

CASE STUDY 59

Integrated model of bioethanol, biogas and bio-fertilizer production derived from coffee processing wastes.

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Country & sector: Honduras, Renewable Energy

Context

The coffee processing environmental consequences are broad and deep throughout the producer and processing countries. These consequences can range from water pollution (surface and underground water), bad odors and concentration of toxic elements in soils, which results in decreased land productivity and increased use of chemicals for its solution.

Aware of the above mentioned problems, international markets for this grain; require mitigation measures, reason why many organizations, seals and certifications promote various forms of coffee waste treatment.

Latin-American coffee producers and processors have found, with the support of designers and suppliers of technologies, innovative ways to meet these environmental market demands which have resulted in various forms of waste management, among which we can find the use of these wastes as an alternative energy source.

The facilities, for the production of bioethanol and biogas derived from coffee processing waste, have been developing in Latin America in recent years, concentrating, most of these experiences, in Colombia, Costa Rica and recently in Honduras, where the number of facilities multiplies each year.

As a result of rapid growth and development of new technologies related to the processing of coffee wastes and biofuel generation, the impact of these type of initiatives has been demonstrated through the improvement in the quality of life of the beneficiaries in environmental, social and economic aspects.

These same aspects constitute the areas of performance valuation of the eco-businesses¹, which have been supported by SNV in Honduras, under the co-implementation framework of the 4b component of the Regional Program for the Environment in Central America (PREMACA). Under this scheme, it was considered that such experiences could be an interesting learning model, through the design, validation and adjustment of a prototype² of bioethanol, biogas and bio-fertilizers production (the first two considered biofuels).

For a coffee eco-business (producer and processor), the implementation of the prototype represents an opportunity to enter differentiated markets that recognize the added value that these initiatives provide coffee as a sustainable product, thereby increasing its competitiveness and contributing to income and employment generation.

Clients and partners

Our client, COMSA is a company that produces certified organic coffee and fair dealing, as well as conventional coffee, classified as Special coffee. It is composed of 244 partners, most

1 Is an organization, agency or group that produces goods and/or value-added services at a fair price, to obtain economic benefits while generating social and environmental benefits, by promoting adequate and equitable use of resources (physical, ecological, human and financial).

2 Is an innovative product that translates into an approach, a methodology, tool, policy or all of the afore mentioned, which can be applied and validated at the level of clusters actors, chains or eco-business. The building process of a prototype is based on a working methodology, that respects and is inspired in the continuous learning cycle sequences, in order to generate positive impacts and develop knowledge.

of them belong to the Lenca ethnic group, of whom 56 are women and 188 are men. The partners produce approximately 15,000 quintals (bushels) of *Oro* (golden) coffee, of which 7,000 are of organic coffee. In the processing of 1,000 daily quintals of cherry coffee (fruit), COMSA produces approximately 18,860 kilograms of pulp, 7,820 liters of mucilage and 3,772 liters of pulp juice, which before the implementation of the prototype, were deposited in oxidation ponds for outdoor decomposition.

The characteristics of the business, plus its technical and financial disposition, made COMSA the business selected for the implementation and validation of the prototype. Its role was to ensure the availability of a financial counterpart for the purchase of materials, equipment, skilled labor and all the resources required for the assembly of the plant to produce bioethanol, biogas and biofertilizers. It has also committed to keep the plant in operation, with the staff trained by SNV, through a local service provider (LCB³).

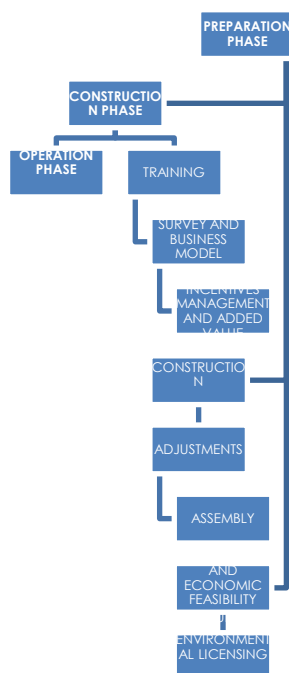
The main partner in this initiative is **DANIDA** (Danish Agency for Development Cooperation) which finances PREMACA operations in all its components, including technical assistance provided by SNV.

Other natural partners are the co-executors of the PREMACA 4b Component: The Foundation for Investment and Export Development (**FIDE**) and the Foundation for Rural Enterprise Development (**FUNDER**) as well as the LCB (Ecoenergy Business Group) which is a company dedicated to the continuous development of specialized technologies to optimize the production and use of renewable energy, its raw materials and sub products as sustainable development alternatives.

