BIO-ENERGY IN FAMILY FARMING: A NEW SUSTAINABLE PERSPECTIVE FOR THE RURAL SECTOR

Bley C[1], Amon B[2]
[1]ITAIPU Binacional Renewable Energy Coordination, Av. Tancredo Neves, 6731 Foz do Iguaçu/PR, Zip Code 85856-970, Brazil. Tel +55-45-3520.6508 – cbley@itaipu.gov.br
[2]Division of Agricultural Engineering, University of Boku. Peter-Jordanstrasse postcode 82 A-1190, Vienna. Tel: +43-147654-3502 - barbara.amon@boku.ac.at

1 INTRODUCTION

The small scale family farming represents 85% of the agrarian structure in the State of Paraná. According to the National Institute of Settlement and Agrarian Reform/INCRA, and the Food and Agriculture Organisation of the United Nations/FAO, employs about 13.8 million people, or 77% of the population working in agriculture. There are about 4.1 million family establishments, which produce almost 40% of the Gross Value of Agricultural and Livestock Production, or 60% of the food consumed by the Brazilian population. Around 70% of the beans and 84% of the cassava, important food in Brazil, come from this source, as well as 58% of the swine production, 54% of the dairy cattle, 49% of the maize and 40% of the poultry and eggs.

The efficiency of a project for sustainable growth in the State of Paraná depends directly on the capacity of mobilizing, not only because of its economic importance in current food production, but also for the real possibility of adding a new function to the traditional agrarian vocation: that of generating renewable energy

The segment hardly renews itself. Only 23% small establishments have had access to financial support in the last three years. The Brazilian Government, besides spotlighting family farming by placing it under the orientation of a specific ministry, the Ministry of Agrarian Development/MDA, in which is the National Office for Family Farming (Secretaria Nacional de Agricultura Familiar), has established and has been improving the National Program for Strengthening Family Farming/ PRONAF (Programa Nacional de Fortalecimento da Agricultura Familiar), started in the biennium 1994/95, with the endowment, at the time, of R$ 100 million for family farming credit. In 2002, PRONAF offered a credit line of R$ 2.3 billion and today, after exponential growth, offers credit of R$ 16 billion, which may allow family farmings to overcome the pattern of need by which it is characterized. After all, according to the MDA, the family farming segment has been increasing its productivity by 3.8% a year.

In Brazil, for at least four decades, both family farming and industrial farming steer their operations towards specialization, single cropping, and livestock type, all highly dependent on chemical inputs. The prices of the products float as in a roller-coaster, in an up and down seasonal movement which is unstable and unpredictable. There is no surplus either for promoting the sector's modernization or for investments in environmental services.

In the environmental and energy context, Brazil is inefficient in its main business: producing foodstuffs. To produce, the sector generates by-products with no market value. There are solid residues and other waste in great proportions. They end up becoming significant environmental liabilities, always in a large scale. It would be better to use the environmental liabilities for the production of energy and bio-fertilizers.

Among all the sources of renewable energy available in the countryside, biomass residue is the most accessible at a low cost, that is, it has the best cost benefit ratio available in the Brazilian rural areas. It must be pointed out that 80% of the Brazilian cities have less than 50 thousand inhabitants. Family activities in agriculture are directly reflected in the specialized sectors of local commerce and industries that supply them with machines, raw materials, seeds, tools etc. Furthermore, local services are also stimulated by family farming and are established in direct dependence of harvest seasons or the financial flows of the trade on the products it generates.

By adding bio-energy generation to small scale family farming production causes a positive impact upon the small towns. A new local economy is put in motion (design engineering, electrical and mechanical maintenance, assistance for the biology of the biodigesters, trade of equipment, raw materials, machinery, engines, generators, piping, control panels, electric connections of low, medium and high tension). This will strengthen dynamism for all the local energy economy, whose sale is done by means of distributing concessionaries, and public bids which generate long-term public contracts at stable prices.

The Distributed Generation, is one of the keys to make family farms viable as micro-producers of bioenergy. It is centered on the possibility of generating energy and supplying it to the distributing grid. In some

countries, bioenergy is generated by micro-generators, as part of programs generally dubbed "*smart grid*", which allows the sharing of the distributing grids with micro-generators as well as with services of data transmission, control and monitoring, creating, therefore, a set of new services housed in the existing distributing networks.

There is a specific and consolidated new regulation for operations with Distributed Generation: the Resolution 390, signed in December 2009 by the National Electric Energy Agency/ANEEL. This Resolution establishes the legal pre requisites for the distributed energy generation with renewable sources.

