



OneWorld
Sustainable Investments

Producing Ethanol from Cassava in Nigeria

A pre-feasibility study for MASDAR



Appreciating your financial, social and ecological assets

June 2006

Introduction



Osprey Investments requires a pre feasibility study report on producing ethanol from cassava in Nigeria and has approached MASDAR Consultants who in turn have asked OneWorld to assist with the preparation of this study.

OneWorld has previously undertaken work in Nigeria in 2005 with respect to the industrialisation of cassava for starch and ethanol. In addition to the work carried out in Nigeria, OneWorld also completed work on the feasibility of cassava processing in Ghana and South Africa.

A core focus of OneWorld's business is in alternate energy feasibility studies and project development, with current and completed projects in bio-fuels, solar, wind and cogeneration in Africa and beyond.

This proposal lays out OneWorld's envisaged approach in conducting the pre feasibility study required by Osprey Investments and gives relevant project experience and profiles of the two consultants proposed.

A work plan, timetable and quotation are included.



OneWorld
Sustainable Investments

Technical Approach: An Overview



A comprehensive database and library of information on the international cassava industry is part of our resource centre, as is research and case studies on the bio-fuels industry, globally and for Africa. This will need updating both in the context of the specifics of this brief, as well as in response to the constantly changing and evolving market dynamics of the bio-fuels industry.

A global urgency to reduce greenhouse gas (GHG) emissions coupled with substantial fossil fuel (driven by oil) price increases is for example driving awareness of the alternative bio-fuels and a corresponding increase in demand. The upward trend in sugar prices is a reaction to growing world demand for ethanol as Brazil are putting more and more of their sugar plantations to ethanol production. Alternatives to sugar as a feedstock for ethanol are being examined and Africa is considered as having the potential for significant productivity, with identified possibilities being cassava, sweet sorghum and maize, to mention a few.

Value chain analysis of bio-fuel production has been a core element of the related work conducted by OneWorld, with corresponding input to university research work (University of Cape Town's Environmental and Process Systems Engineering Research Group) on economies of scale of bio-fuel and bio-gas plant size and capacity. A critical issue to be considered in the proposed work for Osprey is the relationship between raw material supply and reliability and optimum plant capacity utilisation. The cassava industry in Nigeria for example must be considered in terms of a number of factors, not least of which is logistics.

We propose to draw on past project experience, our knowledge base and our established network in producing a pragmatic and user friendly pre feasibility study on opportunities presented in ethanol from cassava production.



Technical Approach: Desk Research



Our understanding is that this is a desk based exercise and given the extensive fieldwork conducted by the proposed consultants in the Niger Delta (which has highly suitable conditions for growing cassava), this seems to be a feasible approach.

We also have an extensive contacts database for the Nigerian business, government and related NGO community and a reasonable network in the country, which could be augmented by the assistance Osprey could provide in further requisite networking to enable this exercise to be efficiently and effectively completed.

It is envisaged that the desk research would be complemented by telephonic interviews and further Internet based research, as well as team work and interaction with other bio-fuels experts in the OneWorld network.

We are located in Cape Town, with an office in Johannesburg. Our facilities include excellent broadband communications and telecoms as well as in-house research and administrative capacity to enable us to expedite this exercise effectively and efficiently



OneWorld
Sustainable Investments

Technical Approach: Context - The Ethanol Market



The current and future market dynamics and prospects for ethanol in the global, African, West African and Nigerian markets will provide context to the pre-feasibility study.

Ethanol has various applications and has long established value in the alcohol producing industry, in industrial grade form. A relatively new market has emerged using ethanol as a transport fuel mix and additive that reduced reliance on oil, at the same time as contributing to significant reductions in GHG emissions. It is envisaged that the pre-feasibility study will analyse these current markets and consider future scenarios.

This analysis will draw on the findings (summarised below) of the 2005 cassava work conducted by this team in Nigeria, 2005 as well as on other work conducted in Africa in the bio-fuels industry.



In 2005, the Nigerian market size was 180m litres of industrial grade ethanol, all of which was imported

- Kyoto Protocol and Convention on Climate Change Protection is placing increasing pressure on world ethanol production
- Global ethanol output currently at 10.2b gallons pa (40b l)
- Fuel ethanol production is set to increase this to 17.2b gallons by 2012 (5-10% annual growth)
- Globally, over 60% ethanol comes from sugar, Brazil provides 50%+ of world supply
- COP: 90l ethanol per 1mt sugar cane @ USD40/t
- Feedstocks are a diminishing resource and US are doubling corn based ethanol production



Technical Approach: The Business Environment in Nigeria



OneWorld proposes to update its information and review the current business environment in Nigeria.

