AFRICAN DEVELOPMENT BANK GROUP

PROJECT : BAGAMOYO SUGAR PROJECT
COUNTRY : TANZANIA

EXECUTIVE SUMMARY OF THE ENVIRONMENTAL AND SOCIAL ASSESSMENT

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<thead>
<tr>
<th>Project team</th>
<th>Head of team:</th>
<th>Investment Officer</th>
<th>Team members:</th>
<th>Social Dev. Specialist</th>
<th>Manager</th>
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Executive Summary of the Environmental and Social Assessment

Project title: BAGAMOYO SUGAR PROJECT
Country: TANZANIA
Project reference: P-TZ-AAG-003

1. Introduction

Purpose of This Summary
This environmental and social impact assessment summary is for the Bagamoyo EcoEnergy (BEE) project. The summary is prepared in accordance with the African Development Bank’s (AfDB) Environmental and Social Assessment Procedures (ESAP) for Private Sector Operations (2001).

Background
The project proponent is Agro EcoEnergy Tanzania Limited, a Tanzania-based agribusiness company, in a joint venture with Government of Tanzania. In 2006 the company signed Memoranda of Understanding (MoU) with the Government of Tanzania (GoT) to cooperate in the development of the country’s agribusiness sector. For the initial project the company is planning a sugar/ethanol/power project to be located 20 km northwest of the town of Bagamoyo and approximately 100 km north of Dar es Salaam. (Figure 1).

Figure 1: Project Area

Source: Michelin Map (Africa) – as modified for this report

The project will include the establishment of a greenfield sugar cane plantation of approximately 7,800 hectares (ha) with an additional approximately 3,000 ha by independent sugar cane plantations (outgrowers).

This sugar project is structured in order to maximise sugar and power production and will out of the by-products from the sugar production, molasses, produce ethanol.
All sugar, power and ethanol produced is primarily geared towards the domestic market that is showing a big and growing shortage of all three end products.

The sugar cane plantations are developed to take advantage of the most modern advances in the agriculture methods: advanced irrigation systems, modern technology and the best available cane varieties. Sugar cane yields are projected to be between 90 and 110 tons per hectare (long time average). EcoEnergy has operated a farm of 200 ha with advanced sub surface drip irrigation in a neighbouring area to the commercial farm since 2007 achieving good cane yields. At full operations, the project will process approximately 1 million ton of sugar cane annually and produce 125,000 tons of sugar for the domestic market; deliver 100,000 megawatt hours (MWh) of power to the national grid and produce 8 million litres of fuel ethanol for the domestic market.

2. **Project Description and Justification**

**Project Justification**

The project is in line with Tanzanian agricultural and rural development initiatives. Only 6,000,000 ha of the total 45,000,000 ha of potentially arable land in Tanzania are currently farmed and 70% of the famed land is hand hoed. Tanzania has a long history of sugar cane production dating back 75 years. Reviving and modernizing the agribusiness sector and attracting foreign direct investment are national priorities as set out in the National Strategy for Growth and Poverty Reduction (NSGRP) and the Kilimo Kwanza (agriculture first) and the SAGCOT (Southern Agriculture Growth Corridor Of Tanzania) initiatives. In this context, the project would be a showcase demonstrating how a market opportunity (ie increasing demand for sugar, power and ethanol) can be used to create a successful agribusiness that uses modern agriculture methods along with a local value-added process industry in synergy and symbiosis with local small holder farmers. The project incorporates a comprehensive Out Grower and Community Development Program that should result in a rapid build up of production capacity by the outgrowers over a four year period from when the local process industry is in place.

**Location and Schedule**

The project will be located in the coastal region of Bagamoyo District, approximately 20km northwest of Bagamoyo Town The land where the project will be located will be provided to the project as capital in Kind by the GOT in exchange for equity. The land was previously used as a cattle ranch but operations ceased during 1994. The project company will lease 21 255 ha of the abandoned ranch located to the west of the Makarunge – Gama Road while the majority of the coastal strip of the former ranch to the east of the road will remain under the control of the GOT. A further 2,000 ha of land in an adjacent village will also be used by the project.

Out of the total 21 255 ha, 7,800 ha will initially be used in the first phase of the project. The remaining part of the project is used for biodiversity and planned future expansions. Pastoralist will be provided with an opportunity to utilize some of the existing grassland and dams with a sustainable number of cattle and other domestic livestock. The project currently operates a 200 ha seed cane nursery located 20 km southeast of the project land. The processing plant will be constructed on a site in the northern part of the plantation (Figure 2).

*Figure 2: Layout of Plantation, Plant and Haulage Roads*
The proposed timeframe for the development is as follows:

Financial Close (FC) is projected to occur on or around [December 2012]

- Commencement of site clearing activities – [Jan 2013] one month after FC
- Development of the second 325 ha seed cane nursery – [June 13 – Nov 13] in a period six to eleven month after FC
- Planting of 900 ha – [2013 / 2014] in a period six to fifteen month after FC
- Construction of processing facilities – [2013 -2014] for two years from FC
- Planting of 4,100 ha – [2014 / 2015] in a period eighteen to twenty seven month after FC
- Planting of 2,500 ha – [2015 / 2016] in a period thirty to thirty six month after FC
- Outgrower capacity development – [2013 to 2018] during a period of six years from FC

**Plantage Development and Operations**

The project aims to be a model for sustainable agriculture production and intends to use innovative agriculture practices to support and enhance soil fertility while simultaneously fixing organic matters and carbon in the soil.

Land clearing will be by mechanical methods using heavy machinery. Land clearing and preparation will employ procedures to minimize release of GHGs. Cleared biomass will not be burnt but chipped and ploughed into the soil during land preparation stage or used to
produce compost. Larger biomass will be brought to the plant site and stored for use for producing power during operations.

Irrigation systems will be installed, followed by the planting of the first commercial crop. A variety of irrigation systems will be used including centre pivots, semi-solid sprinkler and sub-surface drip systems in order to optimise agricultural yield and ensure efficient water management for the specific soil. Planting of sugar cane will be done using mechanical planters.

Harvesting of green cane will be done mechanically. Harvesting machines with in-field tractor-trailer combination (8 tonne capacity trailers) will deliver cut sugar cane to 16 tonne trailers on the side of the fields (loading zones). Two or three of these 16 tonne capacity trailers will then be hauled by one tractor to the facility. Since the sugar content is highest at the base, cane will be cut as close as possible to the ground. The remaining cut will be the base for new cane growth (ratoons) in the following season. The crop is typically replanted after 6 to 8 ratoons. During the replanting phase, minimum tillage techniques will be implemented to minimise the release of GHGs. The replanting schedule will also allow for a fallow crop.

Mechanical harvesting of the cane will leave a blanket of trash leaves and tops in the fields that gradually builds up the organic matter and carbon content of the soils which, in addition to being a carbon sink, improves the quality of the soils as well as minimise the growth of weeds (resulting in a reduction in the need for herbicides). The vinasse (effluent from the facility) will be applied as a fertiliser either in dilute form (by the irrigation system) or in concentrated form i.e. CMS and can also be used in the production of compost that will be spread into the fields.

**Sugar Plant Operations**
Following harvesting, the cut sugar cane is transported within 24 hours to the facility to avoid deterioration of sugar content in the cane prior to it being processed. Upon receiving at the processing plant, the sugar cane is mechanically shredded, run through a diffuser to extract the juice, and separated from the residual fibres (bagasse). The juice is then put through a clarification and evaporation process. The facility will be designed to be flexible so that some juice can be sent not only for sugar production but also for ethanol production. The processing plant will be in full operation for eight to nine months, approximately June through February (approximately 220 effective days per year). During this relatively dry period sugar cane is harvested and sugar, power and ethanol are produced. When the plant is not in operation, maintenance is carried out. This includes cleaning, repair and replacement of parts and equipment as well as replacement of worn machinery. Production may be extended later in the rainy season by storing molasses or by purchasing molasses from at other estates. Power will be generated for the national grid during the full year with exception for a number of weeks required for maintenance of the boiler.

