International Federation of Agricultural Producers

FIPA IFAP

Statement by the farmers of the world on:

"Facing climate and energy challenges through sustainable bioenergy"

Final

BACKGROUND

FAO predicts that it will be necessary to double world food production over the next 25 years using essentially the same land area. Moreover, according to the United Nations, the world population will grow to over 9 billion people, with an annual growth rate of 1%. Energy needs will therefore increase worldwide.

Today, the world economy depends heavily on fossil oil (gas and coal) to meet the world energy needs; only about 10% of energy needs are covered by bioenergy. However, fossil energy does not bear its own external costs in terms of CO2 emissions.

Renewable energy[1] is increasingly becoming a key issue on the international agenda. Oil production is already peaking, yet consumption needs are expected to continue rising in the coming years. Moreover, fossil energy, the largest single source for world energy use, will eventually run out. It is not a question of *if* but rather of *when* this is going to happen. Already world oil prices have reached record levels in 2008 as a result of significant demand increases in emerging economies and limited supplies.
The rise in oil prices has significant impact on agricultural costs borne by the farmer. In this context, there is a need to rationalise energy consumption. Therefore, awareness-raising, education and improved technology through advanced research is needed within the farming community.

Renewable energy, in particular bioenergy[2], is intimately and inextricably bound up with farmers and farming activities. Most sources of renewable energy require large land areas

[1] Sources of renewable energy exist in the form of direct and indirect solar radiation, the heat of the earth (geothermal energy), and the gravitational effects of the moon that creates the tides. Direct solar radiation striking the earth also drives the global weather system and photosynthesis. This, in turn, creates the wind and waves, as well as biomass (plant and animal matter).The energy in falling water may also be considered a renewable energy source but only if the local environmental impacts are sustainable. Generally, new large-scale hydropower schemes are not considered a source of renewable energy due to their substantial environmental impacts. Renewable energy can be converted to many other energy forms. Electricity can be generated from solar, wind, biomass, geothermal, hydropower, and ocean resources. Heat can be generated from solar thermal and geothermal sources, while biofuels such as ethanol and methane can be obtained from combinations of renewable sources". (Source UNEP)

[2] Bioenergy includes all wood energy and all agro-energy resources, and wood energy resources are fuel wood, charcoal, forestry residues, black liquor and any other energy derived from trees. Agro-energy resources are crops specifically grown for energy, such as sugarcane, cassava, sugar beet, sweet sorghum, maize, palm oil, rapeseed and other oilseeds, and various grasses. Other agro-energy resources are agricultural and livestock by-products such as straw, leaves, stalks, husks, shells, manure, droppings and other food and agricultural processing and slaughter by-products. (Source: FAO)

within which to gather relatively large collectors in order to produce meaningful amounts of energy. Farms are generally the only places where large enough areas are available to construct large wind generators and large solar powered photovoltaic arrays and cultivate large areas of biomass for energy. Farmers are therefore well placed to take advantage of the growing attention to renewable energy supplies.

Increased utilization of renewable energy will have a significant impact on agriculture in both the short and the long term. Agricultural sources of energy are becoming the new paradigm for the food and energy business. For farmers, bioenergy represents a new market and a way to diversify risk. Many hope that these products will become income and export opportunities. Both developing and developed countries see them as an opportunity to keep expenditures on energy within the domestic economy. Bioenergy also plays an important role for households in terms of local energy use in many developing countries. Therefore, these populations become less exposed to increased energy prices.

Whereas bioenergy represents an opportunity, there is a need to analyse the real effect of this new product on producers' income. However, farmers are well aware that the production of food and feed remain a priority before the production of bioenergy.

There is a clear recognition of the existence of climate change as a main result of human use of fossil energy. It is also clear that climate change effects will impact negatively on the agricultural sector worldwide. An increased use of renewable energy sources will also mitigate climate change by bringing down greenhouse gas emissions at the global level. This makes it even more urgent to increase the use and production of sustainable energy sources e.g. bioenergy.

