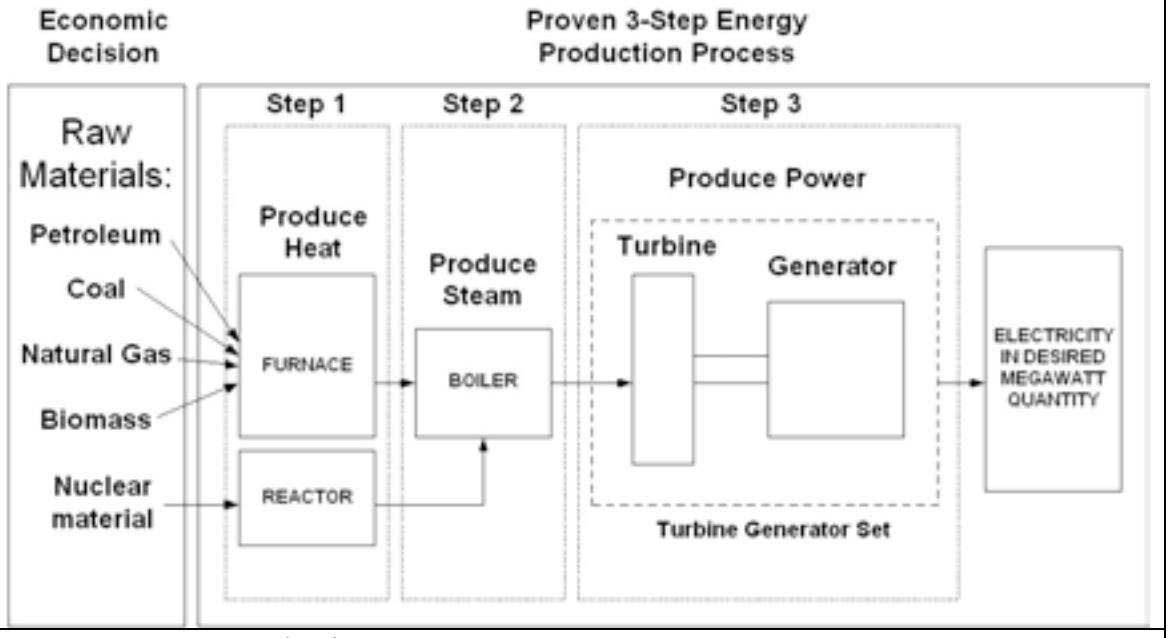

Figure 1. Energy Production Process

Step 1:

The first step is to turn the raw material of choice into heat. This is generally done by combusting the fuel in a furnace. The size of the furnace depends on the type of raw material because some materials are larger than others. In the case of a nuclear raw material, the highly exothermic breakdown of atoms within the reactor is responsible for heat production.

Step 2:

In step two, heat is sent to a boiler which is full of water. The heat turns the water to steam at high pressures. The boiler is indifferent to the type of heat it receives, as long as it is sufficient to boil the water to make steam.

Step 3:

After the steam comes out of the boiler at high pressure, it travels through a turbine where it turns a shaft connected to an electric generator. The power industry refers to the combination of a turbine and generator as a "TG Set." Anyone can purchase such a unit from a variety of companies. Units similar to a TG Set currently operate throughout the country, but a diesel engine instead of a turbine turns the generator. It should be noted that the ability for an engine to turn diesel into electricity is limited by the engine's efficiency which is often well below 33%.

As Figure 1 implies, the bulk of the alternative energy decision has already been made by years of experimentation and optimization within the three step process. Now, the only decision left is to decide which type of raw material is the most appropriate for creating heat in the Dominican Republic.

Factors to Consider for Each Energy Raw Material

A good approach is to first narrow down the options by process of elimination:

Let us first attempt to eliminate the following options:

Nuclear

We believe nuclear power to be too high-tech for D.R., and too dangerous for an island of this size. Moreover a new production facility would take too long to go on line and would be too expensive. Disposal of radioactive waste is a problem. Finally, there are certain international accords, which limit the indiscriminate proliferation of nuclear power.

Petroleum distillates (gradually)

Petroleum is a dwindling resource in high demand from large countries like the United States, China, and India. It is also growing more expensive with each passing day.

Natural Gas

Natural Gas has the benefit of still being relatively cheap, but unfortunately, this resource is not widely available in the D.R. Any combustible gas available locally should be compressed and reserved for cooking fuel, in order to prevent deforestation.

Coal

Coal remains cheap and could serve as a viable supplement to other potential fuels, but will still contribute to excessive levels of green house gasses in the atmosphere, which is becoming an issue of increasing political concern. The main reason to ultimately avoid coal is an economical one, as will become evident with the presentation of biomass as an alternative.

Any discussions regarding the use these fuels will be entertained at the end of the presentation.

Alternative Power Production Methods to Consider

Consider the remaining long term and sustainable energy options of domestic origin that we can utilize without importation:

1. Wind
2. Solar
3. Wave
4. Hydroelectric
5. Biomass

One need not oppose the five energy options for reasons other than inherent cost factors, such as:

1. High capital cost versus installed Kilowatt capacity (Solar);
2. Suitability of the geographic location (wind, wave);
3. Installation time (hydro-electric dams);
4. Availability of arable land (biomass);
5. Comparative costs of operation per Kilowatt,
6. Maintenance Frequency,
7. Projected lifetime of a given installation

Nonetheless, all five options spell Energy Independence Forever.