**Ethanol Plant Operations**
The plant will produce hydrous and anhydrous ethanol from c-molasses available. Molasses is diluted and acidified (if necessary) then fed to pre-fermenters for yeast propagation and fermenters for alcohol production. The resulting alcohol will be recovered by distillation. The hydrous ethanol will be dehydrated by means of molecular sieve absorption. The dehydrated alcohol will then be analysed, weighed and stored in accordance with local excise and safety requirements.
Total storage capacity for dehydrated ethanol will total approximately 2000 cubic metres (m$^3$). A 500 m$^3$ storage tank for hydrous ethanol will also be constructed. Storage tanks and loading facilities will be secured and fitted with fire detection and fire-fighting facilities. The plant will also be designed to allow for the use of more then its own generated molasses as a feedstock for ethanol production. Molasses may be available from other sugar producers in Tanzania at a competitive price adding more value to the molasses than current usages.

**Power Generation**
The bagasse will be fed into a high pressure boiler to generate steam and electricity. The steam and electricity is used to fully supply the industrial plant and the irrigation system with renewable energy. The facility is designed for efficient and minimum internal use of steam and power in order to maximise the surplus electricity that can be sold to the national power grid. The boiler is designed to also be able to utilise secondary biomass such as wood chips and energy grass as fuel. The boiler flue gas treatment will consist of a filter system to minimise emissions of harmful compounds.

**Liquid Wastes**
Vinasse is the main liquid waste stream from the industrial plant. Its high chemical oxygen demand and biochemical oxygen demand makes it a potential hazard to the environment. However, vinasse also has high nutrient value, most notably the amount of potassium (in the form of potassium oxide). The project design includes a plan to recycle the vinasse in order to reduce demand for external use of fertiliser. Some vinasse will be processed to concentrated molasses stillage. It will then be used to produce a high quality fertiliser and used in the sugar cane fields. The project will generate other liquid wastes which will be treated on site prior to reuse in the irrigation system.

*Figure 2: Treatment of Liquid Wastes*

**Other Wastes**
The project will generate solid wastes in the form of domestic wastes and industrial wastes such as spent filter media and ash from boiler operations. Wastes will be recycled as much as possible and where it is not possible, will be transported to a landfill. The landfill will be located near the factory area as agreed with the responsible environmental authorities.

Gaseous emissions are mainly those produced by boiler operations. These include particulate matter, oxides of nitrogen, carbon dioxide, carbon monoxide and sulphur dioxide. The boiler stack will be fitted with treatment systems to minimise the emission of pollutants to the environment.
Water Supply

The Wami River is the only practical source of water for the 7,800 ha main plantation. A permit for water extraction (which would sustain 12,000ha) has been issued by the Wami Ruvu River Basin Water Authorities. The water availability is based on the long term flow data that was generated under the “The Wami River Initial Environmental Flow Assessment”.

<table>
<thead>
<tr>
<th>Month</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
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<tr>
<td>Driest year</td>
<td>m³/s</td>
<td>44.7</td>
<td>29.3</td>
<td>16.2</td>
<td>11</td>
<td>4.6</td>
<td>6.2</td>
<td>16.7</td>
<td>10.6</td>
<td>12.9</td>
<td>6</td>
<td>107</td>
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<td>Mm³</td>
<td>116</td>
<td>78.5</td>
<td>43.4</td>
<td>28.5</td>
<td>12.3</td>
<td>16.1</td>
<td>44.7</td>
<td>28.4</td>
<td>31.2</td>
<td>15</td>
<td>277</td>
<td>736</td>
</tr>
<tr>
<td>Maintenance year</td>
<td>m³/s</td>
<td>52.4</td>
<td>29.1</td>
<td>22.2</td>
<td>16.3</td>
<td>14</td>
<td>27.3</td>
<td>57.3</td>
<td>69</td>
<td>51.6</td>
<td>73</td>
<td>202</td>
</tr>
<tr>
<td>Mm³</td>
<td>135</td>
<td>77</td>
<td>59</td>
<td>42</td>
<td>37</td>
<td>70</td>
<td>153</td>
<td>184</td>
<td>124</td>
<td>196</td>
<td>524</td>
<td>408</td>
</tr>
<tr>
<td>Wettest year</td>
<td>m³/s</td>
<td>192</td>
<td>163</td>
<td>53</td>
<td>64</td>
<td>68</td>
<td>279</td>
<td>529</td>
<td>433</td>
<td>341</td>
<td>490</td>
<td>1302</td>
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<tr>
<td>Mm³</td>
<td>497</td>
<td>437</td>
<td>144</td>
<td>167</td>
<td>182</td>
<td>723</td>
<td>1417</td>
<td>1161</td>
<td>825</td>
<td>1312</td>
<td>3376</td>
<td>1310</td>
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</table>

The specific crop water requirements are dependant on the growing/cutting cycle, with cane being at different growth stages during the course of the year. The peak daily need is calculated to be 5.03 mm/day in February. The irrigation demand for the project is calculated considering irrigation efficiency. Three types of irrigation are envisaged: semi solid set sprinkler (the predominant type); centre pivot; and subsurface drip.

Based on the indicated area under irrigation, the irrigation efficiencies, the Crop Water Requirement and the dependable rainfall, the water requirement throughout the year has been calculated. The monthly water requirement for the irrigation of the estate is as follows:

<table>
<thead>
<tr>
<th>Irrigation method</th>
<th>Area (ha)</th>
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<tr>
<td>Drip irrigation</td>
<td>425</td>
</tr>
<tr>
<td>Center pivot irrigation</td>
<td>3,162</td>
</tr>
<tr>
<td>Sprinkler irrigation</td>
<td>4,241</td>
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<tr>
<td>Total area</td>
<td>7,828</td>
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</table>

The project will construct sufficient off-river storage facilities to cater for the “Driest Year” season deficits and allow for an environmental flow, established by Wami Ruvu River Basin Water Authorities, passing below the project abstraction point.

A storage volume of 4.4 Mm³ will be sufficient to ensure that the sugar cane will receive an irrigation application that is higher than the minimum application that is required for sugarcane survival (25%). In a “Driest Year” the irrigation will be reduced to 35% of the optimum water requirement in October, November and March. In February the irrigation will
be reduced to 85% of the optimum. In the following table the total water requirements have been calculated taking into account the following reductions in irrigation applications:

<table>
<thead>
<tr>
<th>Irrigation application</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of optimum</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>35</td>
<td>30</td>
<td>100</td>
<td>90</td>
<td>35</td>
<td>100</td>
<td>100</td>
<td>100</td>
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The overall bulk water supply system will follow the outline shown in Figure 3 with pumped abstraction into a valley canal, followed by pumping up into a main canal feeding down the estate.

**Figure 3 Bulk Water System**


The EcoEnergy Sugar mill will be using water from the Wami River for a number of factory processes. The raw water intake for the factory will be 2,000 m$^3$/day. The water will be used in the co-generation plant, the sugar plant, the ethanol plant and for domestic use in the factory premises. The flow chart in figure 5.1 gives the differentiation of water requirements in the factory. The factory will generate 1,550 m$^3$/day of waste water, which will be treated to a level where it can be included into the irrigation system. Therefore the net water requirement of the EcoEnergy Factory is 450 m$^3$/day.
Figure 5.1: Flow diagram of EcoEnergy Factory water requirement

**Plantation Surface Drainage**

Drainage systems for the plantation will be designed to ensure that surface water in excess of soil drainage capacity would be drained prior to causing crop damage. The design of the surface drainage system will make usage of the existing natural drainage lines and seasonal streams. This is also considered in the irrigation layout so that waterways and infield drains will transfer water to support the irrigation around or sometimes through the fields to the main drain network and to the sea. In areas where it is proposed to include sub-surface drains, surface drain depth was increased, where necessary, to ensure that the drains would flow freely. Conditions considered in the design include:

- Drains were designed to remove water (29 mm rain per day) from a particular zone in 24 hours;
- 30% of the drains depths are already in place as natural depressions;
- Drains have 0.7 m freeboard and side slopes are 1.5:1

3. **Policy, Legal and Administrative Framework**

**Environmental and Social Impact Assessment**

The ESIA for the project was carried out following the requirements of the applicable Tanzania regulations, specifically the *Environmental Impact Assessment and Audit Regulations No. 349 of 2005* which were made pursuant to the *Environmental Management Act No. 20 of 2004*. The Regulations provide the basis for undertaking ESIA and environmental audits for various types of development projects with significant environmental impacts. Regulation 5 requires the applicant for an Environmental Impact Assessment Certificate to submit a project brief to the National Environment Management Council (NEMC). NEMC subsequently undertakes a screening of the project based on the submitted project brief and registration form and decides if the developer will have to carry out environmental assessment. The steps that need to be taken to conduct a full ESIA are indicated in the Fourth Schedule while Regulation 16 specifies that the ESIA study in addition to environmental impacts must also address social, cultural and economic impacts.