2 THE AGRI-ENERGY COOPERATIVE FOR FAMILY FARMING

Itaipu Binational, the most important hydroelectric power plant in the world, turned its attention in 2003 to the support to new decentralized ways of generating energy. Among other actions for demonstrating the viability of bio-energy, the Company has developed the Project "**Agri-energy Cooperative for Family Farming**", in the Ajuricaba hydro basin, in the Municipality of Marechal Cândido Rondon, state of Paraná. This partnership counts with the support of the Paraná State Rural Technical Asistance Enterprise/Emater-PR and the Paraná State Electricity Company/Copel. This project involves 41 small scale family farms located on the Ajuricaba hydro basin, as a planning unit. Individual biodigesters are being installed in the properties in order to produce bio-fertilizers and biogas. This biogas will be transported through a 22 kilometer-long gas pipeline to a biogas power plant located at a central position, to produce electric, thermal, and vehicular energy.

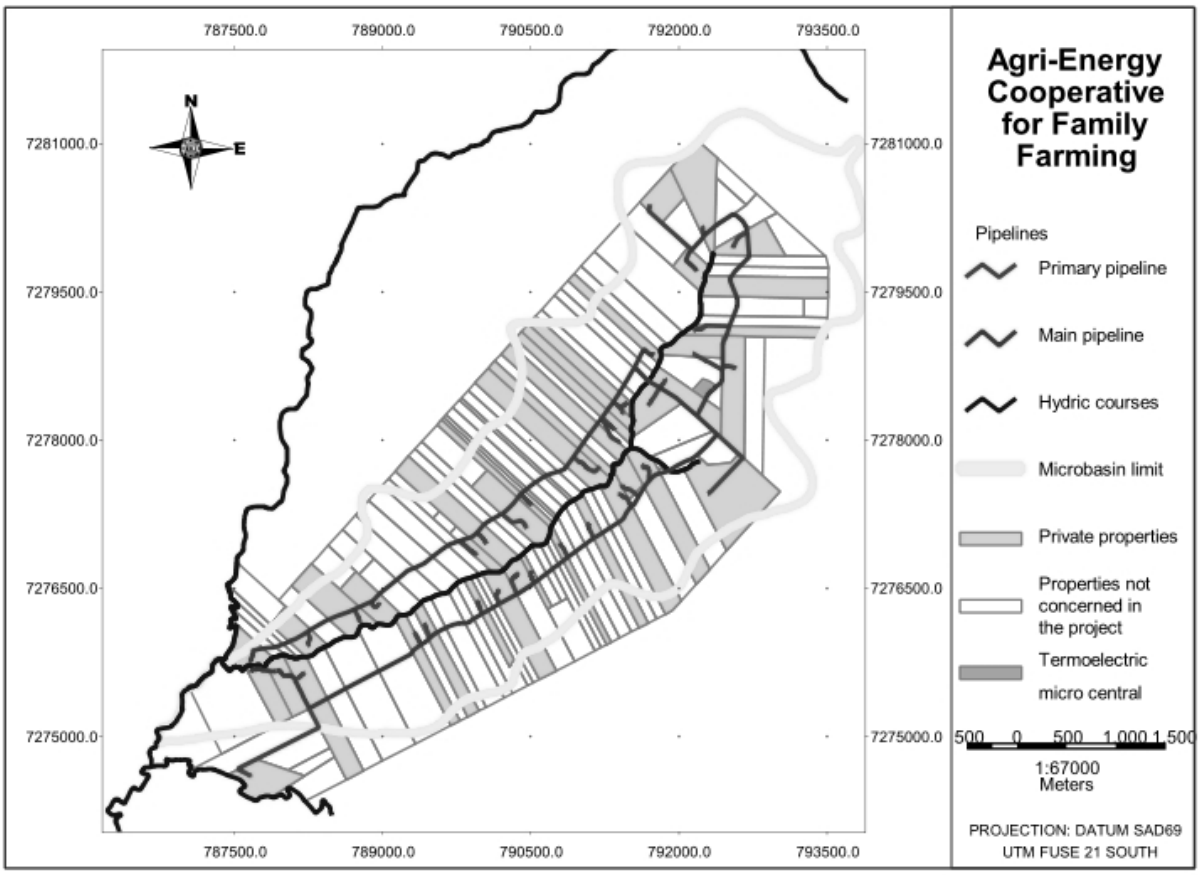

FIGURE 1 **Ajuricaba hydro basin and rural proprieties**

3 FINANCIAL ANALISYS

TABLE 1 **Costs and investiments to implement the Cooperative**

Operational Cost	R$ 52.072,50 per year
Total Investiment Cost - Biodigestors	R$ 685.096,00
Investiment in Each Farm - Biodigestor	R$ 16.714,54
Main Gas Pipeline (~ 22 km)	R$ 134.860,50
Gas Pipeline in Each Property	R$ 3.289,28
Generator and related equipments	R$ 150.360,00