Challenges

In spite of this potential, at the global level, sustainable energy has low penetration in the agricultural sector, and faces many challenges. These include: early adaptation of technologies, geographic location, high capital costs, and cost competitiveness with traditional sources of energy. Most farmers in the world have little ability to make large capital investments in infrastructure to consider alternatives such as renewable energy. However, in many regions of the world, bioenergies represent a positive alternative source of energy for farmers and rural development.

Moreover, farmers are called upon to provide food for a world population that will double by the year 2050. And yet, farmers alone cannot take the responsibility for meeting food needs. They only have the responsibility to produce what will deliver the best returns to their farming enterprise–whether this be food or energy. In rapidly developing nations, demand for energy-intense foods, like meat, is growing. This requires the production of more crops for animal feeds, increasing the total amount of fossil fuels used. One of the main challenges for farmers is therefore, on the one hand, to produce food while on the other hand to protect the environment through minimizing the use of fossil fuels and providing bioenergy, carbon sinks, etc.

Even though bioenergy has multiple benefits, which contribute to address at the same time energy supply constraints, climate change, national security, and economic development issues, there are still questions on issues related to food security, economic and environmental sustainability and trade. There is indeed a need to weigh prospects of bioenergy against their costs.

The policy mechanisms implemented will not be identical for developed and developing countries. However, bioenergy can provide growth opportunities for both types of economies. Increasing the use of bioenergy is largely an issue of policies by governments, institutions, and organisations to create strong, stable investment environment to develop this potential in a sustainable way.

Farmers want to become providers of value-added products instead of only producers of raw materials and buyers of energy. Therefore, farmer ownership is key to ensure improvements of their incomes and to avoid all the benefits going to large bioenergy industries. There is a need to facilitate this farmer ownership and governance by putting in place sound policy instruments. Otherwise, there is a risk that large international firms gain all the benefits and farmers and rural communities would lose bargaining power on prices.

Overall, the key question that needs to be addressed is: will diversification into bioenergy stabilize, or even increase, farmers' incomes or contribute to uncertainty in the marketplace? If uncertainty in the marketplace is increased, what are the mechanisms to be put in place and what kind of policy orientations need to be implemented in order for farmers to reap the benefits offered by bioenergy? What are the most effective and efficient types of bioenergy sources and for which purpose?

This paper looks at policy options and orientations at stake for farmers to induce change in the way bio-energies are developing worldwide, taking into consideration the sustainability issue. It therefore serves to influence policy making and to make sure that farmers reap benefits from this new energy outlet.

I- BENEFITS OF BIOENERGY

Besides providing an important option for world energy, the production and use of bioenergy are linked to a host of issues, such as crop management and cropping systems, food security, land use, water management and rural development, sustainable forest management, biodiversity conservation, and mitigation of climate change. Increased utilization of bioenergy, if properly managed, can help to provide cleaner energy services while contributing to sustainable development and the alleviation of environmental concerns. Bioenergy can be marketed, depending on the needs of the customer, as a source of electricity, heat or fuel.

1.1 Environmental benefits

- **Bioenergy as an opportunity for resource protection, reducing pressure on the local environment**

- Bioenergy stored in the form of biomass[3] is available on demand at any time, regardless of weather conditions, time of day and season. For example, in many countries, unused residues from forests and forest industries represent a large untapped wood energy potential. This could be of utmost importance for the future development of forestry and associated sectors and could help reduce fuel imports, leading to a redistribution of economic benefits. Approximately 60% of the world's total wood removals from forests and trees are used for energy purposes. Wood fuel is one of the main products of forests and trees. While only 30% of wood produced in developed countries is used for energy (33% in Europe and 29% in North America), in developing countries it reaches up to 80%.
- Bioenergy (in particular biomass) allows re-cultivation of lands, making use of set aside and marginal lands and multi-annual energy crops which can combat desertification and land degradation.

- Soil protection can be improved through the use of direct sowing methods for energy crops.

