

SUGAR CANE ALTERNATIVES FOR ELECTRICITY GENERATION AT THE CUBAN SUGAR FACTORIES

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CUBA

HYSTORICAL DEVELOPMENT

**In Cuba, since beginning of the century,
electric energy is been cogenerated at the
sugar industry using the sugar cane
bagasse as the fuel source.**

HYSTORICAL DEVELOPMENT

The electric energy in Cuba is produced in a high proportion in thermal plants using fossil fuel because there are not other sources: as hydro or nuclear that can cover the country necessities.

Installed power and year generation by the sources existing in 1999

Data	Installed Power		Electric Energy Generated	
	(MW)	(%)	(MW)	(%)
Thermal Plants	3182	76.2	12282	90.5
Sugar Factories	818*	19.6	879	6.5
Independent Plants	160	3.8	380	2.8
Other Factories	14	0.4	31	0.2
TOTAL	4174	100.0	13572	100.0

BIOMASS AVAILABILITY

The Sugar Cane can provide biomass to be used as fuel, one of them –the Sugar Cane Bagasse- is obtained at the factory. The High Fiber Sugar Cane (HFSC), the Sugar Cane Crop Residues (SCCR), and the grinding of the whole cane (WC) are other fuel sources that can be available from this plant.

CASE STUDY

In order to achieve economical results from the electric energy generation at the sugar factories and to be able to work the year round, it is necessary to use a second fuel.

This second fuel: petroleum gas, fuel oil, coal or biomass as wood or from the sugar cane can depend of the availability of these fuels. From an environmental standpoint undoubtedly biomass is the first alternative

CASE STUDY

At the sugar cane industry in Cuba there are a number of factories - around 30-40% of the actual factories- that have the best conditions to cogenerate and generate electric energy the year round.

CASE STUDY

There are factories that with a minimum of investment is possible to cogenerate and generate electric energy all the year in order to satisfy the electric energy needs of close towns or it can be supplied to the National Grid.

CASE STUDY

Also using high pressure steam technology is possible to generate 110-130 kw-hr/ton of cane. These are installations that can be considered as Independent Plants.

CASE STUDY

A.- ELECTRIC ENERGY COGENERATED

The electricity generation is of 11.8 MW using three boilers, the sugar factory consumption is of 8.7 MW and there is an electricity surplus of 3.1 MW. The total quantity of energy that can be supplied to the national grid during the sugar campaign by cogeneration is of 11.2 GW-hr.

CASE STUDY

Total quantity of electric energy that can be supplied to near towns or to the national grid in GW-hr.

TIME PERIOD	Generation	Cogeneration	TOTAL
Season	36.0	11.2	47.2
Off-Season	43.2	0.0	43.2
TOTAL	79.2	11.2	90.4

CASE STUDY

ALTERNATIVES FOR THE SECOND FUEL

Sugar Cane Crop Residues: In this case there are available 574 ton/day which means a quantity of 86 250 tons per crop and it is needed 84 672 tons. The use of the SCCR can satisfy the fuel requirements for this project.

CASE STUDY ALTERNATIVES FOR THE SECOND FUEL

High Fiber Sugar Cane: It has been stated that energy cane has around 25% of fiber on cane which means that it will be necessary around 169 344 tons of this type of cane. Considering an agronomic yield of 100 tons/ha ,it will be needed to use 1693 ha. The quantity of land needed for the cane used in the sugar production is of 15 000 ha –for a yield of 70 ton/ha-. The energy cane will require 11.3% of additional surface. It is to mention that higher yields can be expected and that it is not required a soil with excellent properties.

CASE STUDY ALTERNATIVES FOR THE SECOND FUEL

Saved Bagasse at the sugar factory where the alternator is installed, it is not an alternative to be considered in this project because it will change the defined parameters of the case on study, basically the quantity of energy that can be supplied to the electric grid. It could be analyzed the possibility of obtaining surplus of bagasse in near factories, this is casuistic situation and an analysis must be made to determine the economic distance that the bagasse can be delivered

CASE STUDY ALTERNATIVES FOR THE SECOND FUEL

.. The Whole Cane alternative indicates that there can a positive economic result, being necessary to research into the sugar production affectation to define its technological availability. This alternative will allow bagasse surplus at the sugar factory in study.

SUGAR CANE POTENTIALITIES

a.- Using an actual technology with high steam pressure, is can be generated 100 kW-hr/ton of cane.

It will be possible to generate around 4 590 GWh/year (42% of the quantity generated in the country in the year 1990), and supply 2263.5 GWh/year to the National Grid after satisfying all the necessities of the sugar sector.

SUGAR CANE POTENTIALITIES

b) Using combined cycles gas-steam, it is estimated to generate at a rate of 200 kW-hr/ton of cane.

It will be possible to generate around 9180 GWh/year (84% of the quantity generated in the country in the year 1990), and supply 6853.5 GWh/year to the National Grid after satisfying all the necessities of the sugar sector.

CONCLUSIONS

There is a high potential to generate and cogenerate electric energy at the Cuban Sugar Industry, there are possibilities to prepare and implement projects for the generation and cogeneration of electric energy at the sugar factories. Case studies can be made in order to determine technical and economic feasibility for different scenarios during and after crop.