A disadvantage of Wind and Solar energy is that they are still in the developmental stage, and a modern installation today, may be obsolete in the near future.

From a Public Policy point of view, we want remind political leaders that the most regrettable aspect of the Wind, Solar, and Hydroelectric options is the lack of on-going job-creation compared to Biomass. To produce biomass all that is needed is sun, farm land, and a willing labor force which we believe are the primary strengths of the Dominican Republic.

III. WHAT IS BIOMASS ?

You can think of biomass fuel as a light brown solid pellet with half the BTU-value of Coal.

The prefix "bio" derives from the word "biological" which simply means that Biomass is a mass of dry solids with biological origin. Plants and animals both originate biologically, and there is already plenty of good commercial use for biomass from dead animals. Hides bones, meat, blood, hair, and fur all have widespread commercial utility. Dead plants also find a variety of application like cereal seeds (wheat) for bread production, cotton to make shirts, and rice and beans to cook lunch. Sugarcane is excellent for making Rum, and hay makes good cow feed. Any of these products would be worthy of the name BIOMASS if they were not already called something else.

The reason we call all **organic fuels** biomass, is because all biological matter fits into that category. Regardless of the household name of a given biomass, it is made of carbon-based compounds and will therefore burn to ashes, like any other fuel - especially if it is dry. Just like petroleum, propane gas, ethanol, or coal, biomass combusts into carbon dioxide (CO2), Nitrous oxides (NOx), and Water (H_2O) , while putting out HEAT. **Heat is the one component a power plant needs to make electricity regardless of where it comes from.**

The most commonly known biomass fuels are:

1) Wood and wood waste
2) Bamboo
3) Hay (various grasses, including Vetiver)
4) Coffee waste
5) Peanut shells
6) Other nut shells
7) Bagasse
8) Coconut waste
9) Paper and cardboard
10) Municipal waste (a large percentage)
11) Animal dung

Historical Significance

For more than 100 years, people from all over the world have used these BIOMASS FUELS everyday to burn in their furnaces, ovens, and boilers to generate heat or produce steam for their process. Most of these biomass fuels are typically by-products of an industrial operation. Sometimes companies burn biomass in combination with petroleum or natural gas to produce their own power, thereby improving the efficiency and stability of the operation. This sort of energy usage is commonly called **Combined Heat and**

Power (CHP) which is a concept growing in popularity as the price of petroleum rises and concerns over greenhouse warming continually evolve.

The practice of using biomass as a source of fuel subsided with the widespread use of petroleum, especially in major industrialized countries. This shift led to a dependence on oil as an energy source in which most of the world is now painfully entrenched. As a result of price shocks in the petroleum market in the past 30 years, people began looking to develop alternative energy on a large scale. For instance, researchers in the U.S. and Europe (cold countries) started looking for alternative fuels and realized that they could actually grow certain crops just to produce biomass fuel. First, they thought of fast growing trees, like Eucalyptus, Neem, Leuceana, Prosopis etc. Researchers experimented with Bamboo but found the plant did not do well in northern countries with only 6-7 months of sunshine. What these countries finally converged upon in many places is the use of wood byproduct from the logging industry. Biomass plants making energy from wood waste exist in the wooded areas of the United States and are common in Scandinavian countries where there are many trees. In some cases, power plants use coal or natural gas as a supplement to ensure steady operation.

The Dominican Candidate for Biomass: VETIVER

We came along as immigrants from Haiti to the U.S. and said: Hey, how about Vetiver as a biomass fuel. It grows well in Florida, Louisiana, and South Texas and we set up a major plantation to prove it! We soon found that trying to sell a new fuel to Texans is like trying to sell a fridge to an Eskimo. Of course, Vetiver is renowned in Haiti as a plant to produce an important Essential Oil for the Perfume Industry. This oil exists in the root of the plant, which can have a mass proportional to its leaves. My Father Victor Boucard and my Uncle Louis Dejoie (who was a Senator) started the essential Oil Industry in Haiti in the 1940's. Their pioneering work still makes Haiti the world largest producer of Vetiver Oil today. Unfortunately, other than building thatch roofs, no one has put the leaves of theVetiver plant to good use.

This began to change in the late 80's, when we heard about an organization financed by the World Bank called **The Vetiver Network.** These people are fanatics of Vetiver as an erosion control plant. As you can imagine, when you are a worldwide Organization financed by the World Bank, you have a little more credibility than a private Haitian Immigrant. And so, I am happy that the folks from the VETIVER NETWORK finally agree with me that Vetiver is not only the greatest plant in the world to fight erosion, because of its amazing root system; but that it is also a superb Biomass producer and "carbon sink" (we'll explain this term later).

Here are a few botanical facts about Vetiver:

1) According to Dr. Massimo Maffei of the University of Turin, Italy, Vetiver is the one plant on the planet with the highest photosynthetic activity. What this means, is that, given x amount of sunshine and sufficient water and nutrients, vetiver produces the most dry biomass per unit of time.

2) Other plants produce a tremendous tonnage of biomass per hectare like potatoes, sugarcane, sugar beets, grapes, etc. Some of these plants even yield more than 100 tons per hectare. However, such biomass contains 50% or more water moisture, and is difficult, if not impossible to dry quickly in the sun. Vetiver Hay is easily sun dried in a few hours, and produces up to 70 or 80 dry-tons per hectare of cellulosic biomass with adequate water and nutrients. Unlike other biomass, vetiver grows above ground and is relatively easy to harvest, with the right, specially designed Mower.