- Bioenergy as a climate protection and carbon saving source
  Bioenergy is climate neutral and could be one of the cheapest and most sustainable tools to reduce CO2 emissions. Indeed, an important feature of bioenergy is that it can form a closed CO2 loop if the inputs are from renewable sources. The growing of plant biomass removes from the atmosphere the same amount of CO2 as it releases when the bioenergy is consumed. This means that, in contrast to fossil energies, bio-energies are potentially CO2-neutral, depending upon the balance of greenhouse gases emitted, sequestered or avoided in their production and utilisation. It is a way for the farming and forest sector to fulfil climate protection obligations through carbon sequestration in forests and soils. Therefore, bioenergy such as biofuels[4] should be appreciated in the light of their positive externalities rather than focusing only on economic and trade factors.

- Agronomic benefits
  Biogas[5] production standardises and improves the agronomic value of agricultural and other residues through fermentation (transformation of nitrogen into ammonia, which is more easily assimilated by plants). Biogas production from animal manure contributes also to reduce methane emissions from the manure. Methane is about 26 times stronger as a greenhouse gas than CO2.

- Environmental air quality benefits and positive externalities.
  Biofuels[6] and blended fuels burn cleaner than fossil fuels and will as result improve local and regional air quality which in turn will reduce smog levels and provide greenhouse gas savings. .

- Energy balance and efficiency

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3 Biomass is material of biological origin excluding material embedded in geological formations and transformed to fossil fuel, such as energy crops, agricultural and forestry wastes and by-products, manure or microbial biomass. (Source: FAO)It is a renewable energy source based on the carbon cycle, unlike other energy sources such as petroleum, coal, and nuclear fuels

5 Biogas is a combustible gas derived from decomposing biological waste. Biogas normally consists of 50to 60% of methane.

6 Biofuel is fuel produced directly or indirectly from biomass, such as fuelwood, charcoal, ethanol, biodiesel, biogas (methane) or bio-hydrogen., source, FAO

Sustainable production of biofuels should make available significantly more energy than is required for their production. Energy balance varies widely depending on the type of process and feedstock. However, the vast majority of Biofuels have a positive energy balance. A significant majority of studies show that there is a positive contribution of many bioenergy sources in terms of energy balance[7].

For example, biodiesel[8] from a closed CO2 loop has been found to be energy positive at a ratio of more than three-to-one in efficient production systems where by-products from energy crops are burned for heat or power. The ratio for second-generation Biofuels from lingo-cellulose feedstocks such as crop residues and wood is at least ten-to one or more.

1.2 Economic opportunities for farmers

Access to affordable energy is essential to keep economies running. It is the key to enhancing the productivity of industrial and commercial activities in rural as well as urban areas. Through its positive effects on job creation and investment, the expansion of bioenergy is making an active contribution to boosting the economies of rural areas, improving urban and rural public health and local self reliance and thus alleviating poverty, provided it involves the local producers. Job creation occurs throughout the entire chain value from the production process, to the processing along with distribution and research sectors.

In particular, fuel wood and charcoal are proving to be important sources of employment and income for many rural households in developing countries. Wood energy can help promote development, especially in rural areas where investment is most needed and where employment generation is difficult.

Amongst the main economic benefits of wood fuel promotion are: creation of markets for biomass wastes, improved economic viability of thinning and harvesting, promotion of new crops especially on marginal or unused agricultural land, creation of employment in tree growing, harvesting, transport and conversion to useful energy.

- Income generation
  Selling energy produced on the farm can make a valuable complement to farmers' incomes. One could envisage payments by farmers (as is the case in some countries) for waste recycling (treatment) generated by local communities and companies.

- Less dependence on fossil sources of energy; secure energy supplies
  Domestic production on bioenergy lessens reliance on international energy markets, so making a positive contribution to the balance-of-payments situation in a country provided there is no significant government intervention.

[7] Read P (2008), Biosphere carbon stock management: addressing the threat of abrupt climate change in the next few decades: an editorial essay. Climate Change DOI 10.1007/s10584-007-9356-y ;
Paul R. Adler, Stephen J. Del Grosso, and William J Parton, "Life-cycle assessment of net greenhouse-gas flux for bioenergy cropping systems".
OECD draft report on Economic Assessment of Biofuel Support Policies (April 2008), Trade and agriculture Directorate, Committee for Agriculture.

