

"Farming for Energy, for better Livelihoods of Tanzanians"

Project Name: Biodiesel Production for Transportation in Tanzania. - An Integrated Approach to Supply Fuel and Poverty Reduction in Tanzania

SEECO LIMITED

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Executive Summary

SEECO (Ltd) is a subsidiary non- profit sharing Company owned by TaTEDO. It is legally registered and incorporated in Tanzania under the Companies Ordinance (Cap.212) as limited company by guarantees in the year 2001 with a Certificate of Incorporation number 41001. It is located in Kijitonyama area, Dar es Salaam Tanzania within TaTEDO offices. SEECO is an autonomous entity dealing with commercialization of proven renewable energy (RE) and energy efficiency (EE) technologies and services. The goal of the company is to produce and sell in large scale, improved energy efficient products, technologies and services, plan and implement environmentally sound energy business projects on commercial fashion. For the purpose of this business plan, the company intends to promote the "concept of farming for energy" through provision of full technological cycle of production of energy crops: cultivation of jatropha for oil seed, process them into oil and finally production of jatropha oil, biodiesel (diesel obtained from jatropha oil and compost manure. Its founders and first Directors are Mr. Estomih N. Sawe, Mr. N.C.X. Mwihava and Mr. A. E. Ndilanha. The starting capital of SEECO (Ltd) is USD 2,095,000. The founders will also take up the executive responsibilities of the company

The company's biodiesel project will be implemented in Northern zone regions of Tanzania (Arusha and Kilimanjaro) and will consist of:

- a Jatropha plantation of 5000 hectares;
- an outgrowers scheme of jatropha farmers of 5000 hectares;
- a jatropha oil mill for the production of crude jatropha oil (CJO) and
- a biodiesel production unit.

This project will start in 2008 and will be a joint venture between the Company and the Tanzanian Local Government Authorities of Arumeru, Hai, Moshi, Rombo and Mwanga district. SEECO has already ensured 1,000 hectares of land for its plantation in Kirya village, Mwanga district. This business plan has been prepared to the attention of potential investors that have shown willingness to support SEECO and more specifically the start-up of its biodiesel project. Total investments for the project over the next years will exceed the amount of USD 3.0 million. Most of this will be provided by the project itself through permanent re-investment of its profits. Specialized development funds such as the CER will be another main source of finances, which will be tapped into from 2010 onwards.

Background

The agricultural sector can to a large extent meet the energy needs of the modern economy: biomass for heating and for electricity plants, fuel for the whole transport sector. While technically this has always been possible, the availability of cheap fossil oil since the onset of the industrial revolution made the idea irrelevant for decennia. Today, petroleum prices are on the rise due to increased demand, increasing environmental requirements/concerns and by supply constraints. The latter have been predicted long time ago by the late Dr. Hubbert, a world leading oil scientist who stressed that petroleum is a limited resource that will be depleted one day.

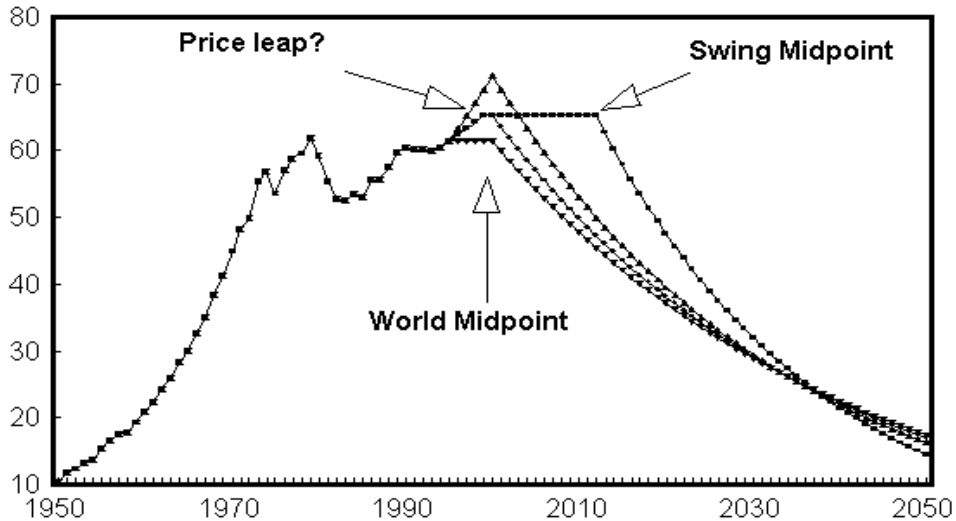


Figure 1: Past and Future Global Oil Production, in billion barrels per year (source: Dr. C. J. Campbell, 1996)

Dr. Campbell, another leading exploration geologist, put some available data in a graph in 1996 (see Fig. 1). The four different lines correspond to different possible scenarios taking place from 1996 onward. The World Midpoint indicates that half of the resources are used. Under the 'Price Leap' scenario, output of crude petroleum peaks as a result of high prices on the market. This may well be what the world is currently experiencing. However, as the resource is limited, a higher peak can only lead to an earlier depletion. Note the first peak that corresponds with the energy crisis in the seventies.

Nuclear fusion and hydrogen are seen as probable energy sources for future societies. However, these technologies are not yet on the shelf today. On the contrary, bio-fuel technology is readily available and even price competitive. Indeed, over the last year's crude oil prices became comparable with some of its vegetal alternatives, as can be seen in figure 2.

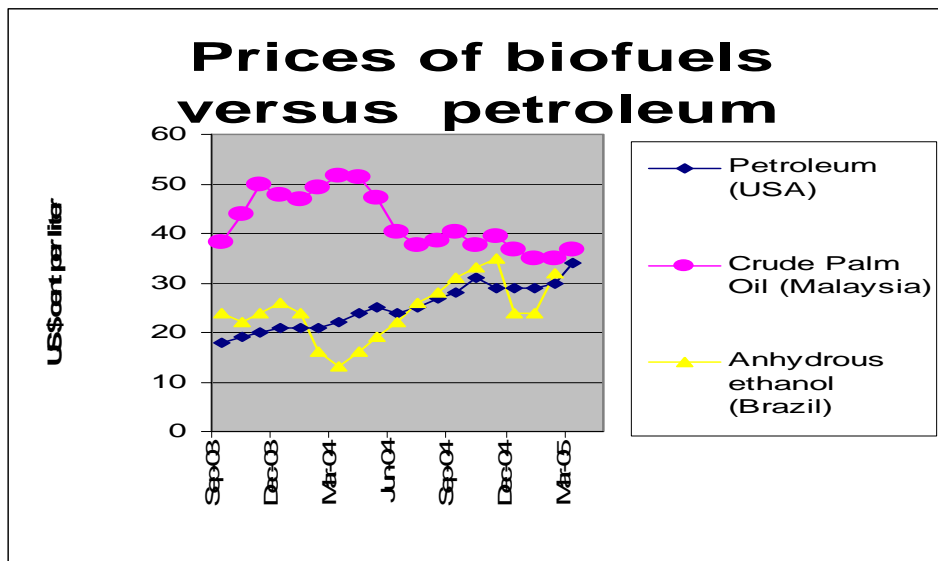


Fig.2: Prices of biofuels versus petroleum (Sources: NYSE, MDEX, and ESALQ)

