HOW TO START & FINANCE A PROJECT
A CASE STUDY OF THE KAYUNGA SORGHUM
ENERGY PLANT, UGANDA

ETHANOL AND POWER
from
SWEET SORGHUM STALKS

PRESENTED AT 2ND BIOENERGY WEEK, RADISSON BLU HOTEL, MAPUTO, MOZAMBIQUE
Great opportunity

Biofuels Africa
As African economies strain under the burden of importing oil this session will examine the critical issues of how African countries can lessen their energy dependence, improve their balance of payments, create new jobs and industry in a sustainable manner without impacting food production.

- Where billions of dollars were going to overseas oil producers, some can now be invested locally- in poor rural communities to benefit Africa
A bio-fuel based economy is one whose basis consists of biomass and technology for sustainably meeting society’s energy requirements. It is necessitated by the need to:

• reduce spiraling foreign oil import costs
• reduce green house gas economies
• mitigate pollution and global warming
• have arid dry lands contribute to a bio-fuels future
• enhance rural economy to alleviate poverty
• Earn Money.
Multiple uses of Sweet Sorghum

- Stalk juice for ethanol
- Grain for food - feed - Fuel
- Stripped leaves and bagasse/stillage for animal feed
- Bio-compost/power for co-generation by distillery
Sweet Sorghum is suitable in more areas
Bagasse of sweet sorghum stalks are not only used to generate power, but also to be pelletized as stove fuel.

Farmers can use pellets to substitute charcoal avoiding deforestation for cooking and heating.
Material balance: sweet sorghum plant 20 million litres

- **Number of Harvests per year:** 2 & 3
- **Harvest yield:** 90 MT stalks/ha
- **Sugar content:** 12-15% (W/W)/MT stalks
- **Electricity yield:** 6 MW electricity/0.45 MT of stalks

- **Sorghum grain:** Currently sold to breweries with plans of value addition for better prices

- **Est. land requirement:** 4000ha
- **Annual ethanol yield:** +5472 liters p/ha
  - +600 US Gallons per Acre
- **Total ethanol production:** 20,000 MT
- **Total electricity production:** 6 -8MW
- **Electricity for internal use:** 2.5MW
- **Electricity for the local grid:** 3.5/5.5 MW

Source: CAMS Global
Advanced Solid State Fermentation (ASSF) of Sweet Sorghum

Partners: NREL (US), Tsinghua University and PetroChina.

Research Activities:
- Characterization of yeast fermentation strain Saccharomyces cerevisiae (TSH-Sc-1) from China for the Advanced Solid State Fermentation (ASSF) process – strain transfer complete.
- Tsinghua University post-doctoral research associate working at NREL.
- ASSF process assessment and modeling of rotating reactor drum bioreactor – publication of one reviewed journal paper, 2 presentations at AIChE 2009.
- Techno-economic analysis of ASSF process and comparison with wet fermentation process – ASSF preliminary analysis complete, validation and sensitivity analyses in progress.

Future Activities:
- Complete techno-economic analyses of sweet sorghum fermentation processes (wet and dry).
- Complete assessment of TSH-Sc-1 fermentation strain.

Impacts:
- Understanding the ASSF technology from biological and process perspectives for sweet sorghum to ethanol conversion.
- Identify the advantages and potential limitations of the process.
- Improve the process for commercial scale of interest in China and US (National Sorghum Growers Association).
Layout Ethanol & Power Plant
FAO Agriculture delegation visits Inner Mongolia ASSF Plant October, 2010
How it started:

- Pre Feasibility study Dec 2010 to Feb 2011
- Farmer Mobilization, training and equipping with farm inputs and implements March 2011 (300 House holds)
- By end of 2013 1,700 house holds
- Land Requirements: is 4000 Hectares in order to be able to produce sufficient sweet sorghum to produce 20 Million Liter of ethanol and 10 MW of power from sweet sorghum stalks.
- Working with 1700 Farmers as out growers. Plan to increase to 10,000 farmers by 2016
- Alleviating poverty. Farmers earn UGS 1,050,000 (US$415) per 3 month per acre of harvest for sell of sweet sorghum grain to Breweries. This will be improved once we have grain processing facilities.
- Have created 16 support and office employees job. This will increase accordingly.
- The Ethanol & Power Plants will employee 500 people in 2 shifts.
- We anticipate by mid 2016, we would be able to have 4000 hectares harvested.
- Bio Green sweet sorghum concept has been replicated in Kenya and soon in Tanzania. It could replicated in other areas in Uganda.
- At start up, there is need for having own funds otherwise not easy attracting OPM
Business Case:

- Choice of Sweet Sorghum, a 3Fs crop providing for Food security, as it contributes to Bioenergy development
- Ethanol produced can be partially used in Uganda and the East Africa region while balance can be exported to China, EU and USA.
- Project to contribute to rural electrification as it earns the company money.
- Use of out grower model thus making use of farmers own land for increased production as opposed to holding large chunks of land where in many cases you displace local people.
- Money from both grains and stalks
- Availability of thousands of farmers willing to participate
- Sweet Sorghum being a major traditional African Crop doing well in local weather conditions
- Strong partnerships with central and local governments, Research Institutions
- Association with strong networks such as GPEB increases chances of attracting foreign investment, technology, financing and skills
- This is a win-win undertaking
pictures of Kayunga Farms, visitors and Staff
Sorghum NRG - Uganda

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