



- GHG emissions reduced by 56,000 t CO₂/yr
- RSB certified plant
- Supply of electricity to national grid
- Registered under Clean Development Mechanism (CDM)

Sustainable Ethanol Plant for Africa

Addax Bioenergy Sierra Leone (West Africa)

Sugarcane syrup to Ethanol plant supplied and installed by Praj for Addax Bioenergy Sierra Leone has many differentiating facets. Be it economical, social, or environmental, it has created a milestone in sustainability. Praj is proud to be associated with this prestigious Ethanol Project.

As there was limited resources and infrastructure available locally, Praj delivered services from grounds up, including infrastructure required for the project to trained manpower.



Background

Addax Bioenergy, Switzerland contracted Praj to install 380 m³/day cane syrup based ethanol plant at Makeni, Sierra Leone (West Africa). The project was initiated in the year 2011 and project was successfully commissioned and handed over in May 2014.

Praj has supplied technology and main process block including Fermentation, Distillation, Molecular Sieve Dehydration and Product Storage Sections. The plant is designed in such a way that in future, with addition of a module to process cassava chips, the plant can operate on 'Dual Feed' mode. The plant is designed to deliver energy efficient operation. A vapor absorption system for energy saving is another innovative aspect of this plant.

Apart from main process block, Praj also supplied Membrane based wastewater treatment plant consisting of Ultra Filtration and Reverse Osmosis. The treated water is recycled to the cane milling, co-generation (power plant) and ethanol plant, thereby reducing fresh water intake.

Praj has installed this project on an EPC basis. The scope includes process plant design, engineering and installation at site (excluding civil work).



Addax Bioenergy

Project Impact

Production of bioethanol and renewable electricity has commenced. It will produce 85,000 m³ of bioethanol per year by end 2016.

This pioneering project involved development of 10,000 hectares of sugarcane plantation, the construction of a bioethanol refinery and a biomass-fuelled co-generation plant to produce green power, contributing to 20% of Sierra Leone's national electricity requirements.

The production of power will reduce greenhouse gas emissions by 56,000 t CO₂ per year through the replacement of fossil fuel-intensive energy, and is the first initiative in Sierra Leone to be registered as a Clean Development Mechanism (CDM) project of the United Nations Framework Convention on Climate Change.

The certification by RSB of the agricultural estate and production facilities in March 2014, the first of its kind in Africa, is also an important recognition of the sustainable practices implemented by the company.

It has been developed in partnership with eight Development Finance Institutions. Addax Bioenergy is certified under the Roundtable on Sustainable Biomaterials (RSB) and complies with the most stringent global sustainability standards, including the World Bank's IFC Performance Standards, Africa Development Bank's Environmental and Social Safeguards Policies and the EU Renewable Energy Directive.

GHG savings :
~56'000 tons
of CO₂ per
annum

Location :
Bombali and
Tonkolili
Districts, close to
Makeni, Central
Sierra Leone

Project phase :
2011 – 2014

Excess power :
15 MW
(for National
Grid)

Facts & Figures

Investment :
About
EUR 400 million

Ethanol output :
85,000 m³
per year

Processing
capacity :
1 million tons
of cane
per year

Estate area :
10,000
hectares



Praj Scope

The EPC project includes:

- License
- Design
- Supply
- Engineering
- Site infrastructure
- Erection
- Startup & Commissioning
- After sales service

critical precess equipment and systems

- Fermentation
- Distillation
- Dehydration
- Water preparation plant
- Receiver and Storage
- Terminal Loading Automation
(Bottom Loading tanker loading station)
- Fire Protection and Hazard zone management

Highlights

Technology

- Plate Heat Exchangers (PHEs) in Fermentation section are cooling on Vapor Absorption Machine (VAM) to reduce cooling tower load
- Energy Integrated Solution. All distillation columns and VAM are operating on exhaust vapors from syrup evaporator effects, delivering significant energy saving of about 80% on fresh steam requirement
- Energy saved is supplied to the grid. Plant supplied 18 MW to the national grid
- Complete skid arrangements for Bottom Loading tankers
- Fully automated ethanol and water preparation plant