The world fuel market is worth more than US\$ 1000 billion per year. Occupying even a fraction of this giant market represents a major opportunity for agriculture. No wonder then that the global production of fuel ethanol (to be blended with gasoline) and biodiesel¹ is starting to grow spectacularly (see Fig. 3).

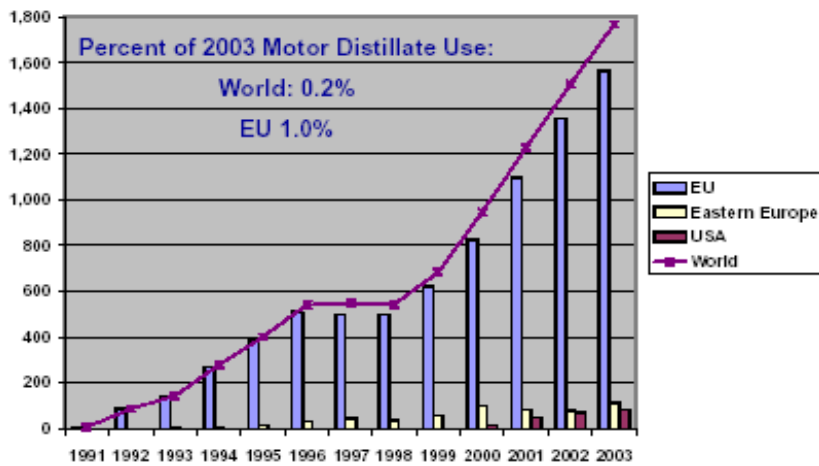


Fig.3: Biodiesel production capacity, in million liters (1991-2003) (Source: IEA)

¹ Biodiesel is produced by modifying vegetable oils and reducing their viscosity by various methods.

Farming systems in the tropics are very competitive for energy crops. For instance, the sugar cane's productivity is three times the one of sugar beet. Brazil is the world's undisputed number one sugar producer and it introduced fuel-ethanol since 1980. Similarly, other crops productivity (oil palm's and jatropha) are far superior to their competitors from the temperate regions; rapeseed, soya or sunflower. Non edible Crude Jatropha Oil (CJO) is the cheapest oil on the market and is no more expensive than crude petroleum. Taking into account that the refinery of pure plant oil (jatropha oil) is simpler than the refinery of petroleum, one may understand that a new era has begun. **'Farming for Energy' will soon outpace 'Farming for Food'**. Not only will biodiesel obtained from jatropha oil be price competitive with conventional diesel, the by-products obtained during its production has also other useful use. The jatropha oil cake produced during the extraction process can serve as feedstock for biogas and compost manure production. This gas can be used for heating, cooking or for electricity generation to finally improving livelihood. Unlike the trade in food and feed, the trade in biodiesel will not be hampered by financial barriers nor by sanitary or phytosanitary barriers. The technology for biofuel production is available to all. Biofuel technology has limited economies of scale, which means that small plants can compete with big ones. Biodiesel plants for instance can be tailored to the size of small towns, villages, schools. It can even be made in someone's kitchen.

Jatropha curcas as an Energy plant

The promising non-edible biofuel oil based plant in Tanzania is *Jatropha curcas*. Jatropha grows well on marginal lands of Tanzania with more than 600 mm of rainfall per year, and it withstands long drought periods. It also does well in areas where the rainfall is only 250 mm, but the humidity of the air is very high. Yield is obtained in the second year of establishment, reaching full production in the fifth to sixth year, once the plant start production it continues for the next fifty years. Jatropha plant is scattered and known by majority of Tanzanian since a long time, but its utilization was limited to the use of the plant as protection hedge around homesteads gardens and graves

Project Description

SEECO biodiesel production for transportation project aims to promote the concept 'Farming for Energy'. The company intends to venture into the production of jatropha seeds that will process biodiesel from jatropha oil, a fuel which is renewable and environmentally friendly. The by products of this project are biogas that can be used for generating electricity, cooking or other uses, and compost manure. SEECO (Ltd) wants to become a major and leading company in biodiesel production and marketing business in the region for the decades to come. Initially it will put emphasis on growth and sustainability. The biofuel market is so immense that SEECO has no reason to fear competition. As in the development of more efficient technologies, SEECO will always be one step ahead of its competitors. The company will foster partnerships with other entrepreneurs, smallholder farmers and both local and central governments, aimed at the production of jatropha oil, bio-diesel and their by-products. The project will contribute to local community development through creation of employment thus reducing poverty, by subcontracting part of the jatropha oil production, by encouraging local entrepreneurship and by supporting local education and health institutions.

The company is headquartered in Dar es Salaam, Kijitionyama area but this project will be implemented in the Northern zone regions of Arusha and Kilimanjaro. The reasons for

choosing the Northern zone regions to host this project are well illustrated. The regions are at the moment famous for jatropha production. The crop is being raised and intercropped with other crops. Another reason for choosing these zone regions comes from the fact of its well climatic conditions and fertile soils. Currently the crop is grown in many sites of the project area as protective field hedge and there are several farmers who are already engaged in the cultivation of jatropha for oil production, making soap and in other uses such as medicinal herb. Jatropha oil offer decentralized and localized source of reliable fuel for running vehicles and generators instead of mineral diesel which is imported in the case of Tanzania. The growing of the jatropha will be a very important source of income and employment opportunities for farmers in the project area. According to KAKUTE, one of TaTEDO's associate, more than 20,981 jatropha plants have been distributed and planted in the proposed project regions area of Monduli, Mto wa Mbu, Selela, Longido and Namanga in Arusha Region. Out of the 20,981 Jatropha plants, 12,329 are managed by KAKUTE and 8,652 plants are managed by women groups in Monduli District. The biodiesel from jatropha seeds will be used as alternative fuel to petrodiesel fuel. This can lead to lower petro-diesel consumption and reduced CO₂ emission. Moreover, the fuel will reduce country over dependence on imported petrodiesel. SEECO biodiesel project main focus is on producing curcas oil and installing biodiesel plant with capacity of producing on average 12,000t/year. To meet this objective, the proposed project will be implemented in two phases.