3) Vetiver (vetiveria zizanoides) is from the "Graminae" family, like many other grasses and grains. However, the variety found in Haiti and the Dominican Republic does not propagate by seed. (This is a great advantage; otherwise, it would be a terrible weed to eradicate). Instead, Vetiver is a perennial, which grows in a clump of seedlings, and which propagates vegetatively by replanting the separated seedlings. A one-year-old clump contains up to 100 seedlings. The propagation ratio is about 50:1. In other words, it takes one hectare of a vetiver nursery to re-plant 50 hectares. Since Vetiver is technically a "rhizome", the single seedling will grow on the periphery, until the plant reaches a diameter of 30 cm after one year and of nearly 1 meter after several years. Such a vetiver plantation can last up to 15 or 20 years without replanting. Once the plantation is established, there is virtually zero maintenance, other than watering and fertilizing. **An established VETIVER plantation is a veritable BIOMASS FUEL FACTORY that only needs to be mowed as needed, any time of the year.**

IV. PROVEN TECHNOLOGY

There is no major technology shift necessary to take advantage of VETIVER BIOMASS ENERGY, or any other Biomass fuel. Any Boiler furnace designed to burn bagasse, coal, municipal waste, or wood, can burn bales or pellets of Vetiver hay with only minor modifications….and vice versa.

Engineering offices build these type of boilers everyday from age old Blue Prints in various sizes, ready to transform any type of thermal energy into steam. **Just place an order with us and we can have one delivered in six months.**
Transforming steam into electric power by way of steam motors, or Turbine Generators (TG-Sets) is also a proven technology, more than 100 years old. TG Sets are a staple of the power industry, which have evolved into a product in themselves. We can also purchase these units easily from a number of eager vendors.

The only thing that should matter to engineers and economists are the following facts about VETIVER BIOMASS FUEL:

1 pound of petroleum delivers	18,000 BTU
1 pound of high-grade coal delivers	14,000 BTU
1 pound of dry Vetiver grass delivers	7,000 BTU

Comparatively, one pound of vetiver contains roughly a third of the energy of one pound of petroleum. Therefore, it would take 3 tons of vetiver bales to replace 1 ton of petroleum. The ONLY change necessary to accommodate three tons of vetiver instead of one ton of petroleum would be a slightly larger furnace.

A barrel of Petroleum holds 336 lbs (42 gallons), and is worth $60 today. This makes a ton of Petroleum (5.9 barrels) worth US$357. In terms of energy, if a ton of Petroleum is worth US$357, then a ton of dry VETIVER grass with only one third of the BTU value only needs to cost less than $119 to be economically favorable. So if on hectare of vetiver produces 70 tons of dry vetiver-hay per year, then we are dealing with a HAY CROP with a value of (70 tons x 119 dollars/ton) $8,330 per hectare per year.

Some economists estimate the rise in oil prices will continue up to $100 per barrel. In that case, the same calculation would mean one hectare of vetiver would yield $13,883! From an agricultural point of view, THIS IS A FARMER'S DREAM. Even if the farmer would discount the hay crop to US$4,000 per hectare, he would provide energy at half the going price, and still make out like a bandit.

If a UTILITY (ELECTRIC) COMPANY would raise its own VETIVER FUEL, it could produce at less than US$700/hectare, or at about US$10/ton COST.

Inversely, a US$10/ton COST for vetiver fuel would translate to a Petroleum price of $30/ton, or $5.08/barrel at equal BTU output.

PETROLEUM IS NO LONGER ECONOMICALLY VIABLE FOR ELECTRIC ENERGY PRODUCTION!

Crop Info Ordered By increasing dollars/hectare

	Dollars/ton	Tons/acre	Dollars/acre	Dollars/hectare
Soy	213	1.41	300.33	$742.12
Rice	275	3	825	$2,038.58
Corn	232	4.015	931.48	$2,301.69
Vetiver	119	28.34	3372.46	$8,333.35

