

CONSIDERATIONS BEFORE BUILDING A BIO-ETHANOL FACTORY IN NIGERIA.

Many people within and outside Nigeria think building a bio-ethanol factory is easy in Nigeria without serious and important considerations. They have little or no knowledge of the basic requirements for setting up such factory. They have probably not managed/operated/get involved in any bio-ethanol factory designing, building and plant commissioning before. The success of this business is beyond adequate fund availability and basic economic considerations for locating an ordinary industry. It is beyond getting land and getting political support. This is a very young industry that brings a lot of thoughts and double thoughts knowing the way businesses succeed in Nigeria. The success of any bio-ethanol industry in Nigeria is a function of so many factors. Therefore, this article is to serve as a guide to both Nigerian and foreign investors of bio-ethanol business in Nigeria. So you will factor in so many assumptions from the concept to implementation. This little write up will provide *some guides* to any potential investors or new entrants into this industry.

The Nigerian government had conceptualized the bio-ethanol development since 2005 but not much had been seen in an industry that is capable of assisting Nigeria in achieving MDG1. Our oil had brought for us, sadness (Niger delta crisis) and joy (revenue). Because of the situation in Niger delta, we cannot enjoy our revenue. Angola may be making a serious mistake if they rely solely on oil without considering the non oil sector for their revenue and economic development. The country must learn from Nigeria.

Any ambitious investors(Local and foreign) in this nascent industry need to consider the following considerations first before jumping into this business. This is the most crucial decision and several evaluations, deductions and extrapolations must be made before taking the final decision of locating and building a bio-ethanol plant in Nigeria:

A. CHOICE OF FEEDSTOCKS

Feedstock and energy costs are typically among the highest inputs costs in this business. The feedstock availability and sustainability is the first key to your success. Other factors are important in determining production cost estimates, profitability and competitiveness. You must pay adequate attention to the feedstock cost and availability. In many bio- ethanol plants, feedstock cost can account for 60-70% of the ethanol input cost depending on the price range and region. Feedstock price volatility should be carefully examined and strategies must be in place for managing this cost. Bio-ethanol can be produced from:

1. Grains such as wheat, barley, grain-sorghum, corn, rice, millet etc.
2. Tubers such as cassava, yam, potatoes and potato waste.
3. Sugar materials such as sugar juice, sweet sorghum and cane molasses

4. Cellulose-biomass such as wood- waste, paper, leafy crop material, rice or wheat straw, pulp mill waste liquor. This technology is still being investigated for a commercial scale. You must develop your factory and operations to be able to handle a multiple feedstock for your bio-ethanol production and multiple products. If you entirely rely on a mono-feedstock for a bio-ethanol factory in Nigeria, it is a risk and as dangerous as holding tiger by the tail. With the recent global attack on agro-fuel, you must position your factory to utilize other feedstock for bio-ethanol production and such feedstock should not be one that will have direct negative impact on human food chain. If you choose a human food related feedstock, make sure you have your own farm and you must produce abundantly that it will not affect the food chain in the community where you are locating the factory. That is, plan to produce and organize more feedstock than what the community and your factory will require on yearly basis. In the United States, corn has been the feedstock for bio-ethanol production for over 15years but there are considerations to change this concept by designing bio-ethanol plants that can use other feedstock. For instance, sugarcane to ethanol factory is coming up in Hawaii while sweet sorghum to bio-ethanol factory is emerging in Texas. There are several grants in the US for further researches on the development of cellulose and other biomass for bio-ethanol production.

In view of this, bio-ethanol project developers must consider;

- i. Feedstock price history, production patterns and trends in the area from which the ethanol plant is likely to acquire the raw material.
- ii. The quantity of feedstock historically available in the area and other sources of industrial competition for the feedstock. Make sure you get an agricultural insurance to insure your feedstock farm against diseases, floods, and other natural disasters.
- iii. Location of the bio-ethanol plant in relation to proximity of the feedstock and methods of transporting feedstock to the plant on a year around basis.
- iv. On site and off site feedstock storage options and methods of moving required feedstock volumes through the receiving system.