Phase 1 (Starting 2008) - As SEECO aims at marketing biofuels, its first priority is to ensure a stable feed stock for its oil refinery. This phase will comprise of the development of a jatropha plantation (5,000 hectares)²; development of an out grower scheme (+ 5,000 hectares) and construction of a jatropha oil mill. A combination of company own estate and an outgrower's scheme is the best guarantee for this. Phase 1 will also produce jatropha oil cake as a by-product. This cake can be sold as animal feed, or it can be fermented to yield high quality compost manure. The three elements of phase 1 therefore constitute the foundation of a healthy jatropha oil business. The income generated by phase 1 will allow SEECO to progressively develop the plantation and to prepare for phase 2. Farmers will be subcontracted and in order to provide the necessary farm input upfront capital cost, the subcontracted farmers will be assisted to develop viable business plans so as to access credits from micro-financing institutions.

Phase 2 (Starting 2009) - A biodiesel production unit (capacity 12,000 tonnes/year). As soon as the supply of crude jatropha oil (CJO) will allow for it, SEECO will embark on biofuel production. The Tanzania Local Government Authorities of the project regions will be SEECO's partner and has been earmarked to be the privileged client. With diesel prices in Tanzania at TZS 1300 per liter (about one US Dollar per litre), the adjective 'privileged' is by no means an exaggeration. While Phase 1 allows for immediate cash generation, the transformation of CJO into biodiesel will increase the profitability of SEECO.

Basically, the second phase will involve installing oil pressing and low cost biodiesel processing plants, operating the plants and selling biodiesel to the identified fleet companies (Coca Cola Company, Vodacom and Tanga Cement). Activities for this phase will start twelve months after the first phase. The produced biodiesel will be sold to the fleet companies of these identified companies and other clients who will be interested to buy the product in the course of marketing undertaking. In the course of using biodiesel

² Mwanga District Local Government has already pledged 1,000 hectares to SEECO for the development of its plantation.

oil for their vehicles; they will eventually reduce greenhouse gas emission, which would have occurred otherwise not happen, in the absence of this project.

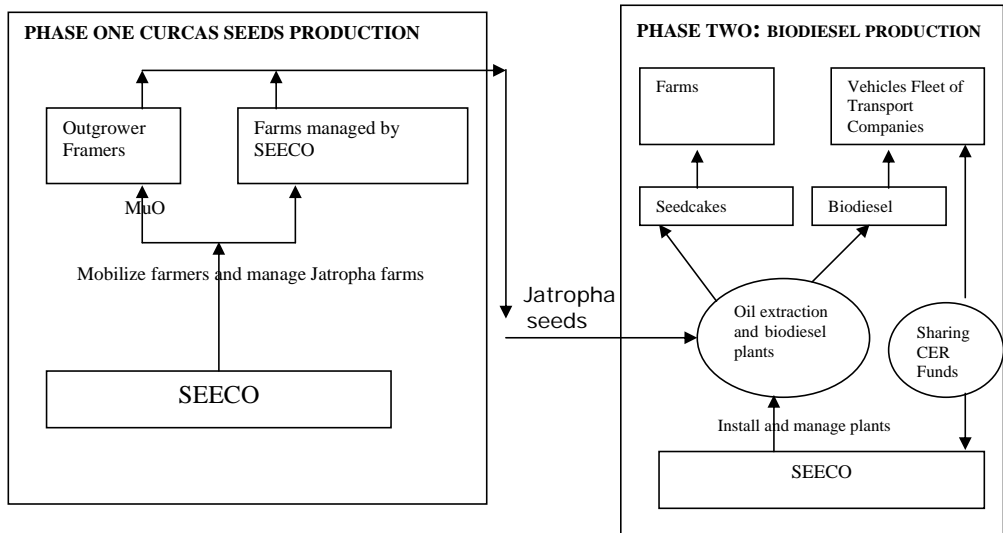
Project objective

The overall objective of this project is to reduce greenhouse gas emission through the use of biodiesel from *Jatropha curcas* oil, a none-edible drought tolerant wild plant.

Specific objectives:

- To produce bio-diesel from Jatropha seeds to substitute fossil diesel
- To support other local economic activities resulting as by products – glycerin industries, cake for biogas plants to improve livelihood of people where this business will be operating and in Tanzania as whole.
- To support local entrepreneurs and companies to develop biodiesel business thus reducing poverty.

Project Schematic



Project rationale

Tanzania’s need for petroleum is growing at an alarming rate. The country is currently the largest consumer and importer of the fossil fuel in the region. Since petroleum is a finite source, renewable fuels, such as biodiesel will help alleviate this dependence. Renewable fuels are ideal petroleum extenders, because they can be produced from locally grown feedstocks. Two primary drivers for the potential increase in production and use of biofuels in Tanzania are:

- Fuel shortage: The petroleum products demand in Tanzania has doubled in the past two years.
- Air quality: ownership of automobiles has been increasing at an explosive rate, contributing not only to the fuel shortage, but also air pollution, especially CO₂.

Based on these drivers, the Government of Tanzania has concrete plans to find a way of reducing the growing demand of fuel for transport through production and use biofuels. A great deal of interest is also emerging in the production and use of biofuels.

Tanzania depends heavily on the import of petroleum products for most of its transportation sector. The annual demand for petroleum products is more than 9 million barrels. The average import value of petroleum products per year is USD 700 million, which is more than a quarter of total foreign currency earned in the country per year. The transport sector alone consumes 40% of all petroleum products imported, followed by manufacturing 25%, households 10% and the remaining is accounted for by agriculture and commerce. Spending such huge amount of foreign money for a poor country like Tanzania jeopardizes other development and poverty reduction initiatives. The existence and the fast increase of *Jatropha* activities have been proved to be one of the local solutions for energy services in Tanzania and piloting has already in two sites in project areas (Engaruka nad Leguruki in Arusha region). Since energy is the critical input for attaining National Strategy for Growth and Reduction of Poverty (NSGRP)³ target and Millennium Development Goal Seven (MDG)⁴ whose focus is to ensure environment sustainability, therefore the proposed project is in line with National and international targets. Furthermore, the proposed project is in line with Tanzania National energy policy⁵, whose focus is on the provision of energy services (in transport sector, end users etc) in environmentally sound manner.

