DRAFT BUDGET

INVESTMENT COSTS

Harvester =0.150 mio $
Sugar Extractor =0.15 mio $
Pelletisation= 0.85 mio $
Cogeneration = 0.12 mio $
BioSyngas = 0.21 mio $
Activated Coal= 3.80 mio $
Ethanol Distilleries= 5.2 mio $

TOTAL= 10.48 Mio $

ANNUAL EXPENSES ESTIMATION

Plantation = 0.48 mio $/y
(600 $/ha)

Financial (i = 5%) = 1.0 mio $/y

O&M (4% I)=0.42 mio $/y

TOTAL = 1.9 mio $/y

INCOME
(estimated on average conditions)

Animal feed pellets=0.416 mio $ /y
Electricity= 0.040 mio $/y
Bio-Syngas= 0.030 mio $/y
Activated Coal = 2.180 mio $/y
Bioethanol= 0.560 mio $ /y

TOTAL= 3.226 Mio $/y

It is now possible to supply modern bioenergy complexes for rural villages based on Sweet Sorghum plantations, this crop being able beyond the satisfaction of the essential needs of the population (food, animal feed, energy), to produce an extra-income from the surpluses sale for an economic sustainable activity.

These Integrated Complexes could provide a vital contribution for a general rural socio-economic development and for considerably increasing the Human Index of Development of the village inhabitants.

Not many commercial sound technologies are today available for these types of small bioenergy complexes. Economics are still penalised by the relatively high cost of manufacture in small series. Transfer of good modern technologies is vital for accelerating their penetration in rural districts.

The comprehensive utilisation and processing of the biomass resource in integrated complexes with the simultaneous production of several high value commodities is essential for the improvement of the economics and large scale deployment of this type of activity

Significant effort for management, technical assistance and for education & training must be envisaged as vital accompanying measure to ensure a viable and durable operation of the complex.

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LATIN AMERICA THEMATIC NETWORK ON BIOENERGY

LAMNET

Bioenergy
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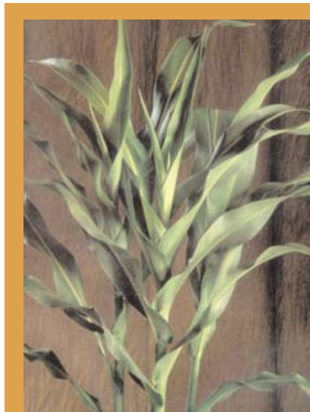
Modern Bioenergy Village Complex

Integrated production of food, animal feed, energy



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SUSTAINABLE BIOENERGY VILLAGE COMPLEX

to satisfy the vital needs of a remote village of 5,000 inhabitants

This bioenergy complex is based on plantation of a dedicated herbaceous but very versatile sugar-starch-lignocellulosic crop (a specific variety of sweet-sorghum) on a piece of land of about 400 ha (farmed twice a year). The complex will be capable of producing (through several commercial sound processing units) a wide variety of commodities, such as:

Food: grains
liquid sugar

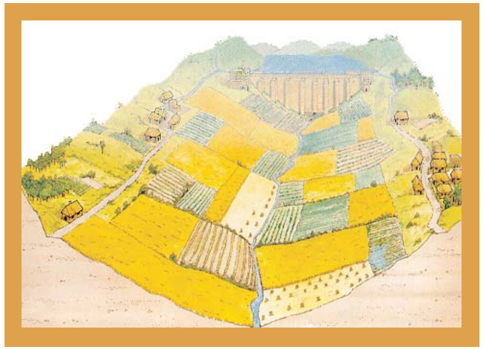
Animal feed (for meat / milk production):
Pellets (grains + 30% bagasse)
leaves

The small amount of bagasse with its sugar content stimulates the cows milk production.

Modern bioenergy: electricity
bioethanol
charcoal
CO2 - solid dry ice (if required)
MHV gas (Charcoal gasification) if required
Solid bagasse pellets

This bioenergy complex will also provide numerous diversified jobs to the village inhabitants.