B. ENERGY REQUIREMENT AND AVAILABILITY

This is the second largest input cost in a bio-ethanol plant after feedstock. Nearness to available and sustainable power source will go along way to affecting the cost per liter of your product. Your in-house power generation does not exclusively insulate your factory from the national grid source. It will only reduce your cost and improves your community relationship. Whenever you are not producing or during your general annual maintenance, you cannot generate your own power. At each power problem during production, there can be loss of all services in the factory. This can result in shutdown of all distillation towers; rapid depressurization of the pressurized columns and flooding of the distillation towers is likely. Excessive pressure will build up in the fermenters due to loss of ethanol absorber blower resulting from power cut/failure. Energy expenses are one of the key variables in site selection that can affect profitability. Give considerations to the following:

- i Historic price, availability and reliability of power supply in the proposed area/community.
- ii. Proximity to energy sources (e.g. natural gas pipeline, coal, baggasse/biogas, electricity, propane and co-generation, etc)
- iii Cost benefit analysis of contract options for all energy sources.
- iv. Emission control costs and permit issuance time for the selected

energy sources.

v. Cost and possible use of a generator as alternative or back up to power holding.

C. TRANSPORTATION COST AND SUSTAINABILITY

The cost of transportation is important to plant input costs and marketing costs. Transportation cost varies considerably depending on mode of transportation and ethanol production volume. Access to reliable, cost competitive transportation is an important site consideration. Bio-ethanol project developers should evaluate the modes of transportation necessary to supply materials to the plant and determine the availability and cost of these modes at prospective sites. Transportation related factors for consideration includes:

- i. Major highway and interstate access to target markets
- ii. Potential for disruption of travel on these routes based on projected construction and historic weather patterns/forecast.
- iii. Proximity of mainline rail to site and estimated cost of related railway services if applicable. The federal government of Nigeria had just attempted to resuscitate the Nigerian railway system. Consider the possible effect of this decision to your site selection.
- iv. Number of transportation providers in the proposed area.
- v. Options for competitive transportation services available.
- vi. Access to weather forecast.

D. WATER RATIO

Water quality, quantity and infrastructure for handling water treatment are important factors in site selection. The water requirements, factor into capital cost of the bio-ethanol plant, operating costs and permit issues will become important when the ethanol plant is finally constructed. Water reuse has become a standard operating procedure in most bioethanol plants today. Wastewater has been minimized and much of the process water is recycled in the plant. Recycling, reuse and treatment of water help to reduce costs. In most modern fuel ethanol plants, the only loss of water is in the boiler blow-down and evaporative loss from cooling towers of the distillation. Therefore, the following are worth being considered seriously when thinking of locating a bio- ethanol plant in Nigeria:

- i. Potential availability and cost of water provided by community water system. The fact that you have borehole water or access to river or ocean does not mean you will not pay a water charge to the government(local, state or federal as the case may be.)
- ii. The cost, volume and accessibility of water from on-site wells.
- iii. Cooling water availability from river frontage sites
- iv. Overall water quality (pH, mineral content, BOD, COD etc)
- v. Existing infrastructure availability for water supply and wastewater treatment.
- vi. Water supply issues affected by any available local, state and federal government laws.

E. FACTORY SIZE

Do not be over ambitious about the factory capacity that you want to build. You may wish a particular volume capacity but the realities on ground may not permit this ambition. You may have to start with the most economic size but with possible future factory expansion. A good feasibility study will tell you this from the beginning. Site size in very many cases, is determined by geographic constraints, land cost and acquisition protocol, proximity to pre-existing infrastructure, etc. Acquire the C of O for your factory before moving to site. Consider the soil test result support your project. For an intermediate bio- ethanol plant size of say 20million gallons per year may require an estimate of say 40-48 acres depending on the plant technology, and configuration. However, air permit considerations, rail and on-site transportation patterns, in addition to future plant expansion; an estimate of near 58 acres will not be a mistake for a 20million gallons ethanol plant. . Generally, Plant site should be large enough to accommodate future expansion. When simultaneously evaluating plant site and size, the following are relevant considerations:

- i. Sufficient space to accommodate plant re-configuration to meet future needs dictated by changes in production output or regulatory changes.
- ii. Additional space for waste water or other pollution mitigation options.
- iii Adequate space on-site road and possible rail configurations

and expanded storage/warehousing

iv. Adequate room for future expansion to accommodate an allied business partnership.

v. Desirable site buffer to accommodate aesthetics goals and air permit requirements.

vi. Prevailing wind patterns and proximity to the community or inhabited dwellings.