Progress year to date: Since the year 2006, SEECO has committed time and resources to initiate this project development. An effort of securing land for farms has continued and 1,000 hectares out of the targeted own farm hectares have been secured in Mwanga district. Survey of this farm to title deed processing is progress. Community consultation as well as out grower farmers mobilization has been done to all project districts of Arumeru, Hai, Moshi, Rombo and Mwanga and response from local government authorities is very much positive. MoU signing is also in progress.

Recent meeting of the company Directors revealed that SEECO is ready to start project farming operations, be it that the current seed production capacity is low when compared with what the business plan states. Nevertheless SEECO remains on track to be the very first biodiesel producer in Tanzania, and as such a beacon to others. SEECO has also extended negotiations with other investors (UNDP, CIDA, UNEP through AREED project etc) some of which have already indicated interest on this venture. The outcome of negotiations with these financiers is awaited, with hope that AREED will be one of them. The promoter has demonstrated serious commitment on development of this business and securing financing for this project will indeed one day be remembered as a big milestone for sustainable energy production in Tanzania.

The CDM and Carbon Revenue.

This project idea was conceived and developed to venture into new sources of African Finance – Carbon Trading. Innovative countries are starting to finance new projects through the Kyoto treaty, which allows industrialized nations to cut emissions by paying for pollution reduction in the South. The Kyoto treaty, which entered into force February 16th 2005, is the first legally binding treaty on the environment. The treaty structure holds governments accountable for meeting their emissions reduction targets, but also encourages them to harness the free market to do so through their industries. Under the Kyoto Protocol, each industrialized country is assigned a legally-binding greenhouse emissions quota, which it must meet or face penalties. The treaty allows polluters who fail to curb their pollution sufficiently to purchase emission reduction credits from another company that produces a surplus or from a project in the developing world under the Clean Development Mechanism (CDM) of the treaty.

The Clean Development Mechanism, one of the treaty's three market-based mechanisms, was conceived as a way to allow industrialized countries greater flexibility in meeting their

emission targets, while at the same time transferring cleaner technologies to developing countries so they can build cleaner technologies into their own economic development programmes. The investors can thus identify projects in the developing world that will reduce emissions and negotiate an agreement with the project developers to purchase the Certified Emission Reductions or CERs generated by the project.

Greenhouses gas emissions by the baseline scenario

The baseline for the proposed project is the amount of mineral diesel that will be substituted by the use of biodiesel fuels. The project will require the carbon credit for 21 years starting from second year of operation.

The produced biodiesel will be sold to contracted fleet companies. The consumed biodiesel will be monitored based on the volume sold from the production plant. The parameters to be monitored to verify emission reductions are taking place include emission outputs, energy production, energy sales and environmental impacts. The specific elements of the monitoring plan will include:

- ✓ Calculation of CERs
- ✓ Project data needs
- ✓ Sustainable development goals or indicators

Project Additionality

In the absence of the propose project all vehicles will continue to use mineral diesel since there is no regulations that require use of biodiesel in the country.

Technology description

Biodiesel is a fuel that can be produced through many ways; one of the most common is a chemical reaction, known as trans-esterification, of vegetable oil or animal fats and alcohol in the presence of a catalyst. Virtually all types of vegetable oils (triglycerols) ranging from refined, crude, animal fast and post frying used oil can be used as a raw material Biodiesel is a renewable energy that can be produced anywhere in the world where oil seeds can grow. Unlike fossil fuel, which adds carbon dioxide to the atmosphere, biodiesel creates carbon cycle with a net zero carbon dioxide emission. The cycle begins with plants taking up carbon dioxide from the atmosphere for the growth. The combustion of biodiesel in diesel engine releases no carbon dioxide to the atmosphere and the cycle begins again. Biodiesel is therefore one of the renewable energies of choice of mitigation of climate change through stabilization of Carbon dioxide concentration in the atmosphere.