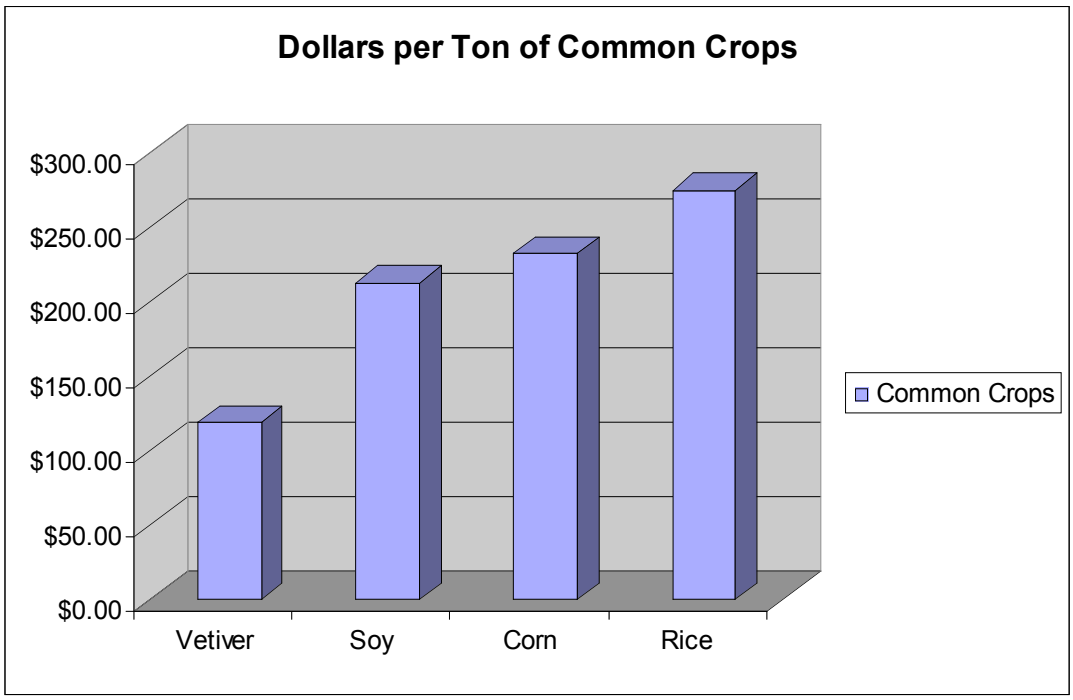

Figure 2. Common Crop Values in dollars per ton

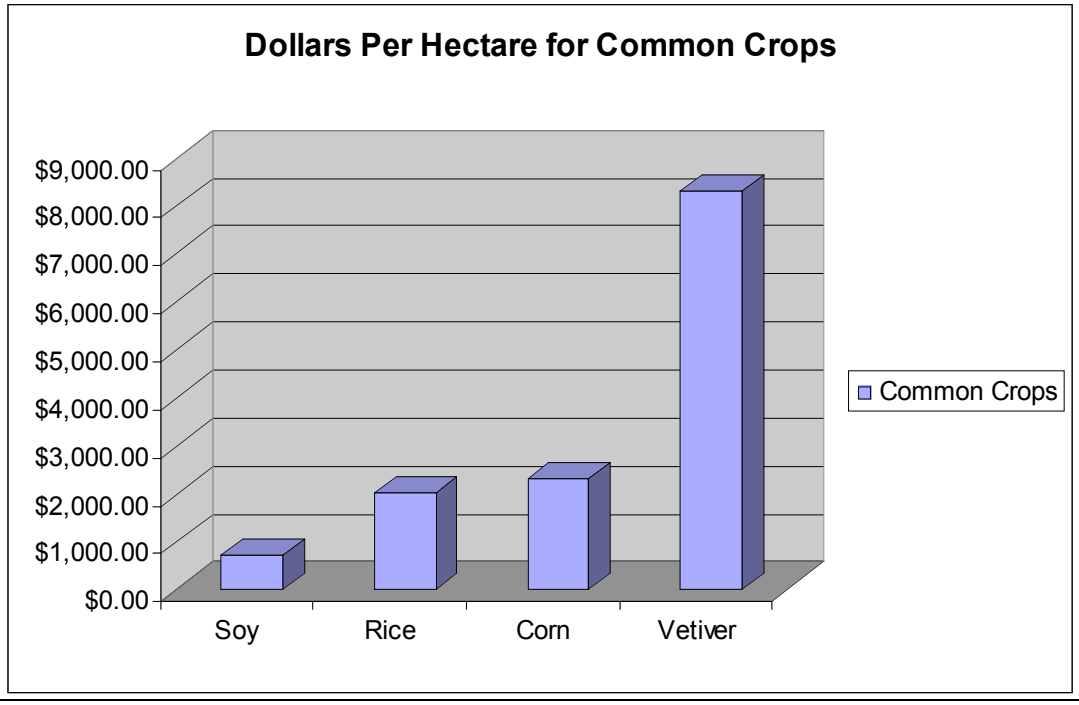

Figure 3. Common Crop Values in Dollars per Hectare

V. ENVIRONMENTAL IMPACT AND BENEFITS

The Dominican Republic is a beautiful Resort Island, thriving on the Tourism. We can ill afford to destroy the environment. In fact, priority number one should be to improve the environmental conditions and to reclaim areas devastated by drought and erosion.

The Vetiver plant not only protects hillsides and flat lands from erosion, but also helps rejuvenate saline soils for future agricultural production. Thousands of acres along the large Canal of the Jaque River remain unused and prone to desertification. Other irrigable lands from Barahona to Jimani are overgrown with useless brush. These lands could be cleared (the cleared brush is good valuable biomass) and planted with thousands of hectares of green, lush vetiver.

Several papers published by the VETIVER NETWORK recommend vetiver field as treatment for sewage water from adjacent municipalities. …an inexpensive and convenient way to irrigate a biomass crop and do some good at the same time.

Counting the leaf mass and the root mass, Vetiver constitutes a huge **Carbon Sink**, of nearly 100 tons (dry weight) of organic matter per hectare. A paper submitted by Michael D. Benge, Senior Agroforestry Officer at USAID and USDA refers to research done by the Center for Tropical Agriculture (CITA) suggesting that some tropical grasses such as ***Andropogon Guyana*** , which is a close relative of Vetiver that produces less biomass:

(***Vetiveria zizanoides)***, could sequester some 50 MT (metric ton) of carbon per hectare per year. Projects involving **"Carbon Sequestration"** are highly recommended by environmentalists concerned about the "Greenhouse effect", caused by the massive daily burning of fossil fuels. Such excess carbon in the atmosphere is a matter of great concern. One way of mitigating the dangerous increase of Carbon in the atmosphere is to sequester it in massive new plantations of biomass. In fact, the Kyoto Protocol foresees that a certain amount of premium and awards be paid out for newly established **Carbon Sinks.**

The same Kyoto Protocol proposes to give **CARBON QUOTAS** to each country based on population and area of land mass…., as a matter of fairness to all the people on the planet who must breathe the same air and live in the same atmosphere. Scientists have proposed a "*sustainable"* amount of Total Carbon to allowable in the atmosphere, which does not increase the effects of global warming. Since developed countries need to burn more carbon (fossil fuels) than smaller countries, there is a provision to allow for CARBON QUOTAS trading for MONEY. In other words, a country **above** its quota, can buy a few thousand tons from a country **below** its quota.