This will be informed by the latest macro economic information and forecasts for the future of the economy as gathered from internationally respected sources.

It will include an assessment of the critical success indicators for a successful investment in ethanol from cassava production in the Nigerian business environment and culture. The following areas will be covered:

- The policy and regulatory environment (for example, with regard to inward investment into Nigeria)
- The fiscal environment - tax, duties and incentives
- General business conditions - logistics (transport), energy and water supply, etc.



OneWorld
Sustainable Investments

Technical Approach: Agricultural Environment



Location of any processing facility will have to take into account climatic and land issues as raw material supply must be close to the factory, given the bulky nature of the crop. The report will make recommendations as to the best locations in Nigeria taking into account these and other agricultural factors.

Raw material supply produced at a internationally competitive cost of production and that supply scheduled to meet the demands of a large scale industrial will be critical to the success of any investment.

Although Nigeria is largest producer of cassava in the world most cassava production is based on small scale subsistence farming. This model is unlikely to be ideal for a large scale industrial processing

Availability of agricultural inputs, (cuttings, fertiliser, chemicals) at competitive prices to enable high yields to be achieved to give a competitive cost of production is also critical.

These and other agricultural issues will be addressed in the course of the pre feasibility study.



OneWorld
Sustainable Investments

Technical Approach: Processing Plant Considerations



There are a number of important factors that have to be taken into consideration when considering the processing facility:

- Optimal Scale
- Selection of appropriate Technology (to the circumstances in terms of both immediate plans and envisaged developments)
- Capital Cost
- Infrastructure Requirements (e.g. energy supply and achieving a net energy balance)
- Raw Material Supply Model
- By-product utilisation (which includes waste matter management. A significant amount of organic waste and waste water arises from Cassava production with environmental implications)
- Management
- Availability of labour and skills

This analysis will be based on our experience which will allow us to make recommendations on the above considerations



Environmental and Social Issues



Large scale industrial production and processing of cassava into ethanol will have environmental impacts which should be mitigated.

Processing requires significant quantities of water which will need to be treated post processing to enable recycling. Also, a large volume of fibre is a by-product which can be recycled for use as a fertiliser through composting which in itself presents as a downstream business opportunity.

We will also cover the current legislation in Nigeria with respect to the Environmental Impacts and outline the process involved for compliance thereto

Nigeria is a nation of more than 130m people. This population is growing rapidly and the country is a complex mixture of ethnic, political and religious groups.

The growth (largely through foreign investment) of a substantial oil industry in Nigeria occurred in the absence of reference to local environmental and social impacts and opportunities with serious, negative consequences. The home of the oil industry is the Niger Delta, also home to the bulk of the nation's cassava production. The region's communities are sensitive which only serves to heighten the already established need for investors to thoroughly consider the environmental and social impacts and opportunities of their developments.

Our proposed approach is to provide a pre-feasibility study that has demonstrable reference to balancing the social and environmental impacts as well as assessing and realising the opportunities thereof. This means that consideration will be given to, *inter alia*:

- Employment potential (based for example on research and experience of the typical job yields of bio-fuel projects), both direct and indirect
- Community ownership and participation models (for example, communities could benefit directly from cassava processing by-product business creation)
- Water and effluent treatment processes
- Energy balance calculations (aiming at achieving a net energy balance)



Infrastructure Considerations



An investment such as the ethanol production envisaged will make significant demands on the supporting infrastructure and the investor will want comfort in the knowledge that the requisite infrastructure is in place and is reliable.

Our objective will be to identify the requisite infrastructure and to assess the current availability and reliability thereof. Where reliability / availability is in question (for example, in energy supply from NEPA), an assessment will be made as to whether or not there is a mitigating solution.

These will include

- Energy supply
- Water
- Telecoms
- Roads and transport logistics
- Storage Facilities
- Port / export Facilities

These factors will have an important bearing on region and site selection.



OneWorld
Sustainable Investments

High Level Economic Feasibility



It is recommended that this brief be treated as a ***pre-feasibility study*** which would facilitate a “stop/go” decision and a basis for determining further detailed investigation and analysis required and which could provide the corner stones of a business plan.

Whilst for example, recommendations can be made at this stage on appropriate technology selection, further work would be required at the appropriate point, to thoroughly investigate and select the technology based on factors such as cost, plant size, raw material supply / alternation, effluent treatment processes, etc.

Based on our assessment of the international ethanol market, knowledge of capital and operating costs of constructing and operating an optimal scale processing facility, OneWorld will prepare a generic excel based long term cash flow model with indicative internal rates of return to assist in decision making to proceed towards the preparation of a detailed financial analysis.