An ESIA for the original project concept started August 2007 by ORGUT Consulting AB of Sweden in conjunction with Ardhi University (Dar es Salaam). In July 2008 a draft ESIA was handed in to National Environment Management Council (NEMC) for review. Adhering to
the regulations NEMC convened a technical review in the second half of August 2008 and after the review a number of questions/clarifications were requested. The response to the questions/clarifications was coordinated by Ardhi University and the final version ESIA was submitted to NEMC in December 2008.

The ESIA was once again reviewed by NEMC and recommendation was handed to the Vice President’s Office, Minister of Environment for approval following which the Environmental Certificate was issued 3rd of April 2009. An update of the ESIA was conducted by Ardhi University in 2011 to take into consideration the latest modifications done to the project design and to ensure compliance with IFC/AfDBs Guidelines and Policies for conducting Environmental and Social Impact Assessments.

The ESIA does not include detail plans for the proposed management and labour living accommodation, nor does it include the transmission lines and upgrades to the haulage roads located within the project area as the impacts are expected to be covered in the general environmental and social control plans for handling of labour accommodation, waste, erosion and watercourses etc.

An ESIA process for the electricity transmission line extending outside the direct project area has started as the line has been increased in size from 33kV to 66kV due to the increased delivery of power to the national grid. The line will run parallel to the Gama-Makurunge road, follow the main road towards Bagamoyo and finally turn of to join into the existing Lower Ruvu substation. The ESIA is carried out by Ardhi University and will be done in accordance with the Environmental and Social Assessment Procedures for African Development Bank’s Private Sector Operations (June 2001). The initial impact assessment results have not identified any major environmental or social issues as the routing has been done to avoid resettlement and environmentally sensitive areas. The T-line will initially be funded by BEE but is over time expected to be repaid by TANESCO through the Power Purchase Agreement.

Other National Laws and Regulations
The following national laws and regulations applicable to the project include:

- **Land Act, Act 4 of 1999**;
- **Water Resources Management Act, Act 11 of 2009**;
- **Water Supply and Sanitation Act, Act 12 of 2009**;
- **Urban Water Supply Act, Act 7 of 1981**;
- **Water Act Amendments, Act 8 of 1997**;
- **Water and Sewerage Authority Act, Act 12 of 2001**;
- **Water Utilization (Control and Regulations), Act 42 of 1974**;
- **Water Utilization Act Amendments, Act 10 of 1981**;
- **Forestry Act of 2002**;
- **Plant Protection Act and Regulations of 1997 and 1998**;
- **Companies Act, Act 12 of 2002**;
- **Industrial and Consumer Chemicals (Management and Control) Act, Act 3 of 2003**;
- **Public Health Act of 2009**;
- **Occupational Health and Safety Act of 2003**;
- **Transport Licensing Act, Act 1 of 1973**;
- **Workmen’s Compensation Act (2008)**;
• Employment and Labour Relations Act, Act 6 of 2004; and
• Labour Institutions Act, Act 6 of 2004.

African Development Bank’s Requirements
In addition to considering the national requirements, the project is being developed in line with AfDB’s environmental and social requirements, specifically the following:

• Environmental and Social Assessment Procedures for African Development Bank’s Private Sector Operations (June 2001)
• Handbook on Stakeholder Consultation and Participation in AfDB Operations (July 2009)
• Involuntary Resettlement Policy (November 2003)
• Information Note on the Checklist for Mainstreaming Gender and Climate Change in Projects (April 2010)
• Bank Group Policy on Poverty Reduction (February 2004)
• The Gender Policy (June 2001)
• Policy for Integrated Water Resources Management (April 2000)

Other Lender Standards
The project is also being developed in conformance with requirement of other lender organisations including the International Finance Corporation (IFC) and the World Bank. The requirements of the International Finance Corporation’s Performance Standards on Social and Environmental Sustainability (April 2006) are being applied. In addition, the following World Bank Group Environmental, Health, and Safety Guidelines are being applied:

• General EHS Guideline (April 2007);
• EHS Guidelines for Sugar Manufacturing (April 2007); and
• EHS Guidelines for Plantation Crop Production (April 2007).

International Conventions and Treaties
The Government of Tanzania is a signatory and has acceded to a number of international/ regional treaties as follows:

• Convention on Biological Diversity ratified on 8 March, 1996;
• United Nations Convention to Combat Desertification ratified April, 1997;
• United Nations Framework Convention on Climate Change ratified in April, 1996;
• The Vienna Convention on the Protection of Ozone Layer and Montreal Protocol on Substances that Deplete the Ozone Layer acceded on 7 April, 1993 and 16 April, 1993 respectively;
• Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal acceded on 7 April, 1993, and,

The project is in line with, and supports, the relevant parts of these agreements.
4. Description of the Project Environment

Location
Bagamoyo District is located in Coastal Region of Tanzania north of the capital, Dar es Salaam. The District has an area of 985,000 ha. Bagamoyo Town is roughly 70 km from Dar Es Salaam City Centre and has a population of more than 40,000. Bagamoyo District as a whole had a total population of approximately 230,000 according to census in 2005. The population is projected to be approximately 290,000 by 2012. The district is composed of 16 wards, which have a total of 82 villages.

Climate
There is little fluctuation throughout the year in the maximum and the minimum monthly air temperatures. Minimum mean temperature varies from 18°C in July/August to 24°C in January/February; the maximum mean temperature ranges from 29°C in July to 32°C in February. Annual precipitation in the area is approximately 1000 mm. The annual rainfall is bi-modal with the first wet period (long rains) occurring in April and May, and the second wet period occurring from November to January (short rains). The driest months are June to September when monthly rainfall is generally less than 50 mm per month.

Geology, Topography and Soils
The land where the project is developed is an old, uplifted and dissected coastal plain. Its topography is largely gently undulating to rolling, characterised by extensive plains, low hill or ridges bottomlands and shallow valleys. The terrain is rising gradually from the coastal mudflats to about 30-40 m above sea level at the western border of the area.

The soils are based on old, dissected sand dunes, with grey sandy soils (locally called mbuga) on the main central areas, falling away to alluvial sands and clays along the Wami River at the northern boundary and the Ruvu River to the South-East). The sandy topsoil which is prevalent is susceptible to erosion during farming operations. Organic matter, phosphorus and potassium are the most limiting parameters for the soils in the area.

Water Resources
Wami River is one of the major rivers draining the Eastern Arc Mountains and the basin area extends from the upper catchments in semi arid Dodoma region through the humid inland swamps in Morogoro region to discharge into the Indian Ocean at Saadani in Bagamoyo just north of the project area.

The largest part of flow in the main Wami River from Dakawa to Saadani is contributed by flows from the Mkondoa River catchment. Flows from this catchment at its outlet at Kilosa constitute more than 80% of flows recorded in Mkata River. Mkondoa River enters the Tendigo swamps where it joins Mkata River. There is significant loss of flow volume during the short-rains (or vuli) in October to December and intermediate rains in January to February. The flow volume loss is due to the filling of the vast Tendigo swamps to their highest levels before contributing to flow increase at the downstream. Water availability in Wami River reaches downstream of these vast swamps depends mainly on the process related to river-swamps water exchanges and water uses in fertile areas upstream and around the swamps.