Furthermore, environmentalists distinguish between "GOOD" CARBON and "BAD" CARBON**.** The latter comes from burning fossil fuels, because obviously fossil fuels which have been sequestered under the ground for millions of years are now being transformed (by combustion) into CO2 and discharged by the thousands of tons in the atmosphere everyday….resulting in a dangerous increase of CO2. By comparison, policy makers have labeled BIOMASS FUEL as "GOOD" CARBON, because the CO2 put out by the biomass-burning Power Plant forms, what you might call a *"close respiratory loop"* with the adjacent plantation. Consequently, GOOD CARBON does not count in the allowable QUOTA, and may be eligible for so-called **CARBON CREDITS.**

VI. CONCLUSION

There is at least one immediate Energy Alternative for the Dominican Republic. BIOMASS FUEL… from the amazing Vetiver plant….of which we have the only plantation in the Dominican Republic at this time. Electricity can be produced at a very low cost, while providing thousands of jobs in agriculture, plus a great number of environmental benefits. Valuable foreign currencies formerly used to import Petroleum fuels, will be saved and put to use in other areas of urgently needed infrastructure development.

References

List of energy experts:
http://www.sustainableenergy.org/experts/biomass.asp

More biomass info:
http://www.eere.energy.gov/biomass/

Bioenergy feedstock:
http://bioenergy.ornl.gov/bfdpmain.html

Lots of NGO biomass links:
http://www.eere.energy.gov/RE/bioenergy-trade.html

Biomass.org
http://www.biomass.org/

International Orgs:
http://www.eere.energy.gov/RE/bioenergy-intl.html

Biomass paper:
http://www.fwc.com/publications/heat/heat_pdf/winter00/biomassp.pdf

Bioenergy Industry Organizations:
http://www.business.com/directory/energy_and_environment/alternative_energy/bioenergy/organizations

PART TWO

ECOLOGICAL POWER & PRODUCTION CENTERS

ABSTRACT OF THE PROJECT

(available in the Spanish translation)

Submitted to the Government of the Dominican Republic by:

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Concept

Without independent electric power generation with renewable fuels, there is no permanent and **nationwide** economic development possible, except for isolated, self-contained, diesel-powered, private profit centers, benefiting only a few . At a time when a barrel of crude petroleum reached US$60/barrel (June 2005), we believe that by utilizing

biomass, solar and wind power to produce and sell power to the greater population, we will position ourselves within the ecological trend currently being debated throughout the modern world. By leveraging the resources of our **agrarian society** for biomass fuel production, we will keep the country's valuable foreign currency reserves available for more urgent purposes, rather than squandering them on expensive fossil fuels payable in US DOLLARS to Venezuela or the Middle Eastern Emirates.

Given the sensitivity of environmental issues in the Dominican Republic (a tourist economy), we propose to include intense ecological activities as an integral part of our **revenue-producing ECOLOGICAL POWER AND PRODUCTION CENTERS**, by setting up an agricultural extension service, which will radiate from such centers and take charge of ecological tasks with a specifically allocated budget, such as reforestation, erosion controls, and the maintenance of biodiversity, on a permanent basis.

We propose to create twelve (12) **ECOLOGICAL POWER AND PRODUCTION CENTERS** in the southern cities of Jimani, La Descubierta, , Duverge, Neyba, Tamayo, , Salinas, Cabral, Barahona, Enriquillo, Paraiso, Oviedo y Pedernales.
The centers will be cooperative-type, profitable, revenue-producing, and financially self-sustaining business ventures, producing 2.0MW of electricity for sale to CDE, 200,000 gallons per day of potable water, the production of bagged animal feed, etc..