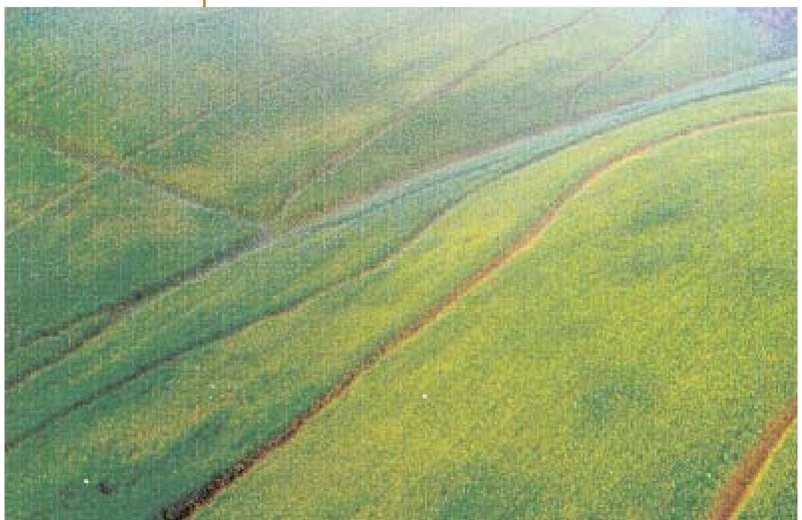
The outputs of the various products (i.e. grains, liquid sugar, electricity, heat, bioethanol, charcoal, MHV gas, CO2 - dry ice, pellets) will exceed the needs of the local village, thus, sales of these commodities will serve as a significant income-surplus base for repaying the initial investment and the running costs. However, it will take two year for the complex to reach a normal operation regime.



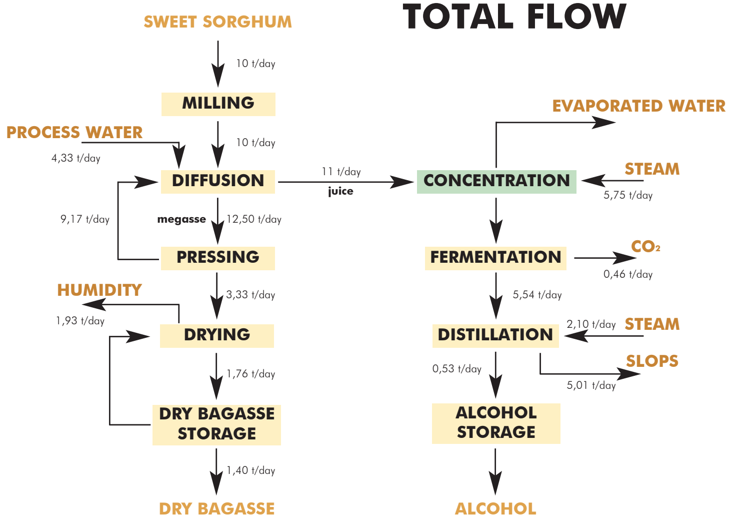
A revolving fund could be sufficient for large-scale deployment of this type of project in districts where socio-economic development is urgently needed.

This type of bioenergy complex can be implemented in villages with a population of 100 - 5000 or even more.

Other configurations of bioenergy complexes can be designed and optimised on the basis of different types of biomass feedstock (agro-forestry residues, agro-industrial wastes, dedicated crops, etc.) but these complexes generally will not be able to supply such a wide range of products as a sweet-sorghum-based complex. Sweet-sorghum has multiple components such as starch, sugar and lignocellulosics, while other types of biomass feedstock don't have such an aspect.



TOTAL FLOW



Data kindly provided by Ing. Aldo Nardi

The integrated bioenergy complex, based on the exploitation of sweet sorghum for the production of bio-ethanol and other energy/industrial commodities, after its high economic viability has been demonstrated, offers a new sustainable path for production of bio-ethanol, which is considered a strategic fuel for the transport sector. Such a project may be implemented in China and other regions on a large scale, as past studies have shown the high yields of this crop in terms of grains, sugar and bagasse in several different climatic belts (i.e. Inner Mongolia, China).

