Renewable Biomass Fuel As "Green Power" Alternative for Sugarcane Milling in the Philippines

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“Greening” the Sugarcane Industry

The project partners have been involved since 1998 in a research and development effort to create greater sustainability in the sugar cane industry. Our long term aim is to create a Net-Zero emission sugar cane industry. Key components of the system are:

- Introduction of Biological Nitrogen Fixing (BNF) and self-detrashing sugar cane cultivars
- Elimination of field burning of sugar cane residues and allowing in-field decomposition to enhance soil quality
- Use of sugar cane residues and energy crops as energy sources to displace the use of fossil fuels in the sugar cane processing industry

Biomass production without N fertilizer!

Biological nitrogen fixing cane varieties and trash farming can meet all the N demands of a high yielding cane crop

Cane residue conserved in a ratooning field can increase soil carbon & biologically fix more than 100 kg N/ha during decomposition

Energy Use in Sugarcane Mills

Approximately 5.9% of the energy used for sugar cane milling comes from bunker oil with the remainder largely coming from bagasse. The oil is primarily used by mills that have three inter-related factories: raw sugar production, a refinery and a distillery. These mills have insufficient bagasse to meet energy demands as many use low pressure boilers which have an average thermal efficiency of only about 62%. Upgrading these boilers can be a good strategy, but many mills could also consider displacing bunker oil with lower cost biomass energy heat sources for their processing energy requirements without making a large capital investment.

Cane field residues are generated at harvest when the cane stalks for milling are seperated from the leaves and tops

Napier grass is very productive with yields up to 30 tonne/ha

Fast growing trees can be used in agroforestry systems to increase sustainability

Finding a Greenfuel Alternative to Bunker Oil for Sugar Cane Milling

This paper examines the use of three biological resources (cane residues, napier grass and fast growing trees) as possible energy sources for creating:

- *a more competitively priced local fuel than expensive imported oil (now approaching $40/barrel)*
- *Reduced greenhouse gas emissions by eliminating the emissions associated with burning 365,000 barrels of bunker oil annually in the milling industry*
- *Greater employment for peasant farmers and rural workers*
- *Opportunities for year round power generation from the sugar cane industry*

Qualitative Comparison of the 3 Biofuels

Biomass Supply	Advantages	Disadvantages
Cane Trash	No land requirement, lowest cost material after bagasse, system already being used by 1 mill, adequate resources are available (496,000 tonnes) for harvest to displace all the bunker oil currently used	Storage requirements, fire hazard at mill, somewhat bulky to handle, slagging concerns
Napier Grass	High yielding and moderate cost, better adapted than sugar cane to marginal hilly areas, low erosion potential, Biological Nitrogen Fixing varieties of napier grass are being identified	Higher transport costs from marginal lands, land rental cost associated with production, logistics of handling more difficult than wood, slagging concerns
Fast growing trees	Easy to burn, logistics of supply system, long experience of use	Higher cost, modest growth rates and longer rotation cycles than crops, costs rising due to increasing demand for wood for cooking and construction

Cost Comparison for Biofuel Alternatives

Fuel value, cost of production and suggested purchase price of sugarcane bagasse, cane trash, napier grass and fuelwood					
Biomass	Fuel value per tonne (wet) based on bunker oil energy equivalent at $30/barrel (P)	Cost of Production (P)	Suggested purchase price per delivered tonne (P)	HHV GJ/tonne	Moisture Content %
Sugarcane bagasse	1,658	0	1,050	18	48-52
Sugarcane trash	2,489	1,048	1,650	18	26
Napier	2,489	1,339	1,650	18	26
Fuelwood	3,100	Varies	2,000	20	35

At time of study completion 1 USD equaled 52 pesos (P)

Conclusions

Resource efficient strategies need to be developed to wean our dependency off petroleum-based energy inputs in primary production of agricultural crops and their associated processing industries. The main findings of this study were:

C*ane field residues harvested as a biofuel after the final ratoon crop cane harvest (approx. 1 year out of every 3-4 production years) was the most promising strategy to economically displace all the bunker oil used in the Philippines milling industry.*

This option would displace approximately 14 million dollars worth of imported oil while creating 4000 local jobs for the 5 month milling season.