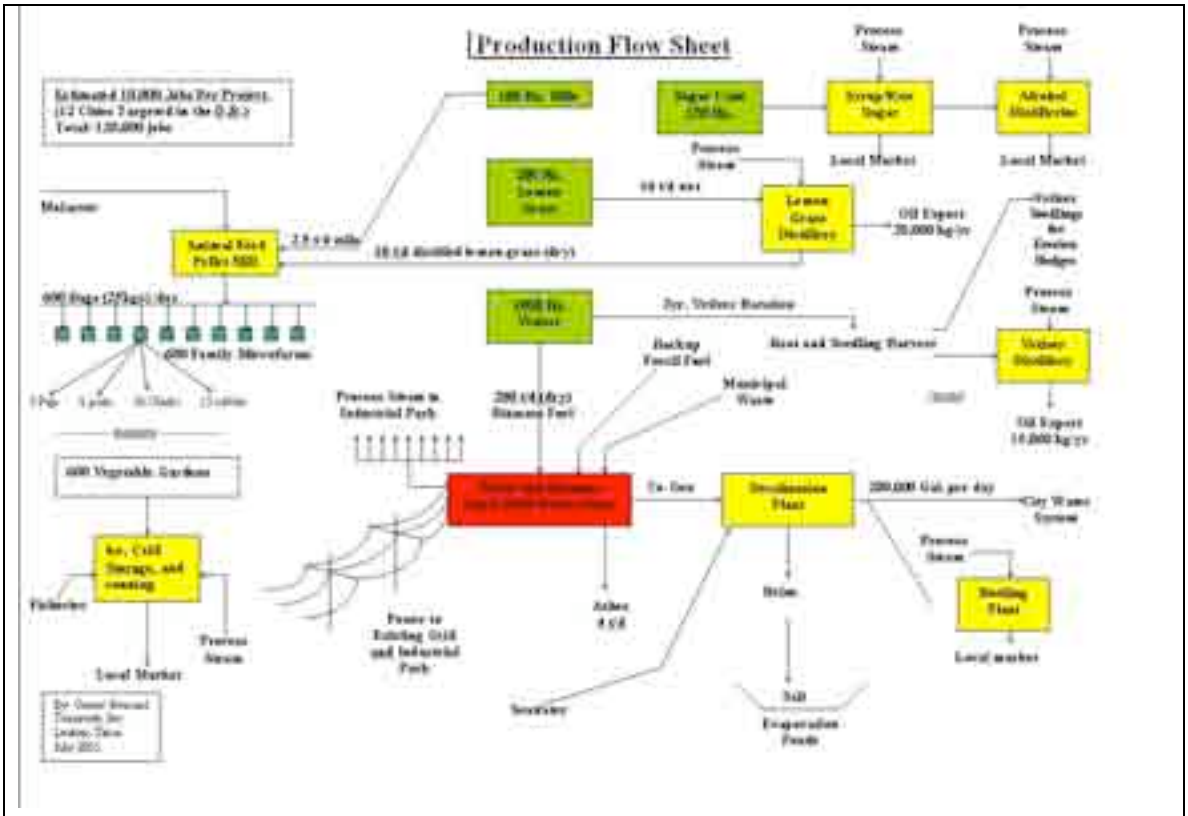


Figure 1. A Hypothetical Production Flowsheet for the Biomass Project

AGRICULTURAL REQUIREMENTS

Each center will call for 1,300 hectares (3,212 acres) under **labor-intensive** cultivation in the immediate surrounding areas, for supplying biomass fuel, aromatic plants, and grains crops, creating tens of thousands of revenue-producing jobs for local farmers, over and above the hundreds of industrial jobs at each location. This acreage and much more already exists in each one of the 12 locations as under-utilized, or low grade (saline) farmland. We propose to provide the support necessary to local farmers for applying modern agricultural methods to the production of the crops called for by this project. This project will also involve nurseries, tree planting , erosion control and watershed management as an integral cost of the operation, thus guaranteeing the continuance of such programs.