Another important factor that determines the amount of water that is available in downstream reaches of the river is the level of water abstraction to cater for various uses such as agriculture
and municipal water supplies. Throughout the Wami River sub-basin, water abstractions are spatially non-uniform and the amount abstracted depends on the total requirement which is, in turn, affected by the local climatic conditions. Two type of surface water abstractions are distinguished in the sub-basin, the dammed and direct-from-river abstractions. The former is usually practiced in the arid climate in upper catchments of Wami in Dodoma where several reservoirs storing river water are operational. These reservoirs store considerable amounts of flow that could otherwise be available to downstream reaches through to the Indian Ocean. Direct abstractions from the river include both licensed and unlicensed abstractions. Currently, there is little quantitative information on the unlicensed abstractions. The licensed abstractions are done by users with water rights. About 99 abstractions from various rivers and 14 from springs in the sub-basin have been given water rights. Despite the lack of coordinates of exact locations of almost all abstraction points, the rivers from which they abstract water are known.

Assessment of existing boreholes in the area indicates that the groundwater water is slightly saline with the trend of decreasing salinity further from the Indian Ocean. It is likely that groundwater salinity continues under a considerable part of the project land. This saline layer likely occurs under a layer of freshwater (which is the result of surface water and rainfall drainage) and the deeper ‘true’ groundwater. Limited analysis of groundwater quality indicates that the water is generally unpolluted.

Flora
The area belongs to the East African Coastal Forests Zone that occurs in a narrow belt along the Indian Ocean from Southern Somalia to Mozambique. Historic use of the land for farming and grazing have converted the land into a semi natural woodland habitat with bush land, dry grassland, forest tickets, seasonally flooded plains, cultivation plots and a number of modified, natural habitats such as mangroves and riverine forest remnants. The closest relatively intact coastal forest fragment is the Zaraninge Forest in Saadani National Park about 20 km north of the project area.

In the northern part of the land there are forest remnants dominated by various species known as African ebony. However, the majority of the Razaba Area is covered by acacia woodlands mixed with other species. The persistence of coarse grasses hinders the spread of the thickets to make continuous woodland. Riverine vegetation occurs in narrow strips of land following the riverbanks or streams and is dominated by evergreen thickets of fig trees and other species indicating abundant ground water. The streams cause siltation and create temporary swamps during the rainy seasons. These swamps and existing dams on the former cattle ranch have become important for the biodiversity of the area and are used as sources of water for both wild and domestic animals. The vegetation on the coastal flood plain is dominated by palm species. Most water logged areas are covered by grasses especially elephant grass following re-current bush fires. Part of the coastal plain is seasonally flooded. Below is a list of key flora species identified in the proposed biodiversity Areas
Outside the project area mangroves occur at the estuaries of Ruvu and Wami Rivers. The mangrove areas are harvested for building poles, boat building, charcoal and export trade. Further the mangroves trap terrestrial sediments, litter and nutrients are thus very important for the protection of other near-shore ecosystems such as sea-grass beds and coral reefs.

Fauna
The project area is potentially rich in wildlife and shares many species with the adjacent Saadani National Park. All taxonomic groups including mammals, birds, reptiles, amphibians, fish and many invertebrate groups are represented. The area has high diversity of both resident and migratory bird species with the composition and abundance of species changing with seasons due to intra-Africa and Palaearctic migrations. The importance of Makurunge coastal area for bird conservation is indicated by the high abundance of birds observed during the ESIA survey. More than 20 different large mammals are reported from the area. Warthog, duiker, Sykes monkey and yellow baboons were physically observed during the project studies while elephant, hippopotamus, bush pig, buffalo and reedbuck were recorded through animal signs. Local hunters and BEE game scouts have also reported presence of such notable mammals as lion, leopard and black and white colobus. However signs of presence have been lower since 2009 due to increase in unsustainable charcoal making and hunting (poaching).

The closed woodland patches and forest habitats near the permanent water bodies including the Wami River riparian forest are the important areas for forest-dependent bird species. Forest remnants are also important to support elephants and other mammals more active in the project area during the wet season when human activities and presence is drastically reduced due to poor road conditions and inundated farm land.
Most mammals occurring in the area are Lower Risk according to the IUCN Red List 2011.2, three species elephant, lion and hippopotamus are Vulnerable. No birds species recorded in the project area is listed on the IUCN Red List 2011.2 Further field surveys are however needed to assess the possible presence of little yellow flycatcher, black and rufus elephant screw and the central Africa tree hyrax found in coastal forest and thickets near Wami river and at the nearby Kisampa Wildlife Conservancy

Affect of current activities on the environment
Awaiting clarifications of project financing, land ownerships and authorization for the project developer to enter the land the project area has experienced a dramatic increase in unsustainable charcoal making and hunting (poaching) in the last three years. This has resulted in an estimated 40% loss of valuable forest, flora and fauna compared with the 2009 field survey when the project originally was expected to start. If these activities are not better controlled by responsible authorities it is highly likely that most valuable biodiversity areas inside the project area will be lost in the next couple of years if the project does not take off. There are now risks that elephants and other migratory game no longer will find it safe to visit the project area.
Social and Cultural

The area has a long history of settlement of farmers, hunters, traders and fishermen who influenced the area by clearing land for cultivation and utilizing the wood. The area has probably been inhabited for at least 1500 years, and until about 1900 the village of Saadani just north of the area was an important trade and harbour town.

However, the area was never densely populated, and although there was cultivation, grazing and hunting activities (accompanied by bush fires to induce new grazing or to simplify the hunting process); disturbances were relatively limited as the frequency of burning was low and only small scale agriculture was practiced. In 1974 the area was given to the Government of Zanzibar for the purpose of establishing a cattle ranch, and the inhabitants were compensated and resettled outside the area. The ranch was stocked with about 7000 head of livestock and the ranch employed about 300 workers from the mainland and Zanzibar Islands to take care of the livestock. The ranching strongly affected the area as many forest thickets were cleared to eliminate tsetse flies. Natural wetlands were modified to establish water reservoirs and several roads were constructed. A ranch headquarter was constructed with several buildings including a primary school. The ranch also established a coconut project which still exists outside the proposed project area. Both headquarters and the coconut project lie to the East of the Makarunge-Gama Road on land which is not planned to be part of the project.

Operations on the cattle ranch ceased in 1994. This was partly due to problems pertaining to control of tsetse fly infestation. Also there were problem with lions and leopards attacking livestock. The remaining livestock was shipped to Zanzibar. Many of the present woodland thickets started growing back as the cattle was removed and the ranch management came to a halt.

In 2005 the former Saadani Game Reserve north of the project area was gazetted as a national park including part of the Southern bank of the Wami River in the former Razaba Area. (Government Notice No 281 of 2005). This area was included in the national park to protect
the mangrove swamps near the estuary and ensure better water access for the wildlife during the dry seasons.

**Social Characteristics of the project area**

Following the closure of the Razaba Cattle Ranch in 1994, the area has over time been repopulated by subsistence farmers living in scattered small settlements (less than 1% of project area), itinerant charcoal producers and Barabaig pastoralists. During the People and Property count in November 2011 the following were counted in the settlements of Gama, Gobole, Kaloleni Biga and Bozi: 37 households and 17 Economic Huts in Kaloleni Biga; 37 houses and 12 Economic Huts in Bozi and 17 houses and 7 Economic Huts in Gama South and Gobole Settlements. Altogether there are 452 people currently living in the project area including 11 Barabaig pastoralist households. The total number of vulnerable people in the area is 167. There are also at any one time over 150 itinerant charcoal producers. There has been a dramatic increase in charcoal making, pole cutting, lumbering and illegal hunting since 2009 due to understanding that “this land belongs to nobody until EcoEnergy gets the title”. This is strongly driven by the lack of formal employment opportunities and market places in the proposed project’s area.

Some more recent settlers have moved there for a range of economic reasons but for the most part they have left their elder children with members of the extended family to continue their education. For those settlers who have their children with them they rely solely on schools in neighbouring communities such as Matipwili, Makurunge and Razaba. Swahili is widely spoken in the area except for the Barabaig Pastoralists who speak their own Datooga language.

Four villages (Fukayosi, Makurunge, Kidomole and Matipwili) and seven sub-villages (Kaloleni Biga, Gama, Razaba, Kitame and Mkawaiuni, Bozi and Gobole) have land bordering the proposed project area. The village populations number from 1000 to 3000 people and comprise a number of major ethnic groups: Wakwere, Wadoe, Wazigua, Wanyamwezi, Wagogo, Wazaramo, Wasukuma, Wanyakyusa, Waluguru, Parakuyu, and Barabaig pastoralists.