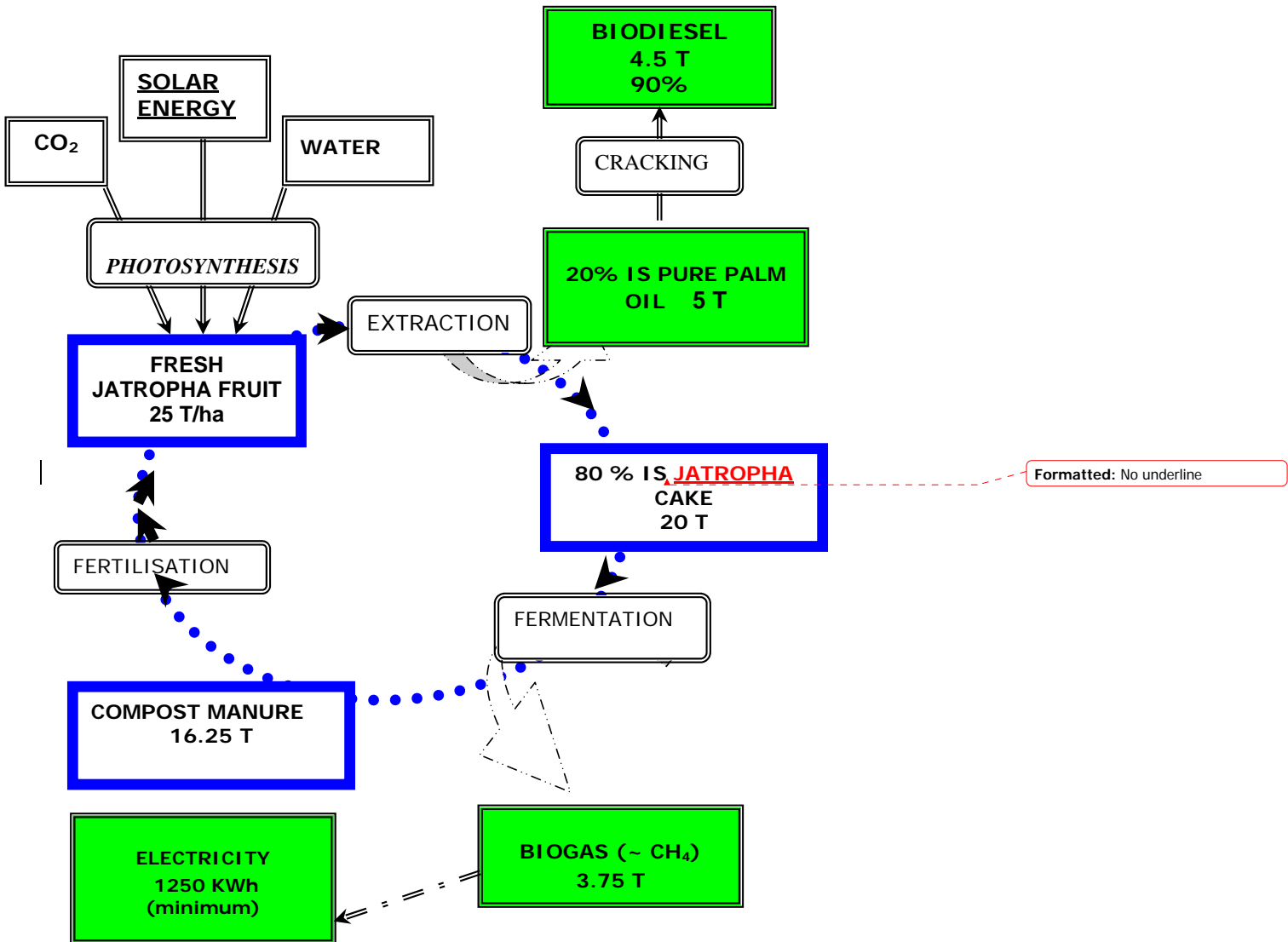
The technology of producing biodiesel is simple. Biodiesel can be produced at a near room temperature and atmospheric pressure without sophisticated equipment. The reaction takes place when jatropa oil is mixed with alcohol in the presence of a catalyst to form biodiesel (Alkyl Ester) and glycerol. The catalyst may be a strong acid such as sulphuric acid or a strong base such as sodium hydroxide or potassium hydroxide. The strong base is preferred to strong acid because it is easy to handle, the rate of reaction is high and the amount of oil converted to biodiesel is also high. The rate of reactions affected by other factors such as temperature, stirring and oil acidity

Biodiesel can be used in any concentration with petroleum based diesel fuel in existing diesel engines with little or no modification. Biodiesel is not the same thing as raw vegetable oil. It is produced by a chemical process, which removes the glycerine from the oil. Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend. Biodiesel is simple to use, biodegradable, nontoxic, and essentially free of sulfur and aromatics. Biodiesel is made through a chemical process

called transesterification whereby the glycerin is separated from the fat or vegetable oil. The process leaves behind two products -- methyl esters (the chemical name for biodiesel) and glycerin (a valuable byproduct usually sold to be used in soaps and other products)

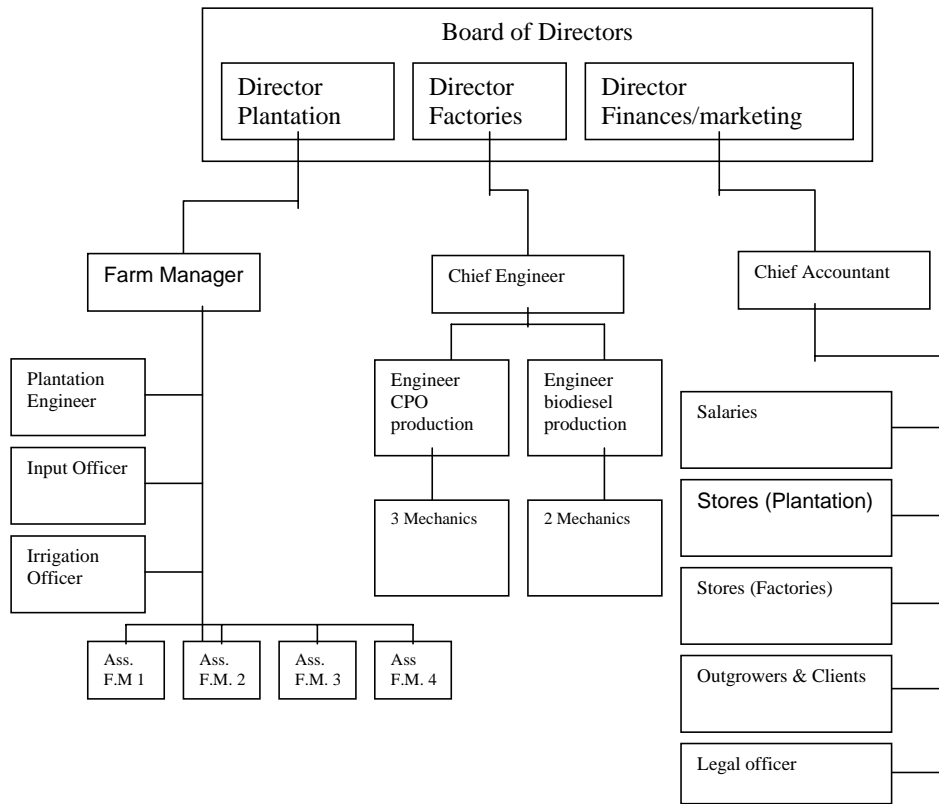
SEECO FLOWSHART

ANNUAL PRODUCTIONS PER HECTARE OIL JATROPHA PLANTATION



Management issues and operational relationships

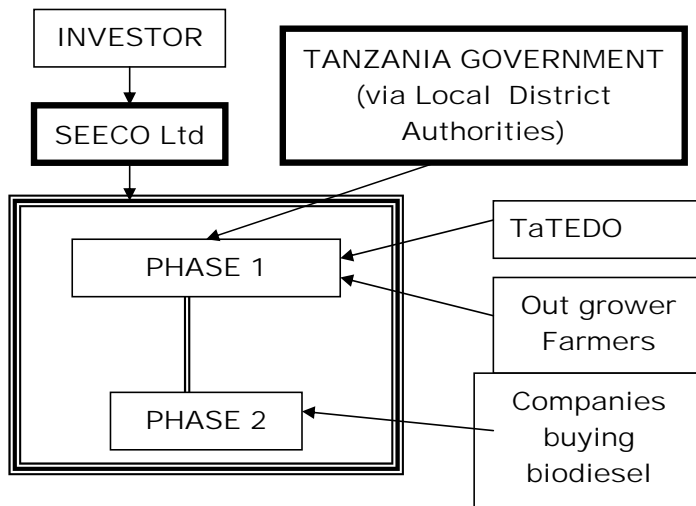
Executive set-up



Key: F.M = Farm Manager

Project Institutional Architecture

The operational relationships of the project are given in the figure below.



