International Federation of Agricultural Producers

FIPA IFAP

RENEWABLES 2004

1-4 June 2004, Bonn, Germany

IFAP background paper

On Renewable Energies from Agriculture

INTRODUCTION

Renewable energy, farmers and farming activities are intimately and inextricably bound together. Renewable energies is increasly becoming a key issue on the international agenda. Global oil production is expected to peak in the coming years. Political instability in the Middle East region has lead to very strong oil prices in the region: 42 dollars per barrel. Concerns about global warming and production of green house gases from fossil fuels is stimulating increasing interest in renewable energies.

All sources of renewable energy require large land areas to gather relatively large collectors in order to gather meaningful amounts of energy. Farms are generally the only places where large enough areas are available to construct large wind generators, large solar power voltaic cells or grow large areas of suitable biomass for energy.

Farmers are therefore well placed to take advantage of the growing attention to renewable energy issues.
Increased utilization of renewable energy will have a significant impact on agriculture in both the short and long term.

Renewable energies include –biomass for fuel (wood and straw)- biogas- bio-fuel (bio-ethanol and bio-diesel) - sugarcane generation of electricity- solar energy- wind energy-thermal-hydro-electricity- fuel-cells.
Bio-energy can be marketed, depending on the needs of the customer, as a source of electricity, heat or fuel.

RENEWABLE ENERGIES FROM AGRICULTURE

BIOMASS

Biomass as a source of energy in Germany

Over the past two years private investors have invested more than three billion euros in generating energy from wind, water, sun and biomass. By expanding the use of bio-energies the farming and forestry sector in Germany is making an important contribution to fulfilling national climate protection obligations.
It is important to note that renewable energies currently account for around nine per cent of gross electricity consumption in Germany, thereby cutting carbon dioxide (CO2) emissions by 50 million tonnes per year.

Wood: The oldest and still the most common form in which biomass is used is the burning of wood in private stoves and increasingly also in pellet heating systems (using pellets made from dried natural wood chippings). There are currently around 1000 biomass heating stations in Germany, each with an output of over 1 MW. 40 million solid cubic metres of wood are harvested each year from forests in Germany; some 60 million cubic metres are growing, making a further 20 million cubic metres available as fuel for heating. In the long term this could replace approximately 3.5 million tonnes of heating oil and hence avoid 12 million tonnes of CO 2 emissions.

Straw and cereals: With prices of finite fossil fuels rising and cereal prices falling to world market levels, it is becoming economically interesting to use cereals, in addition to straw, for energy production. Even church representatives no longer dismiss the use of cereals for this purpose out of hand for ethical reasons.

BIO FUEL

Ethanol as a source of energy in Europe

At the end of the past century, when heat engines appeared, people were making experiments with ethanol from beet as fuel. In 1974, prices of petroleum rose sharply, and in 1980, governments were fighting against air pollution generated by transports. At this moment, ethanol began to be developed as a source of energy and as a "clean" fuel. Programs carried out in that field, named PROALCOOL, lead to an enhancement of the beet network. Moreover, the use of co-products allowed valorisation and competitiveness of the French beet production. Today, other countries from the EU, as Sweden or Netherlands are implementing a beet fuel network. In Sweden, 200 buses and 200 vehicles are working with ethanol as fuel. The process is different from the one implemented in France: in Sweden, ethanol is used pure, as fuel; whereas it's mixed with isobutylene to get ETBE which is used melt with traditional fuel, in France.
In the UE, oleaginous plants are used more often than beet to get fuel and particularly rapeseed network. The ester methylic obtained from rapeseed is used in France for diesel vehicles; it is used in Germany without mixture, and as heating fuel in France and Italy. In 1995-96, areas devoted to rapeseed growing for fuel reached 615 000 ha, among 968000ha devoted to non-food culture.

Importance of Bio-Diesel in South Africa

South Africa is at present highly dependent on imported crude oil for the production of transport fuels and more specifically diesel (71% of South African diesel demand is supplied from crude oil). In 2000 the Government asked the department of Science for a study with the objective of reducing South Africa's dependency on crude oil products. Moreover, it is an indisputable fact that fossil fuels, the largest single source of world energy, will eventually run out. Bio-fuels were recommended as one of the technology options that required further investigation.

The process involves the reaction of vegetable oils with an alcohol (ethanol or methanol) in the presence of a catalyst to produce the diesel (with glycerol as the by-product). Depending on the oil used, the filtration step leaves a protein rich filter cake, which could be used as animal feed or for human consumption used. It is worth noting that South Africa imports oil cake and glycerol to a value of over R1 billion/annum. Oil sources include soya, sunflower, jatropha, ground nut, cotton, canola and a number of others

The bio-diesel production has many benefits:

- Environmentally friendly
- Limited energy resources
- Domestic economic considerations (Leverage farming activities, Increase domestic protein production)
- Reduced oil import dependency
- Excellent lubricant characteristics

But it contains some risks too:

- Domestic availability of Soya Bean
- No long term availability of feedstock
- Climatic conditions
- Unpredictability of forecasting
- Price volatility
- Exchange rate
- Unrelated price benchmarking

One problem laid on the fact that there can be no justification to produce renewable fuels from food sources while people are starving. However, a study by the South African government concluded that by producing fuels from soybeans on a commercial basis, the country would be able to produce significantly more food in the form of protein-rich soy oil cake and maize at the same time. The South African study proved that the production of biofuels does not reduce food production in African countries, but rather increases it.

