Fuels from Biomass: Technology Status Prospects for Utilization in Fishing Communities

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A solar dryer on display at the Center for Nonconventional Energy Development. Directly suitable for fish drying.

Introduction

Most of the fishing communities in the Asia-Pacific region are situated in areas where biomass resources in the form of trees, plants, agricultural residues and animal wastes abound. In recent years, considerable worldwide efforts have been made to develop new techniques and to re-learn old practices for tapping the energy potential from such resources.

Biogas

Biogas is primarily methane (50-65%) and carbon dioxide (34-45%). Its heating value ranges from 600-700 Btu per standard cubic feet. The gas is produced by the anaerobic decomposition of animal manure, human wastes, kitchen wastes, agricultural residues and other organic materials.

The utilization potential of biogas for a fishing village is immense. Cold storage of small quantities of fish could be done by using an ordinary gas refrigerator. For large quantities, electrically powered cold storage boxes could be energized by generators fueled by biogas.

The basic components of a biogas system are the digester, where the charge is decomposed by the action of anaerobic bacteria; the gasholder, where the generated gas is accumulated and stored, and the utilization accessories consisting of pipes, hoses, valves, etc. Depending on the amount of charge material available and the desired enduses of the gas, almost any type and scale of biogas unit may be built by simply following readily available plans in the literature.

The Center for Nonconventional Energy Development, near Manila, Philippines.

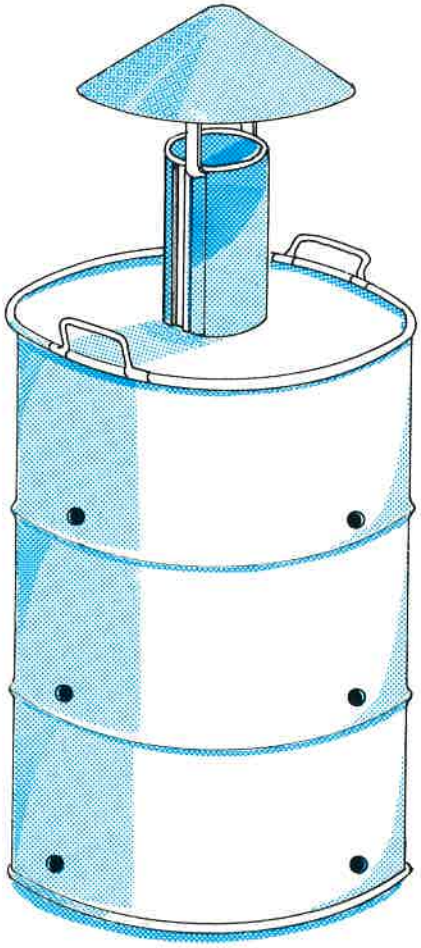
Fuels from Pyrolysis

While wood and agricultural residues could be burned directly to provide energy for a number of village processes, their conversion to charcoal or producer gas results in more energy-dense or more versatile fuel, thus enlarging the scope of utilization. Producer gas, for example, could be made to run a gasoline engine whereas wood could not.

Pyrolysis of biomass materials usually yields producer gas, char, and oil simultaneously. The relative amounts and heating values of these products are a function of the moisture content of the feed material, the residence time, the maximum temperature at the air injection zone and the depth of the reaction bed.

In a pyrolytic converter, the intention is to recover all these products. A UNIDO funded project executed by Georgia Tech and Philippine experts resulted recently in a pilot 1-ton per day pyrolytic converter using rice hulls as feedstock. The unit is rugged, simple to operate and built entirely with locally available materials.

The gas is used onsite for the predrying of feed material. The oil recovered has a high moisture content (30% or more) but burns when ignited. With



Simple drum charcoal-maker.

properly designed stoves, it can be used for domestic cooking. It can also be used for lighting in lieu of kerosene in lamps but some modification of the lamp design and wick material may have to be made on account of the high oil viscosity.

The charcoal produced was granular. For convenient usage, there is a need to briquette the product. This should not present a problem at the village level as there are existing methods for mixing, drying and manual briquetting.

Liquid Fuels

Alcohol is perhaps the most important liquid fuel produced from biomass today. Ethanol or ethyl alcohol, either in pure form or mixed with gasoline, is now being used in a large-scale in many countries to power vehicles.

Firewood and Cooking Stoves

Firewood is still the largest-used biofuel resource in rural communities of the region, including fishing villages. It is used chiefly for cooking. A survey recently made of Philippine provincial cities, towns, barrios, and farms shows that after firewood, LPG, charcoal, kerosene, and agricultural wastes (sawdust and rice hulls) in that order, are the next most widely-used cooking fuels.

Integrated Village Energy System: The Pinamuc-an Project

Most of the described technologies utilizing fuels from biomass have been or are being applied in separate occasions in various rural sites. Recently, the Philippines Ministry of Energy and the USAID embarked on a project that seeks to apply these technologies in an integrated fashion in a small fishing village. The selection criteria included the requirements that the village not be electrified at the moment nor is planned to be electrified under the normal government program in the next 5-10 years; that for control and monitoring purposes, the village have less than 500 households.

Chosen finally was the village of Pinamuc-an in Aklan province. It has about 260 households more or less evenly dispersed in the 319 hectare total area of the island. The main economic activities are subsistence fishing and coconut farming.

The land abounds in biomass resources, including a sizeable mangrove swamp with *Nipales* and considerable amounts of coconut husks, dried coconut leaves, shells and other combustible residues of cocnut processing.

Although the project is still in the planning stage, it is evident that technologies for producer gas generation, small-scale alcohol production and charcoal making, for example, would be highly applicable in the Pinamuc-an situation. The gas producer system could be fueled by charcoal from coconut husks and other agricultural wastes; electricity could be generated by the system for village lighting and for communal purposes such as the operation of a cold storage/ice maker system.

The alcohol distillery could use nipa sap as fermentable material. The alcohol product could be used to power motorized bancas and fishing boats. A small coconut oil mill could be set-up powered by coconut oil/producer gas or coconut oil/alcohol. The product oil could be used partly to power stationary engines in the island and mainly as an "export" commodity.

The project aims to implement the above activities not in the sense of isolated technologies simply brought in by experimenters but as logical components of an integrated plan whose primary goals are to improve the economic condition and general well-being of the people.

Fixed dome biogas digester. Used in China where toilets and animal effluent are close to the digester.