These farmers' herds, dairy cattle and swine, annually generate around 16 thousand tons of residues. Submitted to anaerobic bio-digestion, it will yield around 319 thousand m³ of biogas a year. If used as fuel for engine-generators, this biogas will produce about 507 thousand kWh a year, enough to provide electricity to 170 households with a monthly consumption of 250 kWh each. With the reference value of the electric sector at about R$ 0,130 kW/hour, the project will generate earnings of R$ 5.959,74 per year. The other product of biodigestion, the bio-fertilizers, will represent around 19 thousand m³ per year, with revenue of R$ 95.325,23 per year. In terms of Carbon Credits within the CDM, it is estimated that there will be an emission reduction of 2.5 thousand ton eq of CO_2 per year with revenue of R$ 93,009.31. The expected new revenue totals, therefore, R$ 225,051.61 per year.

TABLE 2 **The analysis of the economic viability of the project presents the following indicators:**

Indicator	**Output**
Payback	7 years
Current Liquid Value	R$ 244.548,97
Internal Return Rate	18,30%
Cost Benefit Index	30% of the investiment
Return of Investiment	15,70%
Net Annual Return	2,30%

4 PURPOSE OF THE PROJECT

The project aims to offer concrete reference for agroenergy in small scale family farming and develop criteria for its economic, environmental, social and energetic sustainability.

Some considerations about agri/bio-energy that can be derived from the Coooperative Project, even if precociously:

- The biodigestion of agri residues, including the animal manure, is the source of energy with the best cost benefit regarding investments and maintenance.
- The legal adoption of the Distributed Generation methodology is a key issue in making all the sources of renewable energies viable, especially bioenergy generated by family farming.
- The paradigm of bio-energy in small scale is essentially collective, co-owned and cooperative. Its territorial unity of planning and management is the small drainage basin.
- The results of bio-energy programs cannot be measured only by the energy unit (kW, or kW/hour), but also by its economic, environmental and social externalities, which can be translated into "feed-in tariffs".
- It is necessary to keep the bio-energy processes under total control of the family farmers. That is why the criterion for the participation in an energy project in a small drainage basin must be exclusively that of being located within the area, without taking into consideration the industrial and commercial connections the producers might have. New structures are needed for handling the paradigm of small scale bio-energy production.
- It will be possible to aggregate value in the farmer's income with carbon credits, commercialization of biofertilizer and of the energy surplus produced in the property.

In order to make the bio-energy in distributed generation a national reality and allow society to reap the fruit of its benefits, the following steps are necessary:

- Creating a new structure for the management of projects in bio-energy;
- Accessing and incorporating land management and tenure systems;
- Stimulating incentive funds and research/innovation;
- Training project designers, specialists in operations and managers for overseeing the implantation, maintenance and monitoring of the generating units;
- Creating technical assistance with an emphasis on bioenergy generated from family farming;
- Establishing a strategy for planting crops without harming the production of foodstuffs, but with sufficient surplus to enrich the residual biomass and increase the production of biogas;
- Defining priorities for the possible applications for family farm generated bio-energy – electric, thermal and vehicular;
- Stimulating the organization of small scale family farmers to make the generation and use of bioenergy viable;
- Setting standards of Environmental Licensing and Clean Development Mechanisms for bio-energy cooperative operations.

5 CONCLUSION

The physical works concerning the Agri-energy Cooperative for Family Farming already started with the ground levelling the 41 related small properties to set up the biodigesters, as well as the central electric power plant, which will receive the biogas transported by a 22 km-long-pipeline to be converted into electric energy. This energy will be sold to the Paraná State Electric Company/COPEL. In parallel, a project is being prepared, according to the Clean Development Mechanism/CDM in order to receive carbon credits. Finally, to close the productive chain, the biofertilizer originated from such process will be used in the 41 cooperative farms and its surplus can also be sold.

Thus, the access of family farmers to the universe of bioenergy, so close to them and yet so often ignored in their activities, is a pre requisite for them to embark on the Energy Revolution of the 21st Century, which is heralded by Ignacy Sachs, and which has not even started yet. This depends on the willingness one may have to remove the mountain of obstacles we have tried to list in this text.

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