F. MARKET POTENTIALS

Of course, this project must not be treated as a not for profit NGO. It is profit making business enterprise. In any business you do not venture into it if there is no identified and sustainable market for your products. This is simply common sense. Bioethanol plant is never operated as an NGO in any part of the world. It is often planned as a profit making business operation. There are 3 major products in this business namely: Bioethanol (fuel/ industrial/beverage), carbon-dioxide and nonfermentable solids often called DDS. The values of each of these products vary from one location to another. Ethanol represents the greatest value among the 3 products and for this reason current and future ethanol markets must be considered during location process. This is typically an important part of the final feasibility study. In identifying the markets for these products, the following factors are important:

i. Bioethanol process and volume utilization history in target markets.

ii. Current ethanol utilization in target markets and assessment of existing competition.

iii. Infrastructure review.

iv Transportation cost and options available.

v. Regulatory. Legislative or legal factors that impact target markets.

Generally, the market assessment will help provide guidance on site related issues that may potentially improve or impede bioethanol marketing from specific plant location or site.

G. COMMUNITY RELATIONSHIP

Key community officials or representative inclusion in this project can help in determining the extent to which the overall community will support the ethanol project in the proposed site. Such supports ranges from community resident awareness and the impact the plant will have on the community economically, tax incentive, employment, poverty reduction/alleviation, life improvement for the residents, zoning changes or a variety of other concessions that vary in value.

Community residents will be far more likely to support the project and less likely to complicate permit and zoning processes, if they understand the positive and potentially negative impact of the proposed fuel ethanol plant on their community. Find out if the community for your project is generally hostile to industrial development or hatred for foreigners. The negative impacts may be minimized by proper planning and site selection. Fuel ethanol plants are generally located at sparsely populated areas. The job created by the fuel ethanol plant, job related benefits, taxes generated by the plant, infrastructure improvement stimulated by the plant and goods and services required by the plant are all important factors that will have positive impacts on the community.

Community concerns can vary from location to location. By all means potential problems will have to be minimized for community residents. Such concerns include; Prevailing wind direction, dust, symbiotic infrastructure, fire safety, plant emissions, noise pollution, plant sight lightning, etc. There is a need for good community relation between the bioethanol project team leader and the community residents. The project leader has specific roles in developing good relationship with community members or residents, regulatory officials, elected leaders, senators, house of Reps, and state house of assembly members from the community and others can assist in this process if so inclined. By contrast, mistakes made during this process may result in near and long term consequences that may hamper the development of the bio-ethanol processing facilities.

h. PERMITS

Prior to Site selection, the bio-ethanol project developer is expected to make initial contacts with state and local authorities who are responsible for environmental regulations and relevant zoning permits. Review of permit requirements will help familiarize the project team with state and local contacts in the various regulatory agencies such as SON, NAFDAC, NESRA and ministry of environment among others. All the technical data in support of permit application must be made available by the developer to the appropriate agencies. Do not hire engineering firm that had never built bio-ethanol plant before for your construction whether within Nigeria or outside Nigeria. Because you will be taking some Risks such as

- a. production and quality compromised
- b. Projects late to market.
- c. Projects behind schedule
- d. Projects missing integral components
- e. Incomplete project
- f. Project over budgeted

By reviewing the permits requirements above, you will accomplish the following:

- i. Familiarize the project developer with the time frame in which various permits can be issued.
- ii. Determine any pre-existing conditions that may make a site unsuitable for a bio-ethanol plant.
- iii. Familiarize the project developer with state and local regulatory officials
- iv Orient the bio-ethanol project developer.

