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**INTEGRATED UTILIZATION OF COFFEE BYPRODUCTS
FOR ENERGY GENERATION**

Presentado por el ICAITI a

**AID Regional Office for Central America and Panama
(ROCAP)**

**Bioenergy Systems and Technology (BST) Project of AID/W
Office of Energy
Bureau of Science and Technology (ST/EY)**

Guatemala, December 19 83

1. INTRODUCTION

This pre-proposal is based on the results from the project "Coffee pulp as fuel for drying coffee in Central American beneficios" under contract 53-319R-3-2 between US Department of Agriculture and the Central American Research Institute for Industry (ICAITI).

The goals of three lines of research included in that contract were:

- a) To design and test a low-cost mechanical press capable of producing a "bagasse-like" solid fuel from wet coffee pulp
- b) To design and test an oven to burn efficiently the solid fuel from (a), and
- c) To extend studies on the production of biogas from the "juice" obtained by pressing wet coffee pulp. Special emphasis will be placed on productivity improvements in order to obtain practical amounts of biogas

The results from that work (Phase One) were presented in the Final Report of the above mentioned project. These are very promising but further efforts are needed in order for them to reach the final users of the technology. The continuation and extension of the research and development, along with the extension of some integrated technologies, is included in the present pre-proposal.

2. OBJECTIVES

This second phase of the research and development work on coffee byproduct utilization for energy purposes includes several objectives:

- 2.1 To test the prototype press during a whole crop season, to evaluate its performance and reliability.
- 2.2 To develop a fluidized bed coffee pulp burner.
- 2.3 To test the direct utilization of combustion gases from the burning of coffee byproducts (pulp, hulls, and biogas) for the drying of coffee beans.
- 2.4 To compare the performance of two methods for drying or pre-drying the pressed coffee pulp with combustion gases.
- 2.5 To design and test a gasification unit capable to handle coffee byproducts (pulp and hulls) with different moisture contents.
- 2.6 To design and test a high rate anaerobic digestion unit to use the coffee pulp juice for biogas production.
- 2.7 To design and test a high rate pond for the treatment of the liquid effluents coming from the digester.
- 2.8 To develop a mathematical model for the simulation of the operation of a coffee processing plant ("beneficio") incorporating energy utilization alternatives, like those tested at ICAITI.
- 2.9 To apply the mathematical model to several coffee processing plants, in order to obtain improved energy utilization.
- 2.10 Dissemination of the project results in Central America.

3. JUSTIFICATION

The results obtained during Phase One (1982-1983) demonstrated the technical feasibility of some technologies aimed to the utilization of coffee byproducts for energy production.

Some of these technologies, like the mechanical press, are already in an advanced stage of development, requiring only extended operational tests before commercial production. However, others still require development and new promising alternatives should also be explored.

The implementation of systems including these technologies in coffee beneficios could represent a substantial reduction in firewood and fossil fuel utilization in one of the most important agricultural industries of Central America.

What is being developed at ICAITI can easily be transferred to other tropical coffee growing areas where the "wet method" of coffee processing is practiced: Mexico, Colombia, Jamaica, Ivory Coast, Kenya, Uganda, Tanzania, Angola, part of India and Indonesia and Papua New Guinea.

4. METHODOLOGY

In order to fulfill the above stated objectives, several types of activities are envisioned:

- 4.1 Literature surveys, including data bank searches.
- 4.2 Study tours by ICAITI personnel (courses, technical visits).
- 4.3 Contracts for short time experts as consultants for specific tasks.
- 4.4 Design, construction and testing of pilot units. This testing will include one crop season.
- 4.5 Modifications and extended operation of the final pilot units. This activities will generate data for the mathematical model.
- 4.6 Preparation of drawings, construction pamphlets, etc., of the units considered as adequate.
- 4.7 Model preparation, testing and development, using data from pilot operation.
- 4.8 Application of the model to theoretical and real cases of coffee processing beneficios, to select alternatives and realize optimization studies.
- 4.9 Presentation and discussion of preliminary and final results in regional technical meetings and seminars organized for Central American beneficio operators, machinery constructors, coffee cooperatives and similar groups.

4.10 Three yearly reports will be prepared three months after the end of the crop season.

5. DURATION

Due to the seasonal characteristics of the experimental work with coffee byproducts, at least three complete crop seasons are required. This means a three-year period.

6. BUDGET

A preliminary budget has been prepared for three years, for a project starting during the off-crop season . Values in US\$:

		1st. year	2nd. year	3rd year	Total
6.1	Personnel	69 510	65 390	36 170	171 070
6.2	Consultants	14 000	11 500	-	25 500
6.3	Equipment and construction	71 500	23 000	-	94 500
6.4	Instrumentation and glassware	11 500	7 500	-	19 000
6.5	Travel (local and international)	25 500	10 950	9 000	45 450
6.6	Bibliography and data searches	4 000	2 000	2 000	8 000
6.7	Seminars (C.A.)	-	6 500	6 500	13 000
6.8	Communications, reports, etc.	1 000	1 500	2 000	4 500
6.9	Indirect costs	55 600	52 310	28 930	136 840
6.10	Contingency	10 090	7 250	3 400	20 740
	Subtotals	<u>262 700</u> =====	<u>187 900</u> =====	<u>88 000</u> =====	<u>538 600</u> =====

TOTAL FOR THE PROJECT: US\$538 600.

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