[8] Biodiesel is a biofuel produced through transesterification, a process in which organically-derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. The biomass-derived ethyl or methyl esters can be blended with conventional diesel fuel or used as a neat fuel (100%) biodiesel. Biodiesel can be made from soybeans, rapeseed or palm oil, animal fats, waste vegetable oils or microalgae oils.

- **Possible use of by products from biomass waste for animal feed (meats and dairy)**
  There is a large potential for the use of by-products from the processing of corn and wheat into ethanol for animal feeding. In many cases, this can replace imports of expensive protein products.

- **In developed countries**

- Risk diversification opportunities
  If the fuel market price for a crop differs from the food market price, farmers can opt to sell to the more lucrative market.
  Besides, the introduction of non food crops puts upward pressure on food prices thereby potentially increasing farmers' returns, regardless of the market they sell to. This might have a negative impact on the cost of feeds for livestock producers.

- Income benefits
  The prices of ethanol and biodiesel are tied to the oil market rather than the food market. Therefore, fuel prices affect the price of biofuel feedstocks. Higher fuel prices push up the prices of commodities that can be converted into biofuels and vice versa.

- Value-added
  Transformation of non-food crops into energy sources offers agriculture the opportunity to add value to otherwise low value products.

- Diversification opportunities of cost-competitive cellulosic biofuel (second generation)
  Farmers can add energy crops to their rotations, capitalizing on the energy market after the harvest of their food crop. Cellulosic biofuel could increase farmers' profits. However, these materials require a more complex process of saccharification followed by fermentation, which raises the costs of production of this biofuel.

- **In developing countries**
  Insufficient infrastructure makes it difficult for developing countries to access markets, so hampering the development of the rural areas. Communication and transportation facilities in rural areas are extremely expensive, or sometimes, non-existent.

- Lower fuel expenditures
  Production of bioenergy locally helps reduce transportation costs to the marketplace. Furthermore, domestic bioenergy production would decrease their expenditures on foreign energy sources, thereby saving much needed currency for other investments. For some developing countries, income from exported commodities does not even cover energy import costs.

- Cash crop opportunities to generate income
  Since energy consumption in developed countries is higher than in developing countries, farmers in the latter may be able to take advantage of this opportunity by producing for export, thus selling value-added products rather than raw materials.

- Cellulosic biofuel could create an even more advantageous situation for developing countries.
  In addition to creating a market for biomass (domestic and export) in which developing countries have a comparative advantage (given climatic conditions and longer growing

seasons), cellulosic biofuels may provide poor farmers with more diversity and flexibility in their cash crop strategies.

- A source of job creation and rural development
  In addition to income generation, processing domestic bioenergy in rural areas leads to job creation and diversification of rural employment opportunities, providing livelihood alternatives thus acting as a deterrent to rural exodus. Therefore, the development of bioenergy may contribute to rural poverty reduction (2.5 billion rural people worldwide and 4 out of 5 individuals live in rural areas in developing countries without electricity, according to FAO).

- It is important to consider the large untapped potential of wood energy sources especially for the development of the forestry and other associated sectors but also for the development of poverty reduction programmes in developing countries.

▪ At the international level

- Stabilisation effect on agricultural market prices
  Biofuels outlets adjust to prices, as opposed to food demand (elasticity of overall demand).
  Therefore, fluctuations in agricultural markets will stabilise through more elasticity in the overall demand.

- Biofuels have a moderating effect on the price of petroleum
  According to the European Union, there is a depression effect of 2% to 3% on the price of petroleum for a 14% incorporation of Biofuels in the EU.

- Availability of agricultural products
  Higher prices will affect the supply side through: the re-cultivation of set aside land (in the EU, CIS (Commonwealth of Independent States) and the USA in particular), technical advancements leading in turn to yield improvements and generally increased investments in agriculture, which are necessary in order to get sustainable feedstock supplies.

II- POLICY PROPOSALS

In order for many of the promising aspects of bioenergy to be realized, farmers in both developed and developing countries must benefit from investment capital and market access. Energy efficiency and consumption trends also need to be taken into account.