SEECO (Ltd)

SEECO is a Tanzania based company. Its Directors will bring together academic knowledge of agronomy, chemistry, finance and business administration, and their more than five years practical experience in modern energy service provision and project management to this project. However the company will source out in-country expertise on biodiesel production partners who may also be a strategic partner (s) and potential funders of this project. The Directors will have the executive responsibilities of the project and will invest through passion and experience. Individual and Group Membership will be open to other entrepreneurs who want to progress into biodiesel production or its related businesses.

Out grower Farmers (smallholder farmers)

Half of the feedstock of the biodiesel factory, will be procured from thousands of local smallholder farmers, organised in an outgrower scheme and associated to the project. These smallholders are crucial to SEECO success, and the project will treat them as such. The complementarities are clear: the participating farmers will increase the production capacity of the project, while the extraction/refinery plant will constitute a stable market. The farmers will be trained and supported in the production of oil palm and they will receive good prices for their products.

In a radius of 25 kilometers from its plant, SEECO will set up a network of trading points where the farmers can sell their jatropha seeds on a regular time schedule. SEECO will bear the cost of the trading network, and thus help the famers get access to the market. 60% of jatropha seeds will be transported on average 50 kilometer to get them to the plant. To this end the project will put on the road five (bio-diesel) trucks.

The outgrower groups will be consulted when relevant policy decisions are to be made. The estimated supply of jatropha seed to FELISA by out grower farmers represents a significant market share for the local farmers, which is equivalent to 1000 thousand full-time jobs.

Another opportunity to local workforce is the direct employment created by the SEECO project. Besides the three directors, the full grown SEECO in this project will employ about five (5) senior officers, forty (40) junior staff (drivers, mechanics, agricultural extension staff, and several hundreds of casual labourers. Local entrepreneurs will be encouraged to take advantage of the many spin-off activities that will come from SEECO. The company will be a major job creator in project regions, both direct and indirect.

The Government of Tanzania

The regional and district authorities are another crucial partner in the project as they will facilitate the project's integration into the local society and economy. They have a great role in awareness creation and in the connection of the farmer community with the production plant through a well maintained rural road network. During the start-up of the project the local authorities will also be requested to assist SEECO find office space and accommodation. The Government of Tanzania will also be invited to participate in this project as an important collaborating stakeholder of SEECO Ltd.

The Tanzania Ministry of Agriculture and Food Security (MAFS) through District Agricultural Extension Staff has since the onset subscribed to the efforts of this project. As an input to the implementation of the Project, MAFS in collaboration with the regional and district authorities in the project sites will assist in:

- establishing the company;
- collecting basic data necessary for project development;
- identifying the project site;
- establishing capacity and modalities for contract farming and management of the outgrower-scheme.

The Government of the United Republic of Tanzania has also formulated a biofuel promoting task force which will boost the marketability of this new commodity. The government could for instance decree the compulsory blending of diesel with a certain percentage of biodiesel. The Government is also a guarantor of SEECO's wellbeing, by protecting the project against hostile forces. For instance, the young company should be granted a monopoly for biofuel production in the project area for ten to fifteen years so as to allow it to consolidate. While the project will build a clinic and a school for its staff and the neighbouring communities, Government will be invited to pay for the nurses and teachers.

The Tanzania Investment Centre (TIC)

The Tanzania Investment Centre is the primary agency of Government to coordinate, encourage, promote and facilitate investments in Tanzania and to advise Government on investment related matters. The TIC is the company's privileged investment facilitator. TIC is committed to assist SEECO:

- To obtain the Certificate of Incentives;
- To obtain necessary licenses;

- To obtain residence permits for its foreign staff if required;
- To obtain and registrate the requested 5.000 hectares of land;
- To secure this SEECO investment.

This project is in fact, an agricultural project and agriculture is a Lead Sector of the Tanzanian economy. This will allow the project to enjoy several investment incentives. Some of these are tabled below

Table 2: TIC incentives for investments in agriculture

	Duty	VAT
All capital goods	0%	Deferred
Agricultural Machinery/equipment	0%	Exempt
Fertilisers & pesticides	0%	Exempt
Farm implements and other inputs	0%	Exempt
One non utility Admin. Vehicle	0%	Deferred
Corporate tax	30%	
Capital allowance	100%	
Withholding tax on Interest on Foreign Sourced Loan	0%	
Withholding taxes on dividends	10%	
Losses carried forward for five years		

Source: TIC

The TIC can help the promoters in finding the best financing arrangement through its knowledge of the world of international financing and more specifically the development funds. The project funding is expected to come from the Clean Development Mechanism (CDM). Indeed, under article 12 of the Kyoto Agreement which is now in force, developed countries can fund emission reduction projects in developing countries and receive credit for doing so.

Specific project activities

SEECO (Ltd) is a renewable energy service company registered and established in Tanzania in the year 2001. The company name is an acronym that stands for '**Sustainable Energy and Environment Company (SEECO)**'. Its founders and first Directors are Mr. Estomih N. Sawe, Mr. N.C.X. Mwiha and Mr. A. E. Ndilanha.

The proposed project will involve the following set of activities: -

- **Capacity building.** SEECO will contract and make use of TaTEDO expertise to build its own capacity in undertaking CDM activities especially on registration of the CDM projects and monitoring of the outputs. Nonetheless farmers capacity on business planning and management will be built to enable them to prepare viable business plans so as to access loan from financing institutions (Micro finance Bank, CRDB Bank and National Bank of Commerce) to develop commercial Jatropha farms.
- **Production of Jatropha seeds.** SEECO will undertake this by securing land, planting and managing a farm of about 5000 ha. Currently, SEECO has already secured about 1,000ha. The 4,000 ha have promised from other project districts

as follows: Arumeru 1,200 ha, Hai 1,500 ha, Moshi 800 ha and Rombo 500 ha. (Source: Field visit and discussion with district authorities) The land secured is located in Kilimanjaro region. Also the same company will subcontract farmers to grow Jatropha as a cash crop selling seeds to the project. It is assumed that in totality, the out grower farmers will manage 5000ha. SEECO has already identified sixty (60) collaborating farmers in project districts and many more enquiries are being received on monthly basis. The identified famers are currently growing the jatropha in small scale and sell them to soap making individuals.