Engineering

- Adherence to European project execution norms
- Adherence to standards like IFC (World Bank Group), NFPA: (National Fire Protection Association), BS Codes: BSI British Standards
- Sierra Leone Regulations (Based on US and UK standards), API ASME, CINI and IEC

Construction

- Compliance with elaborate HSSE site management plan
- Non-availability of material and machinery, skilled manpower and engineering skills within Sierra Leone
- Special Packing for critical equipment (Sea Environment for 5 months and extended port clearance period coupled with heavy monsoon at site)

Mitigation plan

- Undertook prefabrication of tanks, piping and structurals to minimize site work
- Arranged prefabricated camp and centralized canteen facility to achieve desired hygiene standards and a Medical attendant
- Tools and tackles, site infrastructure shipped well in advance
- Skilled manpower, machinery and consumables sent from India
- All Non Distractive Testing (NDT) equipment like X-rays (electrical), vacuum test and Hydro test instruments sent from India
- Full-fledged Quality Assurance & Quality Control (QAQC) team deputed at site to ensure quick response
 - Deputed additional HSE staff to ensure safe working
- Achieved 1.25 million man-hours without any reportable accident
 - Rainfall for almost 9 months of the year
- Effective measures against Malaria, Ebola and Lassa fever

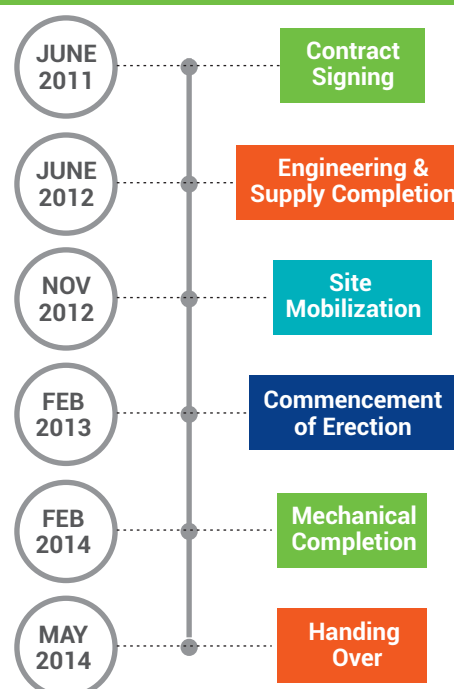
Execution Highlights

- Executed by Praj Industries (SL) Ltd. a step subsidiary of Praj Industries Limited and subsidiary of Praj Africa
- Execution during peak rainy season [max rainfall in rainy season is 650 mm per month]
- Material handling equipment at site included 200MT Crane, 50,40 and 35 MT Cranes, 15 & 12 MT hydra, Cherry Picker, Trailers, Trucks, etc.
- In-house paramedics for complete compliance with IFC norms
- In-house canteen service with a capacity to cater 300+ staff in one go
- Full A/C accommodation camp at site
- Equipment Specific Maintenance Procedure (ESMP) guideline monitored by various lenders like African development bank, European development bank, etc.
- In-house Radiography Testing (RT) facility developed at site. Electrical X-ray machine used for Radiography Tests.
- In order to mitigate risks of radioactive source handling, Electrical machines were used
- Safety Award from Addax was conferred on Praj for Accident Free completion of the project.

Logistics & Material Handling

Praj handled the design, engineering, manufacture, supply and logistics for:

- 600 MT structure
- 650 MT of site fabricated tanks
- 60000 inch/m fabrication of piping
- 250 MT of Bought out equipment
- 300 MT of shop fabricated equipment
- 25 MT of Fire protection & Hazard Zone management equipment
- 300 container load + 2500 cbm of break-bulk including material for ethanol plant, Water Preperation Plant (WPP) temporary infrastructure, tools & tackles, consumable and machiner.