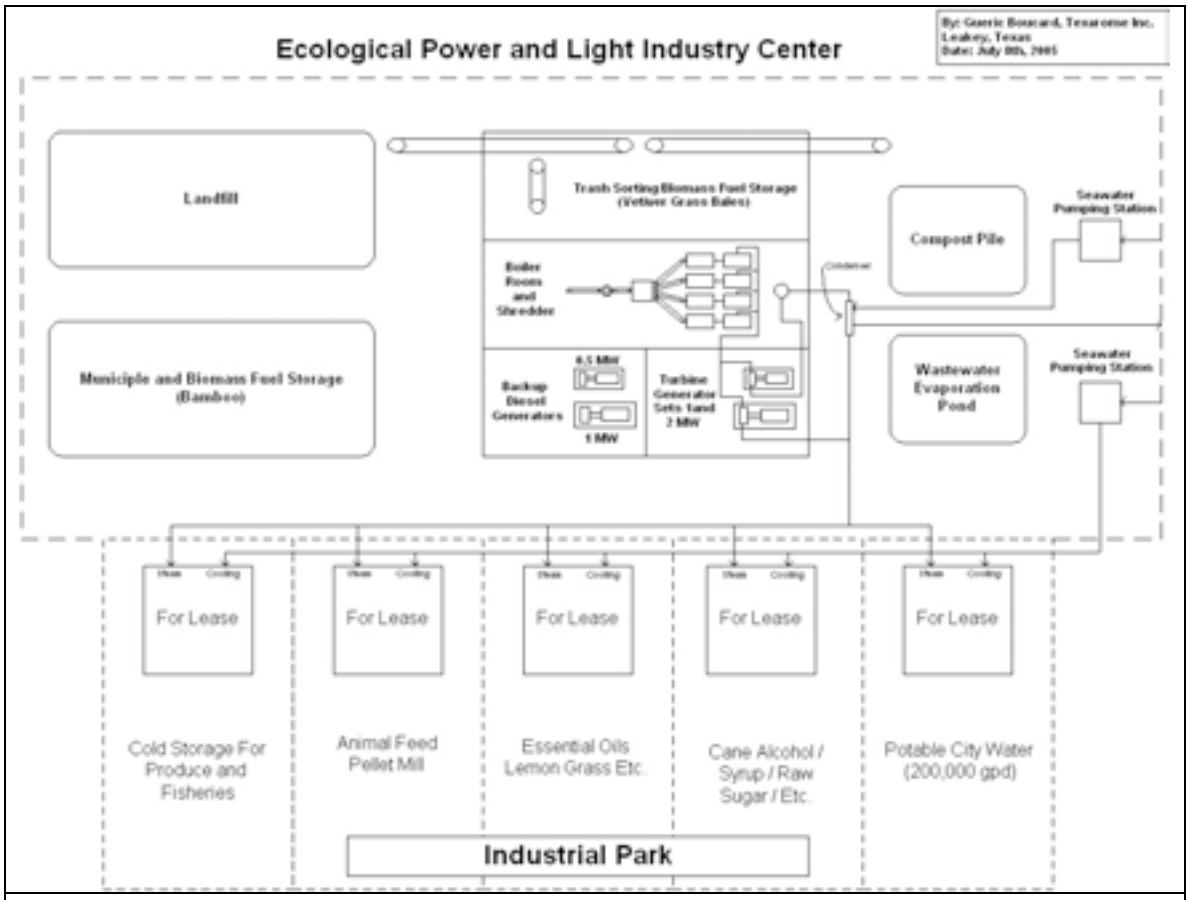


Figure 2. Example of Power Plant Industrial Park Combination

GENERAL STRUCTURE OF THE PROJECT

We plan to update cost estimates and revenue projections for the order-of-magnitude level to within about ten percent after the initial funding by private donors and institutional lenders provide compensation for the required engineering diligence.

Our first recommendation is to handle the entire project as a **private, revenue-producing, business entity**, under the auspices of a reputable NGO, capable of coordinating, installing, and managing the project, in order to deliver valuable products and services to the Dominican Republic's rural population.

The project will enjoy many benefits from such a joint-venture with a non-profit NGO, such as trustworthy management of funds, and selection of decision makers, contractors and experts. At the same time, an experienced NGO will bring greater efficiency to bear in coordinating the work of the various agencies involved such as USAID, UNDP, World Bank, and the European Community, as well the client relationships with D.R. governmental entities.

If we are unable to interest an existing NGO, the author of this project and other interested parties could found a new organization, which could hire the experts needed to move forth.

IMMEDIATE ACTION

The primary purpose of this abstract is to first approach eligible NGOs and international funding authorities. We shall request a meeting with all authorities potentially involved, in order to present the project and obtain as many (moral and financial) **endorsements** as possible. The entities that could possibly be involved, and whose mission it is to promote such projects, are the following:

USAID
UNDP
World Bank
IMF
GTZ (NGO)
Sur Futuro (NGO)
Presidencia de La Republica
Secretaria de Agricultura.
Secretaria de Medio Ambiente y Recursos Forestales
Secretaria Tecnica de La Presidencia

Following the endorsement and approval of our project by such competent authorities, the **chosen NGO**, or a **newly created NGO,** will set out to raise the necessary capital for the installation of the project in the form of grants and institutional loans.

A. The goals of the project are as follows:

Revenue stream #1:

The city shall be charged a fee for the collection and sifting of municipal waste, which shall include the maintenance of City Parks and green areas.

The collecting and sorting of municipal wastes will allow for the utilization of the dry combustible matter as boiler fuel. Separation of the wet organic material will facilitate composting, and the balance of the waste will be disposed of in a properly designed landfill.

Revenue stream #2:

The electricity produced shall be connected and sold to the CDE through the existing power distribution grid.

The production of **2.0 Megawatts of electricity** with steam boilers featuring multi-purpose furnaces, capable of burning biomass, low grade fossil fuels, and municipal waste. The primary fuel will be biomass, cultivated locally on a large scale for that purpose. Biomass fuel will become the new **cash crop** for tens of thousands of small and large farmers alike. The chosen biomass will be **vetiver grass,** but the power plant will also purchase agricultural waste, such as coconut hulls and leaves, driftwood, etc.