I TECHNOLOGY & TECHNICAL PARTNERS

A variety of process technologies are available for bio-ethanol production, but sometimes depend on some valuable variables. They are location specific! Proposed technology should be adequately evaluated against cost benefit considerations and demand driven. You must hire a competent and experienced ethanol production technical partner either locally or foreigner but be guided by the local content act in Nigeria.

J. PLANT MANAGEMENT AND ORGANISATION

Assess the cost of recruiting and training of the management team of the proposed bio-ethanol facility. Establish both management team positions and projected number of employees especially the greenhorns. Successful management will play an important role in the efficiency of plant operations and will in part determine the degree to which the business is profitable. Ensure that the organization is private sector dominated for both success and sustainability.

K. EXPERIENCED CONSULTANTS

This is an exciting project in Nigeria that requires caution and professionalism. The industry is at its infancy in Nigeria. A lot of initiatives and decisiveness will come to play. Setting up a bio-ethanol plant and the entire plant management requires practical experience and skills from concept to construction of the ethanol plant. The project team leader should be a tested and experienced person in bio-ethanol production and plant management. Where these are lacking or inadequate, and then employ the service of hired consultants as applicable. The hired consultants could come in different specifics such as process technology, distillation, energy balance, marketing, etc or a combination of these.

L. POTENTIAL PROJECT HAZARDS & RISKS

A wide variety of factors affect the economics of bio-ethanol production. These factors include feedstock as discussed above among others. A host of other factors will affect production costs and profitability and should be quantified during site specific feasibility study. Based on Zenith Agroethanol Nigeria Limited's experience of several years in bioethanol plants within and outside Nigeria, the following 09 hazards and 5 major risks had been identified:

HAZARDS

- a. Lack of serious commitment by owner-members.
- b. Excessive debt-to-equity ratio.
- c. Problem with management.
- d. Faulty marketing assumptions.
- e. Over optimistic market projections..
- f. location that puts the business in a noncompetitive situation.
- g. Plant specifications are not met.
- h Unrealistically low operating cost projections that cannot be met.
- I Construction contract problems such as delays and overrun.

RISKS

Both the project owner and the Banks /lenders will likely encounter these risk issues and should work out strategies to minimize these.

- a. Market barrier?
- b. Customers defined?
- c. Any advantage over competition?
- d. Projected market share available?
- e. Market size?

M. LEGISLATION/GOVERNMENT

This is also an important consideration when planning to site bio-ethanol plant in Nigeria. We need fast tracking legislation that will back up for this investment. On Monday, 8th August 2005 president G. Bush signed a bill into law called energy security Act of 2005 also known as HR 6. This ensures that more renewable fuel is used by US motorists than ever before. On the 28th February, 2005 the top legislature in China passed the Renewable Energy law for the people of the republic of China. The Nigerian government has not projected the bioethanol industry this way like other countries. The Nigerian bio-ethanol legislation aims to;

- a. Promote the development and utilization of renewable energy
- b. Improves the energy structure
- c. Diversify the energy supplies
- d. Safeguard the energy security

- e. Protect the environment
- f. Realize the sustainable development of the Nigerian economy

We need a coalition of our 36 governors for renewable bio-ethanol, use by blending with gasoline. They must plan to support and encourage, potential bio-ethanol producers in their states. We can grow different feedstock to produce ethanol but we cannot grow petroleum. While petroleum is not renewable, ethanol feed stock is. The federal government through the governors, senators, house of Reps, private sectors, SON, NAFDAC, etc must quickly commence meeting and agreeing on the sustainability of this industry before the end of this current administration in 2019.

So, as plans and drawings and ground breaking are being proposed to build bio-ethanol plants in Nigeria, project developers and owners must keep themselves abreast of the direction and decision of the government on this world exciting project for better environment, job creation, and good reward for the farmers.

N. WORKFORCE DEVELOPMENT PLAN

You must plan for labor. Especially, the professionals that will operate the factory. As you commence ground breaking, you must start sending recruited staff for training. If you build plant before you commence recruitment, you may not get what you require. You may not be in position to include Nigerian content. You will depend on expatriates that could be expensive and exploitative. If your factory will be ready in 2years time, Plan for 1 to 2 years training for the key technical guys that will operate and manage the factory no matter how automated the factory. You may have to include the cost of this in your Feasibility Study. Right now, there is a shortage of workforce in the oil and gas in Nigeria. So plan for your staff too so that you can have a smooth business operation.