Intervention logic and methods

The prototype assumes that the coffee processing wastes can be treated and reintroduced into the production process by the generation of new products (bioethanol, biogas and biofertilizers), due to the characteristics (physical and chemical components) of these wastes, the type of activity that takes place in a coffee processing business, and the efficiency of the clean and innovative technology. The validated proposal developed by SNV is summarized in the following diagram:

Diagram 1 Methodological Process of the Prototype



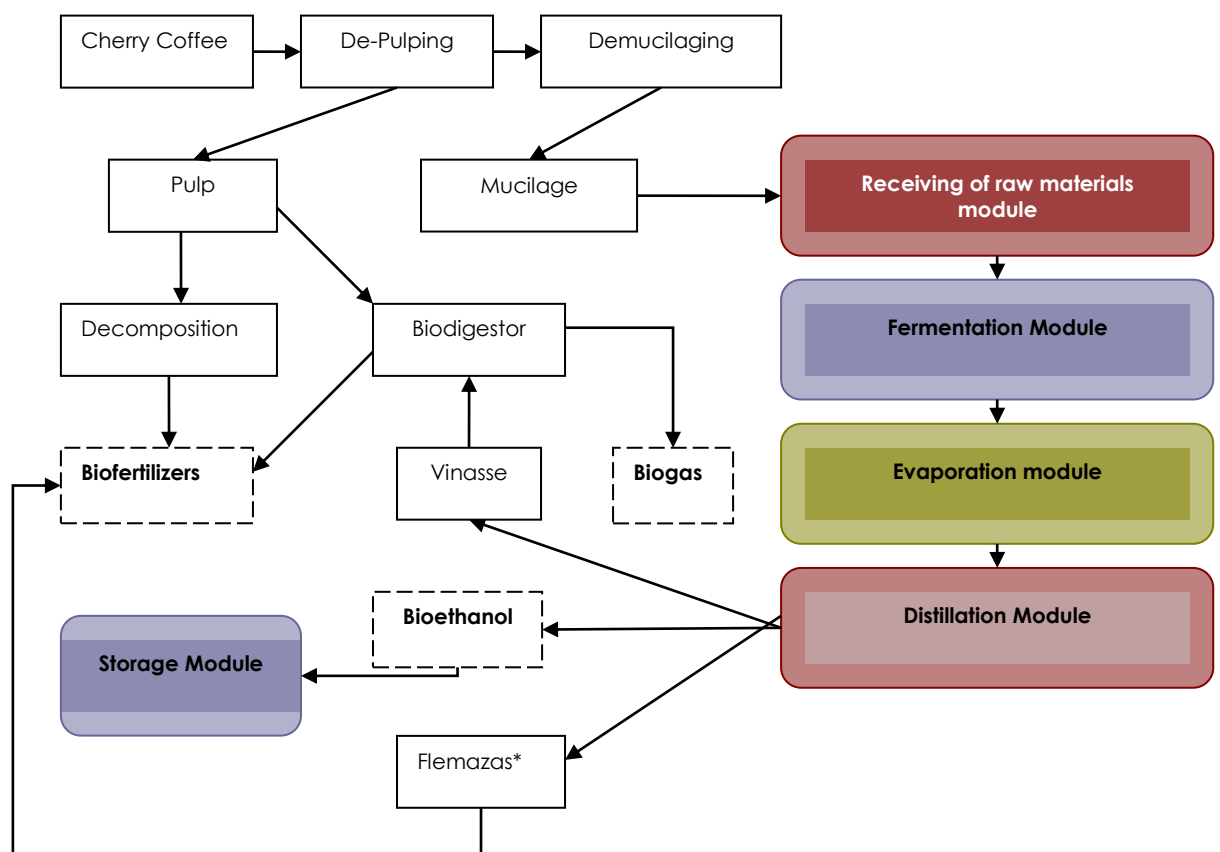
Source: Authors' elaboration based on secondary information.

³ Local Capacity Builder

1. PREPARATION PHASE: This phase includes two important aspects: the study and validation of the technical and economic feasibility of the project, after which the environmental licensing process begins, before the competent national authority (Ministry of Environment).

2. CONSTRUCTION PHASE: includes the development of preliminary designs, quoting and purchasing of materials and equipment, finding local laborers: construction technicians, welders and other staff. It also includes the identification and preparation of the terrain, a key element to adjust preliminary designs and coordinate the construction of equipment which should be ready as required during the assembly, done in modules (see diagram 2); as well as the validation tests, simulating on a small scale all the production processes to obtain real information of the performance of the critical variables of the model for this specific site.