The targeted farmers do not just sell seed, as happens within the edible oils industry, but own, in a cooperative venture, the technology platform for extraction of the oil and enter into a separate agreement with the petrochemicals company that is buying the oil to have access to the oil cake and glycerol for a separate venture where the targeted farmers hold a significant interest.

The price of feedstock used in the production of biodiesel relative to petroleum prices is a key determinant in the feasibility of biodiesel. It is therefore obvious and

remains an established fact that the economic feasibility of producing biodiesel in South Africa, will always be determined by the ratio's between the international price of crude oil, the local diesel price and the prices of oilseeds such as sunflower and soybeans

Liquid bio-energy sources in Germany

In 2003 German farmers planted around 460,000 hectares of oilseed rape to produce around 650,000 tonnes of biodiesel.
Depending on the requirements of crop rotation and location, the area for the cultivation of oilseed rape for biodiesel could be expanded to one million hectares, covering approximately 5 per cent of German diesel demand in the medium term. The production of Bioethanol, the raw materials for which are cereal and sugar beet, is expanding. With an estimated total capacity at three locations of 500,000 tonnes, this is a very promising beginning to opening up a new sales channel in the area of motor vehicle fuel.

The oil seed crop comprises three essential parts. The leaves may be utilised as green manure or forage. The straw may be burnt on the farm to provide heat or electricity. The seed is pressed to extract its oil content and the remaining cake can be used either as high protein content cattle fodder or burnt as an energy source for the production of electricity.

Alcohol from sugarcane provides fuel in Brazil

After 4 hundred years of having sugar as a product, alcohol arrives to dethrone the sugar in only one decade, supported by two petroleum shocks. The last 50 years clearly demonstrate the change beginning from the PROALCOOL program in 1975/76. Prior to that, alcohol had 15 to 20% participation in total sugarcane production. This participation was part of the Federal Government policy that used the alcohol as an instrument of equilibrium for the constant surplus of sugarcane production. This happened by virtue of the splendid adaptation of the sugarcane culture in the Centre-south region of Brazil; by virtue of the minor risk (or better security) that sugar cane offered to the producer, by virtue of the Brazilian experiences with the utilisation of fuel alcohol; by virtue of the known risks of agriculture related to climatic variations. Beginning from PROALCOOL Program, with the incentives for alcohol production expansion, the sugarcane production growth in Brazil showed hallucinated rhythm in exactly ten years, or only two full plantation cycles.
The indirect results are:

- Valorisation of the sugarcane agro-industry and its decentralised development in practically all states of the country, with all the favourable impacts already known.
- The creation of direct jobs: 1 million in rural areas in Brazil.
- Research aimed at reaching a better tonnage of sugarcane per planted hectare: modern techniques of planting, cultural treatments, phytosanitary control, use of seed cane varieties resistant to diseases and pests and with a greater production of sucrose per area planted, are just some of the components of this research.
- The effluents from distilleries have fertilizing characteristics with high content of organic matter and potassium.

The organic matter is important in soil reclamation, mainly in the areas of the Brazilian Cerrado, and potassium is the most important element lacking in the soils, being the main component in the fertilizers formulas used in sugar cane production.

The cultivation of different energy crops will in future enrich the crop rotation and hence improve plant diversity. Soil protection can be maximized through the use of direct sowing methods for energy crops.
Closed loop systems enable the amount of fertilizers used to be reduced. In addition, in the case of liquid manure undergoing digestion in a biogas facility, for example, nutrient recovery is more efficient and methane emissions and smell are considerably reduced.

BIOGAS

Gaseous bio-energy sources in Germany

There are currently around 2,000 biogas plants in Germany, the majority operated by farmers. Their total output is approximately 255 megawatts. As well as commercial fertilizers and food waste, biogas plants increasingly process energy crops such as cereals, maize (whole plants) and grass. This could potentially cover 5.5 per cent of Germany's energy needs
In order to exploit this potential to the full, the German Farmers' Association calls for the promotion of bioethanol production from sugar and/or cereal in the same way as biodiesel. Industry is ready to make the necessary investments.

SUGARCANE GENERATION OF ELECTRICITY

Bagasse of Sugarcane generates electric energy in India

In a sugar cane rich country like India, bagasse can play a very important role in meeting the raw material requirement of pulp and paper industry as well as allied products like particle board. Apart from this, there is enormous potential in the Indian Sugar Industry for producing surplus electric energy for outside sales. India is currently producing about 270 millions tones of cane annually, about 50 to 55% of which is utilised for the manufacture of crystal sugar generating over 40 millions tonnes of bagasse annually. The rest of the sugarcane is diverted for the production of jaggery, etc. the mill wet bagasse produced per tonnes of sugarcane crushed contains electrical energy to the tune of 790 kwh units out of which only about30-35 kwh units are required for production of crystal sugar. Thus, there is an enormous potential for producing surplus electric energy in a sugar plant. All the sugar factories are located in rural India. This had led to tremendous development of rural areas. These factories become the focal point of rural development in the area of operation. They help in the following ways: economical development, educational development, agricultural development, health improvement, better living conditions.