OneWorld
Sustainable Investments

Profile: Colin Watson BSc (Agric) MBA



With 25 years of experience in a broad range of agribusinesses in many developing countries in Africa and Asia, Mr. Watson has impressive commercial and analytical abilities in investment appraisal, project management, consultancy and skill transfer.

In 2005 he directed a team carrying out a study in Nigeria on the Assessment of different models of cassava processing enterprises for the south and south-east of Nigeria, including the Niger Delta.

In 2005 he led discussions with Government of Ghana around the investment by a South African consortium in the Ayensu Cassava Starch Company near Accra and was involved in a feasibility study on the development of a cassava production processing industry in the Makathini are of KwaZulu Natal in South Africa

Under a contract with the International Finance Corporation in 2003, Mr. Watson led an agribusiness opportunity assessment in Tanzania. His team identified agribusiness investment opportunities, including one for \$40 million in cashew processing. In 2002 Mr. Watson led a multidisciplinary team funded by the African Development Bank to identify and develop agro-industry investment opportunities in Ghana.

Earlier in his career Mr. Watson worked for Booker Tate in South Africa on the development of a sugar beet industry in the Eastern Cape and worked with The Commonwealth Development Corporation of UK , involved in managing businesses in The Gambia (floriculture), Papua New Guinea (oil palm) and in Belize (citrus)



OneWorld
Sustainable Investments

Profile: Belynda Petrie BA LLB



With over 6 years experience in the Energy Efficiency and Renewable Energy Sector and 20 years in the project management and human resources area, Ms Petrie has extensive knowledge in the area of alternative energy development and research as well as Business Plan Development.

Due to her renewable energy expertise she lead in the development of a Social Assessment and Social Development planning process for an international natural gas operator in South Africa.

She also led a project for SAWEP (South African Wind Energy Programme) funded by the UNDP, in identifying barriers to entry for a wind energy industry in Southern Africa and identifying mechanisms for overcoming these.

Ms Petrie is Project Director and Consultant for a Solar Power Marketing Study in Southern Africa. Her biodiesel knowledge includes per-feasibility studies on ethanol from Cassava in Nigeria and CDM analysis for a bio diesel project in Southern Africa.. She has worked extensively in Africa on biodiesel projects and has conducted a number of feasibility studies and assessments of ethanol production projects, cogeneration facilities (particularly in the sugar industry) and wind farms.

Ms Petrie has developed feasibility studies and business plans for a range of SMEs particularly in renewable energy and biotechnology. Ms Petrie currently advises the Western Cape government on energy issues in the Western Cape.



OneWorld
Sustainable Investments

Relevant Experience



Jan 2005: Cassava, Nigeria

Completed a two-month pre-feasibility study, social impact analysis and stakeholder engagement process under the auspices of the CEDP, a Nigerian special Presidential Initiative aimed at commercializing the cassava industry in Nigeria. The project culminated in a report and presentation to the clients and Government

August 2005: Cassava, Ghana

Developing turnaround plan for Ayensu Starch factory, a Presidential Special Initiative in Ghana for a consortium of investors from South Africa

May 2005: Cassava, South Africa

Pre feasibility study into the viability of a cassava starch processing factory in KwaZulu Natal, South Africa, looking particularly at the competitiveness of locally produced industrial starch with imported material.

April 2005 - October 2007

INSABA (Integrated Southern African Business Advisory)

An EU funded programme for which OneWorld is the Programme Manager for southern Africa. The programme is established to stimulate renewable energy for productive use and one of the South African projects is a bio-fuel development in the Eastern Cape.

2004 South African Wind Energy Programme

A Feasibility Study for the UNDP project funded by the Global Environment Fund and implemented in 3 phases. Phase 1 was to identify the barriers to establishing a wind energy industry in South Africa and making recommendations to overcome these. Phase 1 has been (just) completed and approved by GEFSEC and Phase 2 is about to commence.



OneWorld
Sustainable Investments

Work plan and timetable



Activity	Man Days
Literature Review & Analysis	3
Global Ethanol Market Study	3
Nigeria Business Environment	2
Agricultural Issues	2
Factory & Technology Considerations	3
Infrastructure & Logistics	2
Environmental and Social Issues	2
Generic Economic Model & Report	8
Total Days	25



OneWorld
Sustainable Investments

Our Proposal



We trust this approach meets your requirements and remain flexible in meeting your needs.

We envisage that aforementioned study will take three weeks (with 25 man-days) from the time of signing a contract at a cost of £8750.00. This does not include disbursements (such as telecoms costs), which will be paid on a reimbursive basis and will not exceed 10% of the consulting fees.

Our preference would be to present the report as a power-point deck plus an excel financial model, which we find to be an excellent way of presenting a pre-feasibility study report of this nature.



OneWorld
Sustainable Investments

The End



OneWorld
Sustainable Investments