The economy in the villages and sub-villages is based on subsistence agriculture, artisans, fishing and small businesses. The major crops grown include maize, paddy rice, millet, beans, cassava, cashew nuts, sesame, sweet potatoes, mangoes and other fruits. Forest resources include medicinal plants, fuel wood and building poles.

Apart from malaria diseases such as diarrhea, bilharzia, measles, pneumonia, TB, Filarisis, VVF and typhoid are the main illnesses suffered by the people in the project area possibly due to dependence on untreated river water and poor housing structures. Malnutrition is prevalent and observable especially among the under-fives.

Fukayosi, Makurunge and Kidomole are accessible from Bagamoyo Town via an all weather road that runs through both villages onto Msata. The road to villages north of Makurunge are, however, very poor; being passable only during the dry season. During the rainy season Wami River is prone to flooding; making much of the area impassable.
In terms of social infrastructure the Bagamoyo District has one district hospital, five medical centres and 49 dispensaries. The district has a total number of 38 health centres of which 71% are owned by the Government. According to the 2007 estimates, every medical centre serves on average 4,700 people. There were 121 registered primary schools, with a student to teacher ratio of 1 to 44 while for secondary schools the teacher to student ratio was 1:18. The district has a total of 140 piped water supply systems, 43 covered wells, 61 open wells, 9 natural wells.

The major source of energy for lighting is kerosene, used by over 95% of the respondents. Fuel wood is by far the major source of energy used for cooking. Charcoal making as source of cash income is significant throughout and around the south of the project area. These areas have the best road infrastructure and hence are easily reached by lorry during the dry season. Most of the charcoal is transported to and used in Bagamoyo, Zanzibar and Dar es Salaam.

More information on social dynamics, cultural circumstances, primary and secondary livelihoods for Project Affected People (PAPs) can be found in the projects Resettlement Action Plan (RAP).

**Project Alternatives**

Alternatives were considered in the development of the project with the objective to compare both the negative and positive environmental and social impacts. The assessment of alternatives considered alternative in five categories:

- **Demand alternatives** (eg producing ethanol only rather than developing the proposed project area for edible sugar production, applying less developed power generation concepts, which generate significantly less power to the local grid, locating the project site to a different area in the district, region or nation);
- **Process alternatives** (eg re-use of waste material, the use of other technologies);
- **Schedule alternatives** (eg restricting construction or operations to a certain time of year).
- **Input alternatives** (eg use of other raw materials)
- **Scale alternatives** (eg changing the scale of the proposed development in order to comply with environmental and social requirements).

A range of systematic methods was used to compare and evaluate the various alternatives including checklists, overlay maps, matrices, mathematical models, description of the main impacts expected and the reasons for accepting or rejecting the respective alternative considered. A simple matrix with the following ratings was used to determine potential impacts:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3</td>
<td>Very high positive impacts</td>
</tr>
<tr>
<td>+2</td>
<td>High positive impacts</td>
</tr>
<tr>
<td>+1</td>
<td>Minor positive impact</td>
</tr>
<tr>
<td>0</td>
<td>No impacts</td>
</tr>
<tr>
<td>-1</td>
<td>Minor negative impact</td>
</tr>
<tr>
<td>-2</td>
<td>High negative impacts</td>
</tr>
<tr>
<td>-3</td>
<td>Very high negative impacts</td>
</tr>
</tbody>
</table>

In the development of proposed mitigation and enhancement measures the team focused on significant positive and negative impacts that were rated +2,+3,-2,-3

Impact Correlation Matrix for the proposed development of the Bagamoyo project.
Impact on the Project Area of influence and Host Communities is also further evaluated in the Resettlement Action Plan (RAP)
No Project Alternative
If the project were not undertaken and if the currently land use were to continue the remaining pockets of valuable biodiversity currently in the area would in all likelihood be decimated by the rapidly increasing unsustainable charcoal making, releasing comparatively great amounts of carbon to the atmosphere, and hunting (poaching) in the project area. The project’s public benefits such as increased revenue to the government, improved infrastructure, introduction of a new cash crop and thousands of employment opportunities would not be realised. The No Project Alternative would also aggravate the current domestic edible sugar and power shortages and eliminate the possibilities to replace imported fossil fuel with domestically produced renewable fuel.

Site Alternatives
The project is the first project in a planned number of projects by GOT to be set up in Tanzania. The project site was selected due to a number of reasons. The site is ideal because of the relative small size (a sugarcane project in for instance Brazil is around 40,000 ha, Kilombero Tanzania 24,000 ha), proximity to Dar es Salaam, access to infrastructure, land ownership structure and the existence of surrounding villages that are willing to participate as out growers. EcoEnergy originally considered to locate the project in Rufiji River Valley, around 300km South of Dar es Salaam. After discussions with Government of Tanzania the company was advised to develop the first project on the former Razaba Ranch outside Bagamoyo instead.

Technology
The technology of the operation of a large-scale sugar cane plantation is well established in Tanzania. However the technology of utilising modern irrigation systems and processing sugar cane into sugar, ethanol and power is well established in South Africa, Brazil and India where the process technology providers are coming from. Therefore, the risk of uncertainty in functionality from establishing the chosen technologies is minimal. There is a strong focus of ensuring that the knowledge base is transferred to local Tanzanians to secure the long term needs of the project developer. This will be done by a gradual phase out process of expatriate staff. By 2015 it is estimated that more than 98% of persons working in the project area will be Tanzanian citizen to a large extend from the surrounding communities.

Ethanol can be produced from other materials and if the feedstock for the plant was changed from sugar cane to sweet sorghum, water requirements for irrigation would be lower. On the other hand, no sugar can be produced from sweet sorghum, the application of sweet sorghum for production of biofuel is yet not fully proven and the yield per hectare is lower consequently, both plant size and the amount of cultivated land would have to be increased considerably with a higher rate of uncertainty in order to produce the same amount of renewable energy. Sugar cane as the feedstock will be able to achieve all the desired products with a low degree of uncertainty.

5. Potential Impacts and Mitigation/Enhancement Measures
There are a number of positive impacts with the project as well as a number of negative impacts that will require mitigation and management actions to reduce the risk. The project developer is planning to do this through various plans such as the Environmental Management Plan, Social Sustainability Management Plan, Resettlement Action Plan (RAP), Safety Management Plan etc.
Positive Impacts

Support to National Strategies

The project supports Government rural development and agriculture development initiatives including Kilimo Kwanza; Energy National Policy; Agriculture and Livestock Investment Policies, Rural Development Strategy; and National Strategy for Growth and Reduction of Poverty (NSGRP) and SAGCOT. Embedded within the strategies are the promotion of sustainability and energy efficiency and poverty alleviation to be involved in the development process. The project also supports the implementation of the Sugar Industry Act of 2001 which advocates the growing of varieties of sugar cane and manufacturing of sugar.

Outgrowers

The project is designed to provide a new source of income to neighbouring villages and farmers as outgrowers. These benefits will come very early during the projects operational phase. The proponent intends to involve the local communities in the project as much as possible through a dedicated outgrower program. The strategy for the outgrower scheme is summarised in The Sugar Cane Smallholder/Outgrower Scheme in Tanzania (November 2008) and EcoEnergy Out Grower and Community development plan (August 2011). The proposed outgrower plan is intended to provide major social and economical development in surrounding villages by offering an enhanced feedstock supply security.

Fully implemented the outgrower component would supply approximately 300,000 tons of sugarcane annually from 3000 ha of outgrower land organised into commercial entities of 75-150 ha each. The outgrower scheme will be operated along clear commercial lines to ensure financial sustainability and will include a comprehensive capacity-building component to ensure that the outgrowers receive the skills and support to run and manage their farms both from a technical and business point of view.

Climate Change Benefits

The release and sequestration of carbon depends on many factors such as the practice used to establish plantations and what type of farming method is used. Monitoring and measurements of actual changes over time of soil carbon content is an important piece of information in order to promote best practices that increase rather than decrease carbon sequestration and reduce carbon emissions.

