Biomass residues evaluation for energy generation in Marajó Island, Brazil

I. M. O. da Silva[a], B. R. P. da Rocha[a] *, S, B, Moraes[b]
[a]Electrical Engineering Department – Campus Universitário do Guamá – CP 8619,
CEP 66075-900, Belém, Pará, Brazil
FAX:+55-91-211-1634; brigida@ufpa.br
[b] Mechanical Engineering Department

Introduction

Marajó Island, a group of fluvial islands in North Brazilian Amazon Region, located between latitudes 02º 30'S and 01º 00'N; longitudes 47º 30'W and 52º 00'W; with total area of 49,606km^2 and 333,063 inhabitants, presents many problems for rural electrification due to geographic limitations and disperse population. Only 32% of the Island population are electricity users, i. e., correspondent to about 227,000 inhabitants [1]. Until now, electricity production in Marajo Island is made using small Diesel generators varying from 2 to 10 kW for isolated houses and larger systems (50 – 400 KW) for consumers agglomerates and small cities. Marajo Island has favorable climatic conditions to explore the immense biomass resources, including animal rejects, culture and forest remains. The biomass residues are characterized by the composts, products and materials of animal and vegetal origin, rejects from industrial, agricultural activities and from urban centers.

Agriculture Biomass Residue in Marajo Island

Manioca, rice, corn and coconut are the main agricultural products in Marajo Island. Annual productivity and energy value of the residues were estimated: dry foliage of the manioca 8ton/ha; rice husk 0,22 ton/ha of husk/tons of rice with husk, straw of rice 5 ton/ha; corncob 0,165ton/ha; corn straw 6 ton/ha; coconut shell 0,34 tons of coconut shell by each ton of coconut fruit Taken the amounts of the products harvested annually, it was estimated the respective amounts of residues and the energy associated to them, which amounted to 12,17 MW[2,3, 4].

Animal Excreta and Biogas Estimation in Marajo Island

Marajo Island has a great cattle and graze area. The number of cattle head is 449,110 and buffalo 259,740 in the Island. In addition there are also 34,054 horses, 238,343 chicken, and 286,316 pigs. Excrement production was estimated from all the animals and 50% of the total was considered for biogas production. Biogas could be used for cooking, lighting, and electric energy generation. In spite of the process of anaerobic biodigestion being known for long time, it is just recently that has globally been widespread. China has been the country that more developed the biogas in the rural areas, seeking to assist mainly the energy for cooking food and domestic illumination. China has an important program for use of biogas having a production of 7,2 million biodigestores installed since 1979, having an equivalent energy value of 48 million tons of coal. In Brazil the studies of biogas usage were initiated in a more intense way in 1976. The main gases contained in the generated biogas are methane and hydrogen. The exact composition will depend on the type of biomass used, biodigestor model and of operation conditions (temperature, pressure, pH) of the biodigestor. The energy value of the produced gas, considering a medium calorific power for the biogas, it is of 27,21 MJ/m^3, with a specific mass of 1,52 Kg/m^3[5]. Energy potential of these materials were estimated using the same production potential pointed in [2]. Agriculture residues can be also used, mixed with the manure, in biodigestores. This was already tested for several residues of the area, producing satisfactory results, using the manure as inoculador of bacterias methanogenic and source of nutrients for the same ones[6]. In the case of the cattle, the confinement of females can be used for a better use of those residues. In a confinement of 100 cows, a biodigestor can produce a volume of 118 m^3 of biogas. This volume is enough for a 15kVA motorgenerator to assist with electric energy the demand of the milker, milker cooler, crusher, disintegrator for the ration mixer and the water pump. The total demand of biogas for the generating group to work these equipments was estimated in 85,3m3 of biogás, which can be supplied in total by the biodigestor [7].

Ethanol Production

The present planted area of manioca in Marajo Island allows the production of up to 2.707 m^3 of ethyl alcohol a year, and planted area for sugar-cane produces 25,9 m3 of ethyl alcohol and 100 tons of pulp with an equivalent to 26,6 kWmed. Ethanol production using starch of the manioca was already attempted at the country in an industrial scale, without technological difficulties for its accomplishment. It is known that the ethyl alcohol of manioca presents a higher cost than that produced using sugarcane, due mainly to the additional stages of processing previously to the fermentation. However, considering the conditions of cultivation of this vegetable species in the area of Marajo Island more favorable than the one for sugar-cane, and that the cost of transport of the ethanol from areas of Southeast and Northeast Regions of Brazil for Marajo Island is higher, this energy option can have a competitive cost and its economic viability should be evaluated.

Use of Timber Wood Residue in Marajo Island for Electric Energy Production

Marajo Island has extense areas of natural primary forests. Firewood production in the Island in 1998 was of 193.432 m^3 and logged wood production was of 716.155 m^3. Production of vegetable coal in the area was 123 tons/year (1998), which was produced using primitive techniques, and it is destined basically for cooking food. The volume of residue produced are around 30% of the logged wood production giving a total of 214846m^3 residue, that could be used for electric energy production [8].

Conclusions

The results of the biomass evaluation in Marajo Island shows that a program to use its rich biomass residue could be an important contribution for the electric energy production. In so doing, will help to establish a sustainable resource system, promote the social economy and improve the environment.

References

[1] IBGE (1991). *Anuário Estatístico Brasileiro*. Rio de Janeiro.

[2] Nogueira, L.A.H. et al. Dendroenergia;Fundamentos e Aplicações. Brasília, ANEEL, 2000, 144p.

[3]. Lora, E. S., Happ, J. F. and Cortez, L. A. B. "Caracterização e Disponibilidade da Biomassa". In: Tecnologias de Conversão Energética de Biomassa, Série: Sistemas Energéticos, v.2, ed. Cortez L.A.B. and Lora S. E. EDUA/EFEI, Manaus, 1997, 509 p.

[4] Chowde Gowda, M., Raghavan, G. S. V., Rangana, B. & Barrington, S. (1995), Rural Waste Management in a South Indian Village – A Case Study, Bioresource Tecnology, v.53, 157-164

[5] M.M.E. - Ministério das Minas e Energia. *Biomassa, Biocombustíveis, Bioenergia*. 1982. Brasília.

[6] Harwood, J. H (1980). "Pesquisas para Produção de Biogás na Amazônia". In: *Acta Amazônica*. v. 10, n. 2, pp. 403-409.

[7] Hardoim, P. C. & Gonçalves, A. D. M. - Avaliação do Potencial do Emprego do Biogás nos Equipamentos Utilizados em Sistemas de Produção de Leite, CD do 3º Encontro de Energia no Meio Rural, Campinas-SP

[8] Vidal, E., Gerwing, J., Barreto, P., Johns, J. (1998) - Redução de Disperdícios na Produção de Madeira na Amazônia. Belém. IMAZON, Série Amazônia, nº 5, 18p.