2.1 The role of governments

In order to expand sustainable energy production in the agricultural sector, there is a need for comprehensive, forward-looking governmental policies including the five following priorities:

1. Increase the demand for sustainable and climate-neutral energy through the use of economic instruments and tools such as tax reductions on bioenergy use, subsidies for the development of bioenergy. In a long term perspective, the development of bioenergy should mainly be demand driven.
2. Making sustainable energy technologies cost-competitive for farmers

3. Providing farmers access to the necessary capital
4. Minimising risks by focusing on sustainability to ensure farmers make profitable investments.
5. Making long term investments in research and development

- **For an integrated approach: mainstreaming renewable energy policies in other economic sectors**

To make the necessary policy changes and mobilise the capital required to realise the full potential for bioenergies, it is essential that governments have the political will to incorporate the goals of sustainable development into all policies. Indeed energy production and use affects almost every sector of the economy (rural development, land-use planning, agriculture, forestry and waste treatment).

- **Creating an enabling environment**

- There is a need for a coherent political and legislative framework to facilitate the development of bioenergy where it does not exist.
- Policy priorities and government regulations to stimulate the production of bioenergy need to be clear and simple and reflect the farmers' interests.
- Financial support to rural areas is needed.
- Management models aimed at reducing production costs, while at the same time stimulating environment-friendly practices, need to be promoted.

- **Need for a whole value chain strategy supporting farmers**

There is a need for a strategy which encompasses tax incentives to encourage investment, incentives for processing facilities, development of quality standards and direct marketing of bioenergy to consumers. This should be done in partnership with stakeholders, including retailers, financial institutions (capital investment, loan guarantees), cooperatives to encourage primary producer investment and ownership, the business sector for technical support to help producers to learn and improve business skills, and research institutions to develop new processing technologies and new energy-specific crop varieties.

Governments need simple administrative and bureaucratic procedures to facilitate this development. It is also important that governments enable farmers to feed the bioenergy they produce into electricity grids. It is not sufficient to say that farmers should produce bioenergy only for their own use –although this is a valuable option that must be considered by farmers i.e. meeting their own diesel needs and insulate themselves from the swings in oil prices. Farmers need real market opportunities to be able to supply energy and sell electricity at fair prices so that they can get additional income.

- **Need to build competitiveness of domestic feedstock**

Feedstock competitiveness will become a hot issue with regards to bioenergy production. A bioenergy strategy that builds an industry based on importing feedstocks will not create gains for local farmers. A competitive policy for commodities and energy feedstock is needed to avoid distortions in global markets.

- **Increased support for R&D**

There is a need to diversify the possible sources of renewable energy through strong primary research on new energy crops, new energy-specific varieties of existing crops, increased production efficiency, improved processing techniques and crops that yield both high energy content and high quality by-products. Agricultural crops are one of the feedstocks but not the

only ones. Some feedstock crops can prove to be more profitable and cost effective than others. The right varieties have to be identified and tested. There are new prospects with lignocellulosic materials, as well as new processes for bioenergy, e.g. synthetic fuels from biomass, biogas as a fuel for cars in pure form and as a mixture with biogas or for use in fuel cells. All these projects need increased support for R & D and biotechnology development. Therefore, the role of the research community in developing cost efficient methods is crucial to enhance the energy potential of indigenous plants to help farmers make the right choices for energy production. Further, small-scale technology for bioenergy needs to be researched and developed.

- **Setting up appropriate incentive mechanisms to encourage farmers to invest in the production of sustainable bioenergy**

Effective remuneration mechanisms need to be identified to make sure both smaller and larger farmers benefit from the development of sustainable sources of energy. Many support systems have been put in place across countries to encourage the production of bioenergy, including tax exemptions, duty rebates, and capital allowances. What are the most appropriate mechanisms that should be put in place to make sure that farmers benefit from the production of bioenergy to generate additional income?

Proposed measures to improve market access of farmers could include:

- an additional refundable income tax credit for small bioenergy producers
- access to commodity credit programs for bioenergy start-ups to help the producer build his own plant.

Proposed measures to improve the financing of bioenergy plants and increase farmers' participation could include:

- setting up a system of matching grants.