This "integrated" project, once implemented on a large-scale, or in a repetitive way, can have important impacts on the economics of such complexes in terms of reducing the production costs of ethanol. Utilisation of particular varieties of Sweet Sorghum as dedicated energy crops is, in this respect, of great importance because the process "integration" comes from the opportunity of converting the several components of the plant: starch, sugar and lignocellulosic. This very important feature distinguishes Sweet Sorghum from other grain crops (corn, wheat, barley) currently utilised for bio-ethanol production in other climatic areas.

In fact, well-known bioethanol crops (i.e. sugar beet- corn-sugar cane) are cultivated only to produce alcohol. Sweet sorghum plants, on the contrary, can provide not only sugar and grains which can be used for bioethanol production, but also large amounts of bagasse, which can be used as fuel to generate steam, electricity necessary for the bio-ethanol production process, syngas, hydrogen, etc., thus providing an energetic surplus for sale.

Bioenergy Village Complex

Adaptable to villages with 100 to 5,000 inhabitants

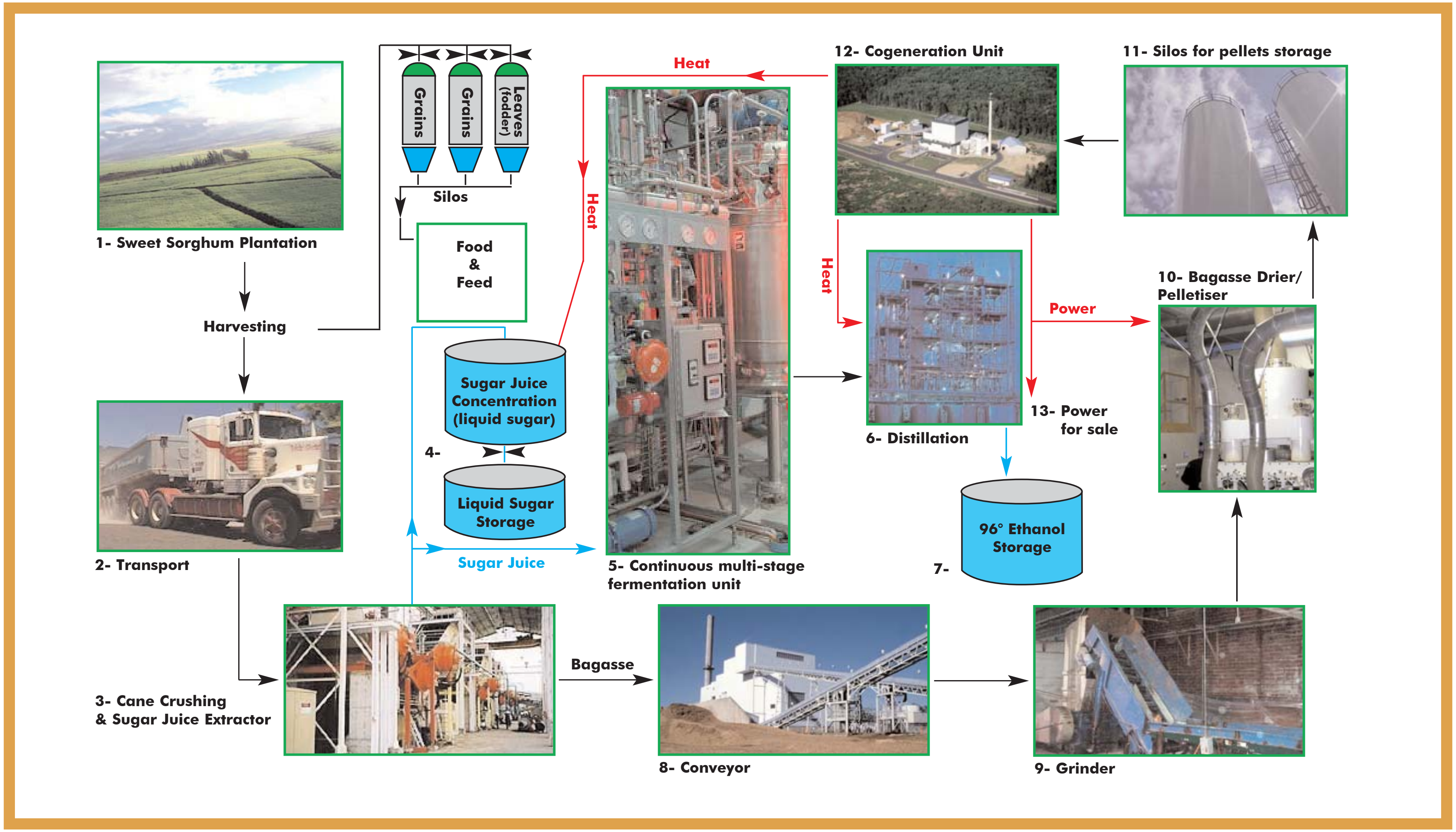
Cogeneration Plant

The biomass pellets are burnt in a combustion chamber to produce steam at 350 °C temperature (25 bar or higher); the steam expands in a reciprocating engine coupled with an alternator powering the electricity network; with a maximum operating time of 8,000 hr/year it is possible to obtain:

- gross electric net energy production: about 800,000 kWh/year
- net thermal energy production: about 1,850,000 kWh/year

Carbonisation

Bagasse pellets submitted to a clean efficient carbonisation process are converted directly into charcoal pellets (for cooking/heating) without the use of any binder-agglomerating compound. Furthermore, charcoal pellets can also be eventually converted into activated charcoal (medium quality). 1 ha could produce 2 tons of activated charcoal, which are sufficient to purify, all the year round, drinking water for 10,000 people.



Should you wish to receive more information on Bioenergy Village Complex, please fill in the form and fax it to ETA att. Ing. Francesco Cariello.