- **Installation of oil expeller and extraction of oil:** The size and type of the oil expeller will depend on size of farms that will be producing Jatropha seeds. One hectar of farms is estimated to yield seed that can produce an average of 1000 – 1800 litres of jatropha oil. The oil expellers with a capacity of one ton per hour will be sourced from locally company known as Suderata located in Arusha Region in north part of Tanzania. This will improve the processing technology from the current hand driven machine used by other small jatropha seed dealers like KAKUTE to mechanized one. Operation of the machine will start in the second year of the project period when adequate production of seeds is assured.

- **Installation of biodiesel production plant and production of biodiesel;** As soon as the production of curcas oil will allow for production of biodiesel, SEECO will install a biodiesel plant and start production. The technology involved will separate glycerol from curcas oil through a chemical process of transesterification. The biodiesel will be sold to the fleet companies and glycerol will be sold to the women groups and being used as materials for soap production.

- **Market and distribution of biodiesel:** SEECO will contact Tanzania Oil Marketing Association, an umbrella responsible for monitoring and controlling of fuel distribution companies in Tanzania to facilitate agreements with fleet companies who will be willing to purchase, distribute and/or use the produced biodiesel in their vehicles. Actual marketing and distribution will be done company special staff to ensure standards, regulations and conditions are adhered to. This will be done after the product has already being tested and approved by Tanzania Bureau of Standards (TBS). Currently standards of biodiesel product are being worked by TBS in collaboration with National Biofuel Task Force recently established in Tanzania.

Expected project financial and non financial returns

Supporting this project will greatly contribute to Tanzania economic development in a way that is economically, socially and environmentally sustainable as follows:

- **Saving of the National Foreign income:** Tanzania depends heavily on the import of petroleum products for most of its transportation sector. The annual demand for petroleum products is more than 9 million barrels. The average import value of petroleum products per year is USD 700 million, which is more than a quarter of total foreign currency earned in the country per year. Spending such huge amount of foreign money for a poor country like Tanzania jeopardizes other social and economic development and poverty reduction initiatives. Successful implementation of this investment will be a big win to Tanzania economy.
- **Energy security benefits:** With agricultural commodity prices approaching record lows, and petroleum prices approaching record highs, it is clear that more can be done to utilize domestic surpluses of plants and vegetable oils while enhancing energy country's energy security. Because biodiesel can be

manufactured using existing industrial production capacity, and used with conventional equipment, it provides substantial opportunity for immediately addressing country's energy security issues.

- **Income generation:** Improved quality of the jatropha oil because of the existence of a perfromant oil extraction mill in the region. Farmers will earn more income thus becoming socially and economically better- of
- **Creation of new job opportunities:** The production of energy crop will employ hundreds of rural labourers and by so doing will boost the local economy. Application of 10,000 ha for Jatropha cultivation is estimated to create approximately 5,000 new jobs
- **Creation of new industries:** Local entrepreneurs and others will see many investment opportunities in the spin-offs of the biodiesel production.
- **Added value to land:** The proposed investment is making use of huge bush land thus giving it more value which could not otherwise obtained in absence of such investment.
- **Healthy benefits:** Using of biofuels have substantial reduction of poisonous gases such as Lead, SO₂ and CO₂ thus reducing chances of cancer and respiratory infections
- Improved environment through reduced greenhouse gas emissions. Environmentally, biodiesel is renewable; it has a net zero carbon dioxide – a global warming gas emission. This makes biodiesel an ideal option for climate change mitigation
- Partnership with other stakeholders – outgrower farmers, local and national stakeholders in biodiesel production and marketing etc.

Main Risks and Mitigation Measures:

- **Supply of Jatropha seed:** On 2004 jatropha seed production was about 6,000 tonnes in Tanzania per year and production is increasing over years at an estimated of 5% a year. This is a result of many more farmers becaoming aware of the potential jatropha crop has. A combination of project owned estates and out growers scheme will take care of this risk. Supply is sometimes irregular in quality, quantity and price. In order to link up supply and demand the project will process the oil to a quality standard that is beyond the current capacity of hand driven extraction mills the farmers are using.
- **Investment climate:** Tanzania is a politically stable country with long history of democracy respect. The government has created the enabling environment and is playing its facilitating role through its centre (Tanzania Investment Centre) effectively to enable private sector players to participate in the energy sector to disseminate and scale-up access to modern and cleans forms of energy. Such incentives like "guaranteed profit repatriation and expropriation of assets provision" are meant to put this risk at minimal
- **Exchange Rate Risk:** Fiscal discipline plus a tight monetary policy are used to keep the inflation low. Consumer inflation in local currency has continued to decrease from 5.4% in 2005 to 4.5% in June 2007 where as the real GDP growth remain 5.9% in 2006 and is expected to hit 7.4% in June 2007. Exchange rate risk will be mitigated by specifying USD for all financial transactions
- **Competition:** At present there is no such a project on commercial basis in Tanzania. However competition will be attracted as others become aware of the huge potential the project like this one has. Project developer's knowledge and experience by the time this happens would provide it a competitive edge that will enable to compete effectively.