HSSE Highlights

- Welder qualification test before deputation to site
- Online Induction & test before departing from India
- Safety Induction at site before commencement of job
- Weekly Tool Box Talk & Safety training
- Weekly Safety meeting with all staff and contractors
- Weekly Safety inspection for site activities
- Weekly Safety inspection of Site & Infrastructure
- Risk Assessment for erection activities with significant hazard
- Safety briefing for team before critical activity
- Praj had established its own team of paramedics and onsite dispensary facility at site to treat the workers and staff members
- Fully air conditioned guest house facility to accommodate 200 workers as per International Finance Corporation (World Bank Group) standards
- Segregation of waste for easy disposal
- Periodic fumigation, housekeeping activities
- Adherence to safety precaution during commissioning as it was declared Atex zone during operation
- 1.25 million Safe Man-hours without reportable incident





About Addax Bioenergy



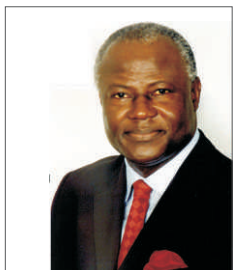
Addax Bioenergy is a subsidiary of private investment group AOG. It was formed in 2008 to develop a sustainable investment model for bioenergy in Africa. It has developed a sugarcane based renewable energy project near Makeni, Sierra Leone, that is producing bioethanol for export and renewable electricity for its own operations, as well as about 20% of the country's power grid. Addax Bioenergy has created a pioneering model for Africa by partnering with eight European and African development finance institutions; integrating strict social and environmental criteria from the start; implementing the largest food production and agricultural training program in the country; introducing innovative social solutions; and demonstrating transparent business conduct.

About Praj

Praj is a global process solution company driven by innovation and integration capabilities, offers solutions to add significant value to bio-ethanol facilities, brewery plants, water & wastewater treatment systems, critical process equipment & systems, high purity solutions and bio-products. Over the past 3 decades, Praj is focused upon environment, energy and agri-process led applications. Praj has been a trusted partner for process engineering, plant & critical equipment and systems with over 600 references across 5 continents. Solutions offered by Praj are backed by its state-of-the-art R&D Center called Matrix. Led by an accomplished and caring leadership, Praj is a socially responsible corporate citizen. Praj is a publicly listed Company.



Testimonials



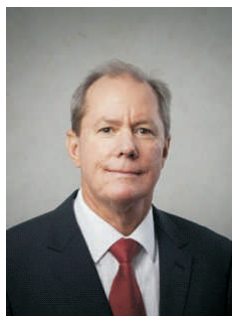
"This is a great achievement for the people of Sierra Leone".

**- Dr. Ernest Bai Koroma,
H.E. the President of Sierra Leone**



"We are proud to be associated as a EPC contractor for the bioethanol plant for Addax Bioenergy S.L. This is first-of-its kind sustainable plant. It will serve as a benchmark in Africa and around the world".

**- Mr. Pramod Chaudhari, Executive Chairman,
Praj Industries Limited, India**



"This is a proud moment for Addax Bioenergy and the people of Bombali and Tonkolili Districts, who have been closely involved in the project from the start. The project has taken six years of investment, commitment and cooperation on the part of many stakeholders to

develop this pioneering project, which demonstrates the potential of Sierra Leone and its people. This reflects our ambition to set a benchmark for sustainable bioenergy investment in Africa".

**-Simon Cleasby,
Addax Bioenergy CEO**



"Being the first plant in West Africa and in Sierra Leone to be set up from grounds up, there were many challenges. But our team ready with solutions. We have a high performance plant which will add value to the community".

**- Mr. Gajanan Nabar, CEO & Managing Director,
Praj Industries Limited, India**

"The success of Addax Bioenergy represents a major breakthrough in Sierra Leone's efforts to become a hub for renewable bioenergy alternatives".

**- Dr. Joseph Sam Sesay
Sierra Leone's Minister of Agriculture**

Addax Bioenergy has changed our lives".

**- Mr. Sylvanus Shyllon Sesay,
Representative of Land Owners**

Praj Worldwide

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