Diagram 2 General scheme of the plant and its modules



Source: Authors' elaboration based on secondary information.

3. OPERATION PHASE: This phase includes training, conducting a market survey, developing a business model and the generation of incentives and added value to the entire operation of the company and its main product (coffee).

The objective of the prototype is to contribute to the definition of technical and methodological aspects to be developed and implemented in wet coffee milling plants, that allow the implementation of a bioethanol, biogas and bio-fertilizers production plant, contributing to the market diversification due to the generation of new products and the diminishment of the environmental impact caused by poor waste management.

SNV designed, validated and systematized this prototype during the time period of June 2009 to March 2010, in Marcala, Department of La Paz, Honduras.

*volatile impurities that pollute the ethanol referred to as *flemazas*

Outcome

A plant was designed and implemented, with the capacity to produce 500 liters of bioethanol daily from 6,250 liters of mucilage; 23 M³ of biogas and 75 kilograms of bio-fertilizers. If we economically value these products by coffee season and based on actual retail prices⁴, a profit of approximately U.S. \$ 37,000 could be achieved.

The water consumption was reduced in 720 M³ (25% of the water needed to process the coffee) during the milling process of coffee and the negative environmental effects of the company have been mitigated (a 50% reduction of the wastewater discharge to oxidation ponds), due to the proper management of coffee processing waste.

COMSA has received social recognition from its community and international coffee buyers due to the environmental and economic contribution of the eco-business in its influence area.

Skills have been developed in COMSA for the operation and maintenance of the plant, as well as the industrial safety measures.

Impact

Through the development of this prototype, with locally adapted technology, SNV has helped COMSA achieve:

- A profit increase of \$37,000 U.S. Dollars per year for the eco-business partners due to the sales of products derived from the implementation of the plant and diminishing of the wastewater pollution mitigation costs, by \$6,000 U.S. Dollars/year⁵.
- Direct employment generation through the implementation, operation and maintenance of the plant, 10 temporary jobs during the four months of construction, and 3 permanent ones for the operation (5 months of the year).

Lessons learned

It is advisable to test and validate various alternative raw materials, which allow the identification of one that could be more viable in order to continue the operation of the plant throughout the year (for periods outside the coffee harvest) and therefore achieve greater profitability and job permanence of the plant operators.

The personnel responsible for the operation of the plant should be identified in advance, to involve them in the whole construction process and thus facilitate their initial training and performance.

There is a broad market to develop such initiatives in Central America, due to the social organization of the coffee producers, many of which seek to articulate to the market belonging to cooperatives or partner businesses, thus centralizing the wet and dry processes, a necessary technical element to establish a production plant of this type.

It would be interesting to explore opportunities to incorporate the initiative into the carbon market through partnerships with other eco-businesses that implement the same technology.

Sustainability

This initiative will be sustainable to the extent that it is economically profitable. The development of a market survey and the design of a business model are key factors that allow the visualization of a short-term return on investment by the auto-consumption of

⁴ A sale price of burning alcohol of L. 120.00 per gallon and 0.15 U.S. \$ per KWH of electricity replaced by biogas, is assumed.

⁵ Transfer of the coffee processing waste

products (savings), the selling of these products in the national market and the international market recognition of the value added coffee (sustainable product), plus the extra revenue that can be obtained by the managing of this type of projects to the voluntary carbon market.

SNV in Honduras, in association with the Spanish International Cooperation Agency (AECI) is reproducing the experience based on this prototype, installing two more plants, but adding the element of the carbon market. In addition SNV is supporting the development of a bio-ethanol market study in Costa Rica where the experience of the prototype has been successfully replicated⁶.

Photos and quotes

View photo files separately

Standard data

- Start and end date of the contract within which the intervention(s) occurred: September 2009-April 2010.
- Composition of the team: Rubén Gallozzi, Bella Sosa, Evelyn Hernández, Orlando Valladares, Rosarito Mosqueira, Carol Elvir, Damien Vander Heyden
- Number of PP-days already invested per category: staff 164 /LCB 164
- Relevant partnerships: DANIDA
- The financial resources invested: US\$ 75,000
- Client satisfaction and enhanced capacity scores: 4 out of 4

⁶ For more information see:

<http://www.snvla.org/mm/file/HN%20SNV05%20%20Bioetanol%20v7%20Centroamerica.pdf> <http://www.coopvictoria.com/noticias.html#>