In 2009 FAO conducted a Bioenergy Environmental Impact Analysis (BIAS) of the planned Ethanol Production from the Bagamoyo Project. The findings of the BIAS provided the developer with some useful findings and recommendations to continue with more thorough site-specific assessments. Following this advice EcoEnergy has clarified its intention to sign an agreement with a research consortium to perform baseline analysis of carbon, focusing on below ground carbon storage. This will also include a Life Cycle Assessment (or LCA) carried out to quantitatively assess the environmental impact and the energy requirements of sugar and ethanol produced from the plant from its initial raw materials to its final disposal (i.e. cradle to grave). This LCA will take into account any other products or services that may be required to facilitate its use and/or production. The BIAS report provided following information based on the analysis of the project;
Almost all sugarcane ethanol production systems can meet the greenhouse gas limits of 35% and 50% required by the RES directive (CEC 2008). It is however also a matter if the Tier 1 or Tier 2 approaches are being applied and that higher yields leads to less greenhouse gas emission. Source: FAO BIAS of Ethanol Production from Sugar Cane in Tanzania, Case Study: Bagamoyo (2009)

The power delivered to the national grid will on the margin for many years still replace power generated from diesel generators. 100 000 MWh delivered to the national grid replacing 100 000 MWh diesel generated power reduces CO2 emissions by 100 000 ton CO2/year. 8000 cbm of ethanol that is used to replace gasoline reduces global CO2 emission by approximately 16 000 tons/year but if ethanol is replacing charcoal for cooking the GHG benefits are estimated to be three times larger.

Furthermore, the nation will benefit directly from becoming less dependent on energy imports and in the longer perspective support development towards energy self-sufficiency based on renewable energy. This would open up for a new area of possibilities reducing the imports of oil which currently gobbles up approximately 40% of all export revenues including revenues from tourism

In order to reduce the total amount of carbon released across the production life cycle, the Project will follow the following sustainability practices:

1. A "no burning policy" when clearing land, using the cleared biomass in co-generation producing extra bio-power in the boilers at the processing factory.

2. Green harvesting of the sugar cane leaving a blanket of leaves on the field that is broken down into the soil as organic matters turning the soil into an efficient carbon sink.

3. Co-generation: using high pressure boiler for renewable power for internal energy usage and for exporting to the grid.

4. Co-generation: using high pressure boiler also in off season generating more renewable power for export to grid.

5. Bioethanol in vehicles and machinery when ethanol production starts and increasingly more and more as ethanol vehicles becomes more available and viable.
The Project Developer also intends to investigate the possibilities to register for CDM financing on account of reducing GHG emission as done in similar co-generation projects.

**Direct and Indirect Employment**

The project will require labour during construction and operations and much of the workforce will be drawn from the local communities. The project will at the maximum of the construction period employ more than 1000 workers and when fully operational approximately 2200 workers. In line with the GoT’s policy to meet labour market needs, future curricula of some Vocational Training Centres (VTC) are planned to be adapted to the requirements of agribusiness development and operational techniques, to ensure adequate standards and numbers of skilled workers required by the emerging industry. Discussions are ongoing to establish a VTC in Bagamoyo Town, since many of the future skilled workers such as supervisors, technicians and operators, will be recruited through VTCs, with priority given to those from the coastal region.

Senior and junior managers will be recruited using the combined networks of the proponent but also using recruitment companies as there is an established sugar industry in Tanzania, as well as through close collaboration with higher learning institutions. At the start up stage it is expected that approximately 2% of the workforce will be senior regional and international experts. Over time the vision is that 100% of the workforce will be Tanzanians. Manual labourers will be recruited from the local community as far as possible. The great majority of the Employees will live in Bagamoyo and the surrounding villages and will be offered transportation to the site in buses when necessary.

The dramatic increase in local income from direct employment may have the indirect benefit of attracting people away from unsustainable means of income such as charcoal making and hunting, having the indirect benefit of alleviating strain on natural resources. The project will also benefit the local economy through the direct provision of goods and services from locally-based people and businesses to supply the operation as well as the workers.

**Negative Impacts**

**Construction Phase**

- Change in population level due to influx of workers and labourers causing pressure to social services, food and facilities
- Soil erosion due to runoff effects and loosened top soil during ploughing and planting
- Changes in the quality of surface water due to chemical use
- Changes in the level of crime due to increased number of people in the area
- Increase in the risk of communicable diseases (e.g. HIV/AIDS) and human health due to increased population of workers and social interactions
- Change in the level of traffic intensity and traffic accidents due to increased number of vehicles concurrently with better transport facilities
- Loss in the village workforce to the project
- Loss of biodiversity during clearing and establishment of the plantation
- Fair compensation for land and other properties to be affected by the project
- Loss of land through Project Land Take (Mitigation measures developed in RAP)
- Loss of farmland and land based livelihoods (Mitigation measures developed in RAP)

**Operational Phase**
- Localised changes in surface and groundwater hydrology due to the project activities notably irrigation.
- Changes in the quality of surface and groundwater due to use of agrochemicals
- Potential interference with migration routes of elephants and other animals
- Increase in the level of crime due to increase in population in the area
- Interference with marine ecology
- Increase in the risk of communicable diseases and human health due to increased population of workers and social interactions
- Increase in population due to influx of workers and labourers increasing pressure to social services, food and facilities
- Increase in the volume of traffic intensity and traffic accidents due to project activities concurrently with better transport facilities.
- Increase in income in the village will lead to youth resorting to prostitution, drinking and loss of morality
- Increased resource use conflicts, particularly land and water
- Loss in the village workforce to the project.
- Loss of access to the natural resources found on the central government land, e.g. for grazing, hunting (poaching) and charcoal making

Decommissioning Phase
- Soil erosion due to run off effects and loosened top soil due the removal of sugar cane
- Loss of employment and income to workers, local economy and the nation
- Change in life style and quality of workers due to loss of employment

The more significant negative impacts and their planned mitigation actions are described in the following sections.

**Biodiversity**

*Loss of biodiversity during clearing and establishment of the plantation*

*Potential interference with migration routes of elephants and other animals*

The project will implement a number of mitigations to prevent loss of biodiversity. Through plantation layout planning, conservation of belts of natural vegetation between fields will maintained. Large trees and forest patches along roads and field borders will be maintained for the benefit of birds, invertebrates and small mammals and contribute to natural insect pest control and the aesthetic value of the area. Specific protection measures will be taken for existing habitats including IUCN listed threatened species. Endemic or threatened species will be left untouched or replanted within protected biodiversity zones and or other suitably protected areas. To allow for continued movement of large mammals to and from Saadani National Park migration routes will be maintained.

The project will also work with Wildlife Division and Sadaani National Park and the surrounding communities to promote biodiversity and to address indirect impacts that may be caused by the project development.
Water Resources

Localised changes in surface and groundwater hydrology due to the project activities notably irrigation. A buffer zone will be created around the Wami River to reduce the risk of water pollution and siltation. A buffer area will also be established around the smaller seasonal streams. Location of constructed drainage channels will be done with consideration of environmental issues. To minimize impacts to surface water or groundwater by herbicides and fertilizers or excessive river water intake the project will implement protective measures. Design and planning of irrigation and fertilizing systems (including choice of and application schedule of herbicides and fertilisers) will be done in consideration of protection of water resources. Application of organic cultivation methods will be implemented over time as soil fertility is improved. River water extraction will be done in accordance with permit requirements and water use will be monitored. The project will use and expand existing storage dams to minimize potential impacts to the downstream environment.

Natural Resources

The project development may increase pressure on adjacent forested areas. The project will encourage establishment of both village forest reserves (see biodiversity map) and woodlots in nearby areas for production of firewood and poles for own consumption. To alleviate against increased human wildlife conflicts due to larger animals changing their migration routes towards surrounding land the project will take measures in conjunction with the mandated structures such as the Wildlife Division and SANAPA to advise and support nearby farmers who may suffer from increased wildlife foraging on their fields. This support may include:

- Support to establish wildlife management areas;
- Assistance to control problem animals; and
- Initiatives involving communities in wildlife protection and ecotourism.