SOLAR ENERGY

The use of Water pumping with photovoltaic energy in Morocco

A document from the Center of Development of Renewable Energies (CDER) raised that water pumping is the third significant application of photovoltaic energy in Morocco after telecommunications and decentralized rural electrification. It specifies that the Center has set up various types of solar pumps through the kingdom and has implemented more than thirty pilot-projects including two photovoltaic test centers at l'Ecole des Mines in Marrakech and Taroudant, and other projects in Tata, since 1983. The first conclusions of this experiment showed that pumping by photovoltaic solar energy requires little maintenance, does not set any running problem and is characterized by a specific autonomy from the energy source and by a reliability of the technology.

In addition, a comparative study showed that the threshold of competitiveness of photovoltaic solar pumping compared to diesel pumping is about 1.200 to 1.500 m3 per day (water discharge height daily flow get for a solar radiation of 5 kWh/m/day). In other words, this threshold corresponds to a village of 1.000 inhabitants with an average consumption of 40 litters per day and a discharge height from 30 to 50 meters. On the basis of this experiment, more than 500 photovoltaic solar systems of pumping, whose powers peaks vary between 600 WC and 2 kWc for flows from 20 to 150 m3/day, are currently implemented in Morocco.

ECONOMIC CONSIDERATIONS OF RENEWABLE ENERGIES

- **It gives farmers a viable alternative to producing food and to buying energy**

- **It could have a positive effect on the balance of payments and reduce import dependency**

- **It strengthens domestic, rural agricultural economy by actively contributing to IRDP (Integrated Rural Development Planning)**
  In fact, it can provide an economic impetus for agricultural and rural development and help rejuvenate rural economies with a significant financial impact on commercial and developing farmers and agricultural businesses.

- **It leads to the utilisation of agricultural surpluses.**

It could create certain commercial opportunities from the by-products such as glycerol and oilcake.

- **It allows a more efficient use of the farming potential of land and plants**

The increased production of agricultural crops for non-food purposes offers the opportunity to utilise land that would have been an unexploited resource otherwise. Several animal and vegetable oils are being displaced in the food market as a result of health factors and biodiesel from these resources could offer a high-value alternative market for oil seed and tallow producers.

The cropping of oil seeds takes place annually, thereby reducing long-term investment requirements. Annual crop residues (including pressed seedcake) can be

burnt throughout the year in local electricity generation plants, thereby smoothing out the production income cycle. Existing agricultural distribution facilities can also be utilised to convey increased oil seed production, unlike with any other sustainable transport fuel.

- **Creation of additional employment**

The utilisation of set-aside and under-utilised land by the agricultural sector have been shown to increase employment potential by one person per twenty hectares dedicated to energy crops. Studies in Ireland and France indicate that the resultant regeneration of the agricultural sector can create between 11 and 15 jobs per 1, 000 tons of biodiesel produced. Given that most of the production processes involved are carried out in rural areas, this provides a much-needed boost to rural agricultural economies where new job opportunities would be created.

POLICY RECOMMANDATIONS

Partnerships

- There should be supply agreements with oil-producing farmers cooperatives /associations and downstream industries.
- There should be an international collaboration for finding a solution to the future lack of energies in the next centuries.

Funding

- International and national community should invest large amounts of money in both new commercial agricultural enterprises and in downstream industries of bioenergies.

Support and incentives

- There is a need for a promotional and institutional infrastructure and incentives for the production, supply and marketing of bio-energies.

- Subsistence and emerging farmers should be supported and encouraged to play a meaningful role in the establishment of a bioenergy industry.

Information

- Identification of sufficient knowledgeable entrepreneurs to take up the opportunity to develop the agricultural seed production is needed.

- The true production potential of sunflower and other oilseeds in the commercial as well as developing or underdeveloped areas should be thoroughly investigated.

- There is a need to initiate an international study, which will indicate the most likely future availability of crude oil plus the anticipated fuel prices.

Capacity building in developing countries

- The International community should mobilize funding opportunities attached to renewable energy projects to be implemented in developing countries.

Research and Development

- Research should be focused on finding alternative pest management strategies and pesticides for the effective control of stored grain pests.

- More research work is needed to help plant breeders and farmers to increase the yield of sunflower seed, as well as to improve the quality of cultivars in terms of oil, protein and fibre content. Research should target market-driven efficiencies and new product development in the form of new cultivars, etc.

- Research should take into account: Oil seed candidates and status in terms of invasive crop species; the way to minimize risks arising from crop diseases, soil conditions, vulnerability to conditions of drought and storage constraints.

- More attention should be paid to the utilisation of sunflower oilcake with a higher percentage fibre than, for instance, Soya bean oilcake.