Proposed measures to address regulatory issues could include:

- setting up strong regulatory standards including appropriate quality control systems.

Proposed mechanisms to be implemented by governments to reduce business risks for farmers for the commercialization of new technologies such as high risk and high cost cellulose bioenergy could include:

- direct capital investment in the project or provision of a commercial loan guarantee.

Carbon Accreditation to reward farmers

- An environmental accreditation for bio-energies, and an appreciation of their positive externalities rather than focusing purely on economic and trade principles, is required. Environmental accreditation is necessary to reward farmers for bioenergy production. If such an accreditation is based carefully on environmental grounds and greenhouse gas emission savings, then it would be compatible with WTO trade rules.

Internalising the collateral benefits of bioenergy

- An incentive that could be used to offset the price difference between fossil fuels and bioenergy is to internalise the collateral benefits of bioenergy. The Clean Development Mechanism (CDM) of the Kyoto Protocol as well as the upcoming

new protocol could offer, for example, additional incentives for establishing energy plantations and opportunities for technology transfer. The CDM and other financial mechanisms should be further developed and dedicated to harnessing the full global potential of bioenergy. These financial mechanisms should represent the cornerstone of a new global strategy on reducing climate change and boosting economies and investments in bioenergy in developing countries.

Is it acceptable for farmers to have as a condition for access to bioenergy incentive programs, an acceptable quality assurance program? This needs to be thought through carefully. Indeed, too many complicated conditions might delay the development of bioenergy. Some countries may choose optimal systems. However on a wide world basis, inappropriate systems would lead to the creation of additional handicaps to certain farmers due to unfair competition.

- **Database/information sharing**

It would be desirable to create a database and web-site where interested investors and farmers can exchange information and negotiate new projects. However, the first investors must be the farmers themselves. Farmers must be, as much as possible, in a situation to own and control the whole chain from field to energy production and distribution.

There is also a need to develop information exchanges between farmers from developed and developing countries on implementation of sustainable energy policies. In particular, existing and adapted tax incentive models to encourage sustainable energy production, as well as knowledge on technology processes should be documented.

- **Developing communications and information campaigns**

Governments should undertake pro-active and concerted information campaigns to encourage bioenergy production in order to both extol its economic benefits and to build consumers confidence.

- **Establishing a participatory framework to analyse the situation**

Prior to designing any instruments or tools for the development of bioenergy, there is a need to identify the problems and make a thorough diagnosis of the situation. To this end, a Stakeholder Commission should be put in place to analyse the situation, including relevant national government bodies, civil society organisations including farmer organisations, the private sector and the research community.

2.2 The role of farmers' organisations

- **Extension services and technology transfer through:**
  - Training support on bioenergy production through practical demonstration sites, national non-food crop centres, farming media and literature.
  - Information sessions for farmers on how to enter the bioenergy business
  - Extension resources to work with potential bioenergy development groups and identify specialised advisory services to help producers through the process
  - Extension through local agricultural advisors on new varieties, production methods and technologies for energy crops to ensure that farmers continue to innovate and maintain the most competitive production techniques.

2.3 Partnerships

It is a good strategy to use voluntary and pluri-lateral agreements that create a chain from production to end use, ensuring the quality of the production and fair prices especially to the producer. Farmers' organisations, energy companies, the forest industry, state organisations, research organisations as well as other interested stakeholders work closely together to develop a viable bioenergy policy in which farmers share equitably in the benefits.

III- UNCERTAINTIES AND CHALLENGES

3.1 Limitations to the development of bioenergies: the need for careful planning

- **Bioenergy is not a miracle solution to farmers' income problems** despite widespread agreement on its potential for farm income generation. However, it can help solve part of the energy and climate change problem. Long-term assessments of economic, environmental, and social prospects are needed in order to avoid unfulfilled expectations and failed investments. There is a need to plan this development carefully and ascertain immediate and long-term prospects for bioenergy guided by a rational land use policy, and a judicious selection of crops and production areas as well as a conscious effort to protect the rights and welfare of farmers. Careful planning will thus ensure long-term both food security and energy security, provide part of the solution to climate change mitigation as well as making sure that profitable markets exist for farmers.