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POSITION

ADDRESS

POSTCODE

COUNTRY

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FAX

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Area of interest in biomass use

Date

Signed

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Sweet Sorghum Plantation

The following productivity (average) value per year can be considered:

Bagasse (dry): 15 Ton/ha
Grains: 5 Ton/ha
Sugar: 7 Ton/ha
Leaves: 1.88 Ton/ha
Root: ~ 2/3 ton/ha (recycled on the soil)

Cane crushing and Sugar Juice extraction.

The fresh cane will be processed in a cane crushing and sugar juice mechanical extraction unit for its conversion into bioethanol. After this operation, about 45,000 ton/year of sugar juice (5,600 tons of sugar) and about 24,000 ton/year of bagasse (50% humidity) will be available. Part of the sugar juice could be utilised as liquid sugar (high concentration), while the remaining part for Ethanol production.

Fermentation

The fermentation unit is completed with one mash buffer tank, two small yeast propagation tanks, two fermentation tanks and ancillaries. In this plant a side stream of mash is fed to the yeast propagation tank and mixed with fresh yeast available on the market, nutrients, and process water, to produce sufficient yeast cells to balance process losses. The enriched yeast suspension is then pumped to the fermentation tanks.

Distillation Plant

The beer is fed to the distillation unit to strip and concentrate the alcohol to the required level.
The distillation unit is complete with one column and with all ancillaries. This process uses a special technique to recover most of the residual ethanol remaining in the whole stillage when it leaves the distillation unit, preventing valuable ethanol from being either blown into the atmosphere as polluting VOCs or discharged in the water.

The activities of LAMNET include the analysis of available bioenergy technologies and systems as well as the development and implementation of policy options for the promotion and deployment of bioenergy.

Should you wish to receive more information on this Thematic Network, please contact the project coordinator:

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