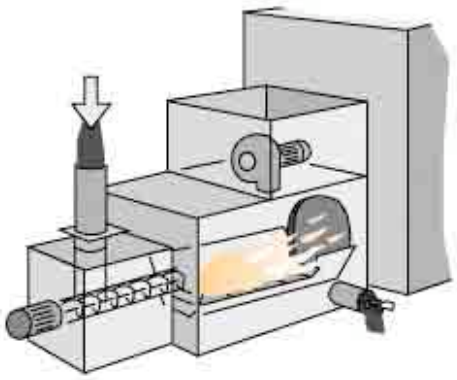


Figure 3. Biomass Furnaces

Figure 4. Typical Fire Tube Boiler

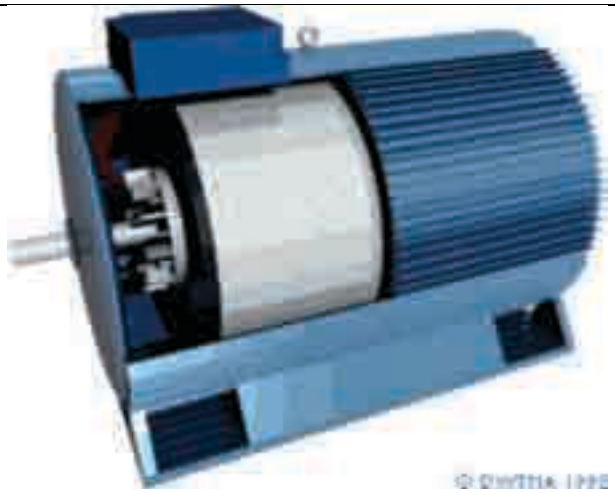
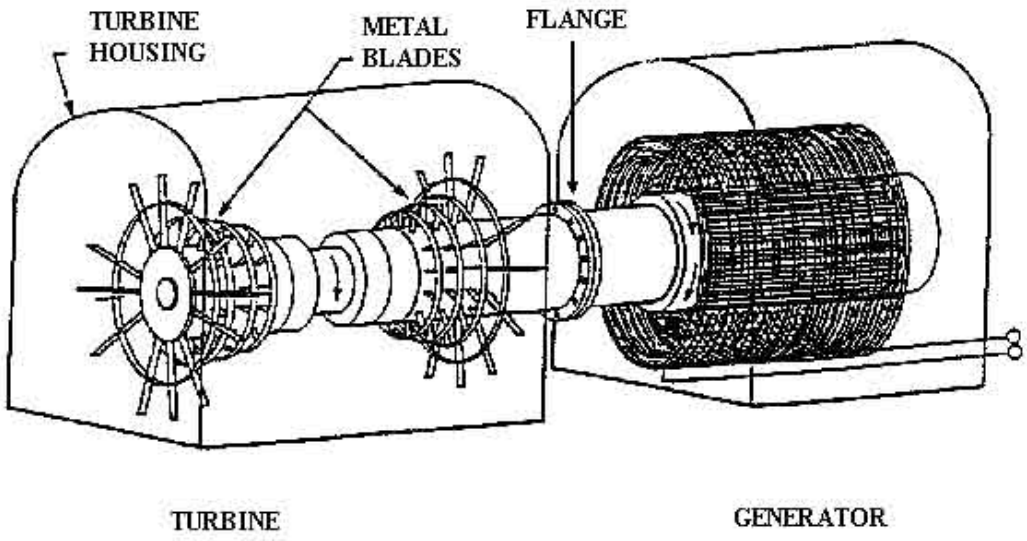


Figure 5. Turbine and Generator



When a turbine is attached to the electrical generator, the kinetic energy (i.e., motion) of steam pushes against the fan-type blades of the turbine, causing the turbine, and therefore the attached rotor of the electrical generator, to spin and produce electricity.

Figure 6. Example of a Turbine Generator Set

Revenue stream #3:

The potable water will be pumped into the existing water distribution system and sold to the city**.** (Lago Enriquillo, Laguna de Rincon, y lugares con acceso al mar).

The waste energy of the power plant will serve to operate a downstream **seawater evaporator,** which will produce some **200,000 gallons per day** of potable water for the town and the surrounding area.

Figure 7. Example of a Compact Sea Water Evaporator

Revenue Stream #4

The animal feed pellet will be bagged and sold (by a subcontractor) at a subsidized price to participating local farmers.

Aside from running and supporting organized farming for the production of biomass fuel, the project will commission from local farmers a large acreage in **lemon grass** and **milo.** Once the valuable essential oil is extracted from the lemongrass with the steam of one of the Industrial Park processing facilities, the cellulosic grass will be mixed with the milo and molasses to produce an all-purpose **animal feed pellet.**

Figure 8. Example of a Pellet Machine

Revenue stream #5:

All sites of the **Industrial Park** will be **leased** to individuals and corporations to generate **revenues** for the project.

There will be an **Industrial Park** surrounding the electric Power Plant, which will provide five or six industrial plant buildings to house **agro-processing facilities,** requiring steam, cooling water, potable water, and electricity around the clock. There will also be several commercial building sites for **small factories, assembly plants** and **arts & crafts shops.** The Park may also accommodate a **cold room** for agricultural produce and fisheries, needing clean ice and electricity 24 hours a day.

Figure 9. Example of Large Metal Hangar

Non Revenue Producing Activity

The only non-revenue producing activity of the proposed project shall be the creation of an **Ecological Extension Service,** which will be budgeted as a percentage of sales, and financed by the project to engage in **tree nurseries, reforestation, erosion control,** and **watershed management.**

B. INVESTMENT

It is estimated by the authors of this project that each one of the twelve (12) **ECOLOGICAL POWER AND PRODUCTION CENTERS** will require a one time capital investment of US$3-5Million EACH, depending on location. The exact costs of the project will become more specific in the course of significant engineering diligence which will be funded by those interested in the project's implementation.

This being **a PUBLIC UTILITY PROJECT**, we propose that it be managed like a cooperative and operate on a marginal profit, so as to make the services available to the general population at the lowest possible cost. The company should retain any accumulating profits intended only to optimize and/or expand the operation.

The motivation of the authors of the project is primarily civic in nature, with a desire to run their existing businesses in a prosperous and peaceful Dominican Republic, and contribute positively to the national economy.

The authors being already in the business of biomass (vetiver) production and the construction of agro-processing plants, they would entertain the possibility of acting as general contractors and suppliers of biomass for the project. Certainly, the authors would be interested in being one of the paying "tenants" of the Industrial Park.

Author Information

Essential Oil Production:
http://www.fpl.fs.fed.us/documnts/usda/agib666/aib66601.pdf

Mexican Vetiver:
http://vetiver.org/USA_grimshawmexsp.htm

Bandera Electric:
http://www.bandera-ec.com/images/band305.pdf

Essential oils:
http://www.fpl.fs.fed.us/documnts/usda/agib666/aib66601.pdf

Vetiver Prize in '93:
http://www.vetiver.com/TVN_NL10.pdf

Biomass power:
http://www.vetiver.com/TVN_NL09.pdf