O. COMMUNICATION

Modern communication system is very important. Most Nigerian farmers now have cell phones for effective communication. GSM service is growing and we are in a world of wireless internet services/Vsat. DSTV coverage is excellent, turning the world into a global village. Think well of

this as effective communication could have a huge value adding to your bio-ethanol project proposal successfully.

p. **SAFETY**

Just like in any modern industry, industrial accident is a serious issue. More seriously, are repeated accidents such as fire, especially one that results into fatality. Safety ethics adherence is required from the beginning of bioethanol production to product distribution, marketing and utilization. Most cautions taken into consideration in an ethanol plant look elementary, but they are the fundamentals. They are the basics and necessary. Their non compliances could result in lethal consequences. Both plant and employees' safety are very crucial.. Safety plans and implementation in a bio-ethanol is as important as in the Aviation industry too. But both manufacturing and transporting of ethanol requires utmost caution. Spills and injuries can and do occur. Sticking to safety plans is necessary and productive to bio-ethanol operation. Any technology can be made safe if engineered properly. Give your bio-ethanol plant construction to Engineers that had credibly built such plants before. Be careful we deal with a lot of reactive, rather than proactive in Nigeria. Too often, an emphasis on safety is established after an accident.

With this dynamism and seeming growth, there are more inexperienced operators and managers that may hurriedly join the workforce. Therefore, employees' safety and health will become momentous. Safety and health program in line with OSHA (occupational safety and health administration) must be fully documented and implemented. Both new and veteran ethanol employees must be trained on the requirements of OSHA as a resource. In consonance with OSHA, bio-ethanol producers should conduct hazard analyses and compliance audits on a regular basis. It is expected that the proposed plant and ALL the employees will be fully and well insured against any eventuality. The entire ethanol plant management is responsible for the safety of all the Staff. Below are few relevant questions that you must ask

your plant designers to guarantee the safety of your bio-ethanol plant:

- ✚ Do you have written Standard Operating procedures...SOPs that include instructions for fire and explosion handling?
- ✚ Are storage tanks designed and laid out in accordance with tank failure precautions?
- ✚ Do you have written Start-up and shutdown SOPs?
- ✚ Will the plant have lock-out/tag-out and vessel entry SOPs?
- ✚ Will the plant design meet all regulatory bodies (e.g. SON etc) and professional bodies (e.g. Nigerian Society of Engineers, etc)?
- ✚ Are the plant designers, licensed and professional engineers?
- ✚ Will the plant lighting in the building explosion-proof, or could it be an ignition source?

Q. CORRUPTION

This is a single epidemic that distorts businesses in Nigeria for a long time. It has affected virtually all sectors of the economy. Though, corruption is global but you are a new entrant into a business that attracts carbon credit on a global scale. You are attempting to operate within the largest African country with the largest population of black-man concentration in Africa. In this era of President Muhammadu Buhari, you can be rest assured that you would not encounter much of corrupt practices in the course of implementing your bio-ethanol project concept.

R. TAXATION

Whether you are a local investor in Nigeria or a foreign bio-ethanol investor coming to Nigeria, you must know that Nigeria is a federalist country. By the 1999 constitution, taxes and levies are charged at 3 levels, i.e federal, state and local. The present government of president Buhari will not tolerate tax evaders in this industry. Tax in Nigeria is a compulsory monetary charge imposed by government on manufacturing companies, persons, entities, transactions or properties to yield public revenue. You will be inviting litigation that could lead to imprisonment if you evade tax in Nigeria. You may encounter illegal levies at the local government level where there can be fake tax collectors, unscrupulous revenue officers facilitating unlawful negotiation

and extorting bribes from taxpayers. You must intuitively identify them and avoid patronizing them. This is not a business that must be trivialized by this kind of shady deals with dishonest government officials at all levels. Be careful!!! The government at the centre can frustrate you by this act.