Use of Chemicals

Changes in the quality of surface water due to chemical use

A programme of Integrated Pest Management (IPM) (in accordance with the World Bank Group EHS Guidelines for Plantation Crop Production Guidelines (2007)). Generally fungicides may be used when planting sugar cane where hot water type control is not used. Some insecticides will also be used. If pesticides need to be used, low toxicity versions will be favoured. Care will be taken with respect to fish, amphibian, and avian toxicity levels.
of the poor quality of the soil, fertilisers will need to be used to correct the deficiency of nitrogen, potassium and phosphorus. While there is a strategy to move towards organic farming in the long term, it will be necessary to use fertilizers at the start to supplement the supply of nutrients, especially nitrogen. At the full operation the project may use up to 3400 tons of DAP and 5100 tons of urea per annum. Chemical fertilizer application can be applied through the drip irrigation system, a process known as fertigation. This would ensure timely application and a constant low but optimal level of nutrients for the plant as well as minimum nutrient runoff or drainage to the drainage area. With other irrigation systems, nutrients will be applied to the soil mechanically or manually either in the form of vinasse, compost or chemical fertilisers. Application of all chemicals will be done using strict procedures to protect worker and community safety and to minimise overall use.

**Resettlement**

*Fair compensation for land and other properties to be affected by the project*

In 2007 when the government granted the use of the land to the company, the company undertook a survey to determine who was still living on and using the land. The survey found that 60 temporary and 2 permanent structures on the land, all in the northern area. Since that time there has been additional influx onto the land by people using the land for small cropping and grazing. In March 2011, the company initiated a formal process to develop a Resettlement Action Plan (RAP) in accordance with AfDB’s Involuntary Resettlement Policy and IFC’s PS5. The acquisition of the land and establishment of the project will result in a variety of physical, economic and social impacts and in particular the resettlement of people currently residing or using lands within the project area. Altogether there are 452 people currently living in the project area including 11 Barabaig pastoralist households. The total number of vulnerable people in the area is 167. There are also at any one time over 150 itinerant charcoal producers. The RAP will guide on minimising these impacts through consultation and a careful selection of appropriate resettlement sites, capacity building and other factors, which could transform negative impacts into positive effects. This for example can be achieved through improvements to the host community, in terms of livelihood or infrastructure, which can in turn mitigate hostility. PAPs need to receive as much information as possible to make informed choices about livelihood alternatives. A compensation matrix will be developed which has a combination of financial and ‘in kind’ packages, tailored to the individual.

**Food Insecurity**

Increasing cost of food and diverting human resources from current grain or food production to the production of sugar cane for sugar, bioethanol and power production may lead to food insecurity. However this is not expected to be the case for the Bagamoyo Project as the use of farming cooperatives is expected to provide the local farmers with the knowledge to also cultivate their present food plots more efficiently and the planning framework to ensure balanced production of food and cash crops. Furthermore during the rainy season the production slows down. This should create an opportunity for permanent employees to apply for time off in order to return to their fields during this very important season for farming and food production. Since this project will also produce sugar for domestic use, it will help alleviate the sugar shortage problem which currently is about 150,000-200,000 tons per annum. Therefore, it will contribute in enhancing food security since sugar is one of the important food ingredients in the country.

**Environmental Hazard Management**

*Accidental release of hazardous materials during storage or handling; and*
Industrial accidents to workers during plant or plantation construction and operations.

The project would operate under the requirements of the Tanzania Industrial and Consumer Chemicals Act (2003) that requires proper management and control of industrial and consumer chemicals in Tanzania. It requires that any person dealing in industrial chemicals register with the Industrial and Consumer Chemicals Management and Control Board. The Act requires that any person wanting to erect a storage facility for bulk chemicals should undertake an ESIA. The Act requires also that there be in place contingency plans and procedures for managing accidents, spills and contaminated sites. The project will also use inorganic fertilizers, disinfectants, and herbicides in its operations. All herbicides, which are going to be applied have been certified by Tanzania Pesticide Research Institute (TPRI) and will be applied and handled in accordance to the provisions of the standing regulations and acts notably the Tanzania Pesticide Control Regulations of 1984.

The project has prepared a plan that specifies hazardous material storage and handling and spill prevention and response methods. Workers will be trained on management of hazards and proper procedures. Workers will also be trained on safety requirements and methods pertaining to their job in order to reduce the risk of accidents. Workers will use proper personal protection equipment (PPE). Workers will also be trained in emergency procedures.

8. Monitoring Program

Environmental and Social Management

An Environmental Management Manual has been developed for the project to make sure appropriate procedures are in place to ensure impacts identified in the ESIA are properly managed. The manual is based on the major components of an ISO 14001 Environmental Management Systems standard and in addition to an environmental policy, includes the following sections; planning, implementation and operation, checking and corrective action and management review. As part of the programme, specific Control Plans have been developed for the following:

- Compliance with Applicable Environmental Legal Requirements;
- Hazardous Materials;
- Oil and Pollutant Spills;
- Management of Biodiversity;
- Erosion & Watercourse Management;
- Service of Equipment within the Project Area;
- Solid & Liquid Waste Management;
- Workplace Emergency Preparedness;
- Vinasce and Excess Molasses Management;
- Carbon Emission Management;
- Archaeological and Historical Management;
- Forest Management; and
- Bush Clearing.

A Social Sustainability Management Plan has also been developed to manage social impacts identified in the ESIA. The document includes following sections:

- Community Consultation Management Plan
- Health & Medical Management Plan
An organisation and responsibilities plan has also been developed to guide environmental planning and implementation. The project will require that the main contractors designate a qualified Site Environmental Officer (SEO) responsible for implementation of mitigation measures set out in the Environmental Management Plan.

During operations, the project expects that it will establish a Sustainability department within the business of approximately 17 full-time employees covering: sustainability management; corporate social investment; sustainability planning; quality, environmental, health and safety, and corporate communications.

**Types of Monitoring**
The project's environmental and social monitoring programme includes four categories of monitoring:

- **Baseline monitoring** – the measurement of environmental parameters during a pre-project period and operation period to determine the nature and ranges if natural variations and where possible establish the process of change.

- **Impact/effect monitoring** – the measurement of parameters (performance indicators) during project establishment, operation and decommissioning phase in order to detect and quantify environmental and social change, which may have occurred as a result of the project. This monitoring provides experience for future projects and lessons that can be used to improve methods and techniques.

- **Compliance monitoring** – involving periodic sampling and continuous measurement of levels of compliance with standards and thresholds.

- **Mitigation monitoring** – to determine the suitability and effectiveness of mitigation programmes, designed to diminish or compensate for adverse effects of the project.

**Monitoring Indicators**
The project will use ecological and social indicators to monitor the status of the surrounding villages and habitats within the project area and important nearby terrestrial and marine ecosystems (e.g., the riverine forest around the Wami River, mangroves at the Wami River Estuary, coral reef areas, sea grass areas). Monitoring of water resources will include evaluation of surface water and ground water indicators such as flows and water quality. Social indicators to be monitored include household income, employment and access to potable water. At a national level, macroeconomic indicators to be monitored include:

- Area used (hectares) for agro-energy production locally and nationwide
- Units (m³, tons or kWh) of agro-energy end products produced
- Units (preferably liters or m³) of agro-energy sold domestically
- kWh (kilowatt hours) of biomass based electricity produced and delivered to the grid
- Displaced net CO₂ emissions tons (or CO₂ equivalents, to include also other greenhouse gases) through the project
A summary of the project’s environmental and social monitoring plan is available in the full ESIA report.