- **Drought:** Being an agricultural enterprise on which farmers rely on natural climatic conditions, drought season may devastate company operations. Irrigation from lake Tanganyika is being planned to supplement for rain shortage, although experience of serious drought have not been recorded for the past ten years
- **Market for the biodiesel:** The regulations are yet in place something that might pose difficulties in marketing the biodiesel. The recently appointed biofuel Task Force in Tanzania has been assigned to prepare and put in place regulations that will govern biofuel production and marketing in Tanzania. It is expected that the Task Force will have regulations in place by the time this project will be starting producing biodiesel in January 2008
- **Biodiesel standards and test rigs, regulatory environment, quality of biofuels**
Biodiesel standard is not yet established in Tanzania. The Biofuels task is in process of developing the rules and regulations concerning the biofuels production and use in Tanzania.
- **Financing of the project**
Project financing is another risk belongs to the project. The risk can be overcome by securing funds from various donors who are interested with climate change programme. Also the CDM funds to be obtained from the project will be used to pay back loan from the banks and other investors.
- **Availability of land**
Availability of lands for production of jatropha seeds is another risk which can hinder the success of project, however this is not expected to be a serious risk as the SEECO is closely working with Local Government who owns huge land in their land banks. The already established good relationship with these District Authorities will take of this risk to minimal
- **Willingness of farmers to enter into scheme**
The willingness of farmers to enter into scheme is another risk for this project. The risk will be overcome by raise awareness about the project and climate change issue, ensuring the farmers on the market of the jatropha seed to be produced and also the CDM funds to be obtained be used for sustainable activities in the respected area such as building school, health centers etc.
- **Ability of side enterprises to generate revenues:** Most of the companies owned farms and those of out-growers will intercropped with other crops preferably seasonal crops to ensure constant revenues from the beginning of the project activities. This revenue line plus that of jatropha by-product enterprises will put this risk at minimal.
- **Transport to the oil expeller and biodiesel pressing site:** The project sites are well accessed in terms good roads – all are tarmac, telephone lines and other infrastructures.

Marketing issues

SEECO concept stems from an extensive desk study on biofuels, conducted in Tanzania by TaTEDO and WIP-Renewable Energies (2005) revealed that oil yields from jatropha of up to 1700 kilogramme per hectare were possible in Tanzania from

smallholder farmers. From these results Jatropha has been proved to have significant potential of providing biodiesel for transportation in Tanzania.

The national biofuel market in Tanzania is 20 thousand barrels per day (International Energy Agency) or 1.2 billion liters per year. At a price of 40 dollarscents per liter this represents a market volume of US\$ 480 million. With its initial production capacity of 9 million liters per year, SEECO is just entering this vast national market. As of now, 'the sky is the limit'. SEECO's sales volumes are not limited by the size of the market but by its production capacity and by the market's willingness to buy the new product. SEECO is confident it will easily convince the incredule by running its own fleet and targeted company fleets on biodiesel. Government would also be invited to support the marketing efforts with a financial incentive.

Project Financial Requirement:

SEECO has made available the short term and long term cash flow projections analysis for the coming 21 years starting from 2008. For successful implementation of the business activities SEECO is in need of financial support amounting to total investment of USD 2,095,000 for the two phases of the project. Most of this will be provided by the project itself through permanent re-investment of its profits (capitalisation). Phase 1 of the project will begin with a start-up period of two years (2008-2009). The total physical investment during the first two years as per the business plan is US\$ 1,389,150 mostly for land preparation, buildings and machinery. The operational costs evolve over the years; with supply of jatropha seeds being more important at initial stages with trend of decreasing with maturity of company own plantations. Operational revenues are sufficient to cover operational costs, thus maintaining a positive cash flow growing over the years. The starting capital is insufficient to cover the financial needs during this period, now applying for financial assistance from investors and development partners. Funding for Phase 2 is expected to be negotiated with other investors and specialized funds such as the *Clean Development Mechanism* (CDM). From the project financial projections, the following investment financial needs appear:

Description of Finance Required	Total Investment (USD)	Entrepreneur/ company Contribution (USD)	Donors, investors Contribution (USD)
Start up costs – farms establishment and development costs	1,350,000	350	1,000,000
Capital infrastructure – procurement of biodiesel refinery plant, buildings etc	189,000	0	189,000
Working Capital	450,000	50,000	400,000
Marketing & Sales	106,000	6,000	100,000
TOTAL	2,095,000	56,350	2,038,650

Supporting Documents

- Profiles of company developing the project
- CV of Directors
- Map of project sites
- Calculation of CERS

APPENDIX

1. CALCULATION OF CERS

Baseline scenario emissions

Baseline emission source	Comment	Equation and estimation
Fossil Diesel used for transport		<p>Litres of biodiesel * 3.2 Kgs CO₂ equivalent</p> <p>Biodiesel produced (L) / year =</p> $\frac{\text{Biodiesel produced (kg)}}{\text{Density (kg / L)}}$ $= \frac{12000 \times 10^3 \text{ kg}}{0.878 \text{ kg / L}} = 13667.42 \times 10^3 \text{ L}$ <p>Baseline emission for CO₂t/yr =</p> $13667.42 \times 10^3 \text{ L} \times 3.2 \text{ kg CO}_2 \text{ equivalent / yr} = 43734 \text{ t / yr}$
Baseline Sub-total		43734 t CO₂ equivalent / yr

Calculation will be made on emissions from electricity, which will be used in the oil extraction machines and water heater and transportation of seeds and equipments to the biodiesel production site. All this will be deducted from the total GHG reduction.

Project activity scenario and emission

Project activity emissions source	Source	Equation and estimation
Biodiesel	Any N ₂ O and CH ₄ involved in production or use of bio-diesel	Defaults can be used
Emission from electricity and/or fossil fuels used in the manufacture of biodiesel	Utility produces most of its electric power from hydro-power stations which constitutes about 99.9% of its total production and the remaining 0.1% comes from Diesel Power Stations. From Zambia study the average	<p>Calculated as weighted average of the country grid =</p> $270 \text{ kWh/hr} \times 24 \times 365 = 2.268 \text{ GWh/yr}$ $2.268 \text{ GWh/yr} \times 0.1 \text{ tCO}_2 \text{ / MWh} = \underline{\underline{227 \text{ tCO}_2 \text{ e / yr}}}$

	emission of carbon dioxide per Megawatts is 0.1tCO ₂ /MWh	
Upstream expeller/extruder Down stream bricketting/extrusion of seed cake	Energy emission per tonne of biodiesel	Power demand is 525kW 525kW* 24*365 = 4.599GWh/yr 4.599GWh/yr*0.1tCO ₂ e/MWh = 460 tCO₂e/yr
Net methanol production and transportation	Energy/emissions per tonne of biodiesel	300l/day (1-2%) Must be calculated 300l/day*0.9kgs/l*2kgs/kg methanol = 197 tCO₂e/year
Glycerol produced		Insignificant and ignored
Seedcakes production replace fertilizers		Nothing as land is degraded or sparsely cultivated
Project activity sub-total		887 tCO₂e/yr

Emissions Reductions	tCO ₂ e/year
Baseline subtotal	43,734
Project activity subtotal	887
Total (Baseline – project activity)	42,847