Public participation was an important element of the sustainable development process for the project. Various stakeholders participated in the ESIA study and consultations were held with local communities, village, ward and key district officials. During consultations, the local communities had opportunity to air their concerns. The general concerns and issues that were raised have been included in the list of anticipated negative impacts together with planned mitigation measures. Methods for stakeholder engagement included unstructured interviews, focus group discussions, presentations and subsequent discussions. Stakeholders were identified through scoping, networking, literature review and interviews. Important partners and stakeholders on issues pertinent to the project include:

- Communities and individuals in the villages surrounding the project area
- Pastoralists crossing through the farm with their cattle on the way to markets in Dar es Salaam
- Village officials especially those responsible for matters involving water, land use and natural resource management (such as the Land Use Management and Environment Committees at the village level)
- Bagamoyo Government and local authority officials such as:
  - Bagamoyo District Commissioner
  - Bagamoyo District Council
  - Bagamoyo District Executive Director
  - Bagamoyo District Natural Resource Officer
  - Bagamoyo District Agricultural and Extension Officer
  - Bagamoyo District Administrative Officer
  - Bagamoyo District Land Officer
  - Government ministries, parastatal organizations, agencies, institutions, and departments such as:
    - Ministry of Energy and Minerals,
    - Ministry of Natural Resources and Tourism (Wildlife, Forestry and Beekeeping Departments),
    - Ministry of Agriculture and Food Security,
    - Sugar Board of Tanzania,
    - National Sugar Institute
    - Ministry of Regional Administration and Local Governments,
    - Ministry of Planning and Economic Empowerment,
    - Office of the Vice President, Division of Environment,
    - National Environment Management Council (NEMC),
    - Tanzania National Parks Authority (TANAPA)
    - Saadani National Park Authority (SANAPA)
    - Wami River Basin Office
    - Ruvu River Basin Office
    - Tanzania Coastal Management Partnership (TCMP)
    - University of Dar es Salaam
    - Ardhi University

International Institutes and Non-governmental Organisations such as:
  - Institute for Energy and Environment (Evaluation of the environmental
Disclosure of the ESIA was carried out by the NEMC through their Technical Review Meeting process. Disclosure involved the announcement that the ESIA report was available for comments during the review period. Public feedback was considered in the NEMC’s decision-making process. All in line with the legal requirement for performing an ESIA in Tanzania. The project has also undergone other consultative processes which are guided by the Stakeholder Engagement Plan to ensure that various stakeholders are continuously informed and engaged throughout all phases of the project.

10. Complementary Initiatives

During the course of project development, the company consulted with numerous specialists and organisations to ensure that development plans were appropriate in terms of alignment with sustainable practices and CSR initiatives.

Tanzania Government will become a major shareholder
EcoEnergy Bagamoyo gets access to the land in a transparent process where the Tanzanian government becomes a major long term shareholder of the company in exchange for land. This model, of equity in exchange for land, is applied on a project for the first time and is now intended to serve as a model for a new national policy relating to large scale land investments in Tanzania for agriculture of forestry.

Housing
The Developer is planning for an off-site housing model with the aim to maintain and integrate the vast majority employees of the Bagamoyo Project into the existing communities. This model promotes sustainable community development in general with the main purpose being the strengthening the social structure in the surrounding villages and new growth points also providing the large majority of the employees and their dependants the right to their homes, schools, clinics and other local facilities regardless of whether they continue their employment with the Project. The planning responsibility will be shared by the local government, community and the Project. It is anticipated that the local population will grow beyond the new influx of employees for the Project. The vision for housing is therefore to support the local communities in planning residential areas not only for people directly related to the Bagamoyo Project, but also for other community members within or outside of the supply chain. Each employment category requires different housing arrangements and the Project will provide extra housing allowances in order for each employee to build or acquire his/her own house within the plans set by the local town planner. The aim of the accommodation policy is for all categories to optimise worker capacity by good, safe housing, where family life is well organised. Good housing also promotes better health for workers which leads to a more stable and reliable workforce.

Healthcare and Medical Facilities
The Developer plans to establish in-house healthcare facilities in the form of an occupational health clinic with the emphasis on prevention and awareness programme, as well as an onsite mobile clinic, equipped for handling minor injuries and diseases, that in emergencies can operate as an ambulance. The Project is also looking at linking employees to the National
Medical Insurance Scheme to make use of the available medical care as a starting point while urging for improved medical facilities at these service points

**Benefits to surrounding communities**
The project includes a comprehensive programme to develop small-holder farmers from the beginning. The project is designed so that a market opportunity will be created from day one to the local farmers to supply sugar cane through a comprehensive outgrower programme that will give work to an estimated 1500 small holder farmers.

**Sharing knowledge with others**
Further to the Lenders monitoring programme Stockholm Environment Institute (SEI) has expressed an interest to, together with a number of local Universities and Government Institutions, follow and monitor the project over a ten year period in order to build solid scientific knowledge from a number of aspects such as long term effects on:

- Livelihood changes
- Net effects on GHG emissions and energy usages
- Water and nutrient resource management
- Ecosystem services and multifunctionality of landscapes

Other Important partners and stakeholders on various socio-economic issues include but not limited to:

- **Food security issues**: The Ministry of Agriculture and Food Security, District Agricultural extension workers, bi- and multi-lateral agencies in particular the Food and Agriculture Organization (FAO) of the United Nations, nongovernmental and civil society based organizations.

- **Issues of vulnerable people**: The Ministry of Community Development, bi- and multi-lateral agencies including the UNHCR and MS, nongovernmental organizations, representatives of the pastoralist groups, local government representatives.

- **Health service issues**: The Ministry of Health and Social Welfare, the NACP, local government representatives, private health service providers, bi- and multilateral agencies, nongovernmental organizations.

- **Issues pertinent to education**: The Ministry of Education, local government representatives, private education providers, bi- and multi-lateral agencies.

- **Professional capacity building issues**: The University of Dar Es Salaam, the Vocational Education and Training Centres, the Sokoine Agriculture University, Ardhi University, the Tanzania
Agricultural Development Trust, Netafim Irrigation University, the South African Sugar Association, Sugar Research Institute and the Tanzania Students Networking Programme.

- Accommodation issues: The Ministry of Land and Human Settlements, local government representatives, UN Habitat, contractors, legal representatives, the World Bank for water and sanitation issues, bi- and multi-lateral agencies.

11. Conclusion

The project has the potential to bring significant development for Tanzania and to be a catalyst for modernisation and growth of the agribusiness sector. A large-scale sustainable agriculture business using modern irrigation, harvesting and cropping techniques with local value added processing would serve as a model for the sector in the country. The project has other socioeconomic benefits in the way of generating direct dividends, tax revenues to GoT and all the indirect effects from 11 000-15 000 new jobs.

The project development will however require the conversion of large tracts of land to dedicated agricultural use. This has the potential to reduce biodiversity where sensitive habitats are either cleared or indirectly impacted. Land take will also require the physical and economic resettlement of a number of informal land users. Project operations also create the risk of impact to the environment by hazardous materials and project-related wastes and discharges. Project operations also create a risk to the local communities who share the usage of natural resources including surface water and the marine environment.

In order to ensure that the development benefits remain greater than the project impacts, the project will need to ensure that mitigation measures developed to avoid or minimise impacts to environmental and social resources are fully implemented and that they are monitored for effectiveness. BEE has expressed its commitment to implementing all the recommendations given in the ESIA against negative impacts and enhancement measures for the positive environmental and social consequences. The developer is also committed to carry out internal and external environmental auditing and monitoring schedules to ensure project sustainability with least negative impact on the social, economical and ecological environment.
CONTACTS

Any queries on this document should be referred to the following contact persons:

AGRO ECOENERGY TANZANIA LIMITED
Mr. Anders Bergfors, Managing Director, Agro EcoEnergy Tanzania Limited, P.O Box 23423, Dar es Salaam, Tanzania. Tel.: +255 22 260 12 85, Email: Anders.Bergfors@ecoenergy.co.tz.

Mr. Per Renman, Manager for Quality, Environment, Health and Safety, Agro EcoEnergy Tanzania Limited, P.O Box 23423, Dar es Salaam, Tanzania. Tel.: +255 22 260 12 85, Email: Per.Renman@ecoenergy.co.tz.

AFRICAN DEVELOPMENT BANK
Ms. Subha Nagarajan, Senior Investment Officer, Industries and Services Division (OPSM.2), Private Sector and Microfinance Department (OPSM), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia. Tel: +216 71 10 3902, Email: s.nagarajan@afdb.org.

Ms. Rachel Aron, Senior Social Development Specialist, Environment and Climate Change Division (ONEC.3), Energy, Environment and Climate Change Department (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvédère, Tunisia. Tel.: +216 71 10 2792, Email: r.aron@afdb.org.

Mr. Uche Duru, Senior Environmental Specialist, Environment and Climate Change Division (ONEC.3), Energy, Environment and Climate Change Department (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvédère, Tunisia. Tel.: +216 71 10 3817, Email: u.duru@afdb.org.