- **Currency fluctuations**
  With the predicted increase in reliance on imported fuels, comes an associated increased exposure to currency fluctuations

3.2 Insufficiencies

- Insufficient attention is being given to the potential of wood energy and agro-energy in forestry and agriculture. In cold countries, wood is used for both heating and producing electricity. In some developing countries, wood is used for cooking purposes. Therefore, there are different uses to the same raw material depending on the country or region. This means that different strategies are needed to adapt to the various conditions bearing in mind the sustainability constraint.

- There is little information and statistical data on resources, production, trade and consumption of biomass for energy purposes.

- There is a lack of human resources trained in bioenergy as well as inadequate educational and technical materials.

- There are insufficient tools, methods and models for project development, evaluation and monitoring, particularly regarding bioenergy supply.

- There is a lack of equipment and poor knowledge of the appropriate practices for harvesting, transportation, storage and use of bioenergy, in particular in developing countries.

- On technical and economic issues, there are many insufficiencies including:
  - lack of data on the quantity, quality and potential of bioenergy sources and conversion technologies;
  - poor understanding of the energy balances of bioenergy production systems and of their potential and limits to reduce greenhouse gas emissions;
  - poor understanding of the interrelations between wood and agro-energy systems;
  - insufficient information about costs, advantages and disadvantages of using wood and agrofuels;
  - lack of regulations to ensure that bioenergy is produced, traded and used according to appropriate guidelines and standards.

- No clear study has been carried out on energy costs of production for each type of bioenergy. These costs should include the ratio of energy consumed to produce the plants such as tractors, inputs.., energy consumed to transport the raw product from the field to the factory and finally the energy consumed to transport bioenergy to the location of consumption.

3.3 Challenges

- **Towards certification standards for bioenergy?**

Some organizations and governments are pushing for certification standards for bioenergy, in particular for biofuels with sustainability as a requirement for certification. This raises the question of the sort of criteria to be applied to measure sustainability. Should sustainability be based on land use and cultivation practices? Should it take into account food supplies or food prices? Do we have to look at sustainability of bio-energies by their impact on mitigating climate change? Should sustainability also relate to people's livelihoods in which case contract conditions for farmers, and working conditions of plant employees would be criteria? What if the use of land for biofuel feedstock results in farm consolidation and the loss of livelihoods for small-scale farmers? Biotechnology could also be a certification issue.
It is important that governments set up a harmonised framework for the establishment of sustainability criteria for the production of bioenergy. However, certification of bioenergy should not be used as a trade barrier to protect domestic production as there are already many existing standards which create trade distortions. Indeed, by establishing new standards for sustainable production, bioenergy may play an important pioneering role in the world commodity trade, with all renewable and non renewable commodities eventually subject to such criteria e.g. introduction of equivalent certification schemes for current fossil fuel energy. However, these standards should be harmonised at the international level and should therefore follow the international principles of transparency. Further, governments need to set up capacity building programs on eventual standards and certification schemes related to bioenergy.

- **Effects of bioenergy on food supplies**

The statement is frequently made that there can be no justification to produce bioenergy from food sources while people are starving. Some people question whether energy crops will compete for land with food crops putting in danger food security and driving up food prices.

How do we keep the balance between calorie demands and transportation needs? From this angle, it may seem obvious that producing food or bioenergy as close as possible from where it will be consumed makes sense thus reducing transportation costs for energy production. While we recognise that transportation distances are determined by economics and that long-distance bulk transport does not always carry a significant energy penalty, it makes sense to find the right balance whereby less transportation is needed to either produce food or energy. Part of the answer to this challenge lies in growing multi-purpose crops and in using production methods which can be applied both for energy and food purposes.

- **Effects of bioenergy development on prices and competition issues**

Given that the price of bioenergy is linked to the price of oil, rising fuel prices will put upward pressure on the price of crops for energy feedstocks. A steady and sustained increase in commodity prices should enable farmers to resume agricultural production and to improve their incomes and the living conditions of rural communities (after 40 years of depressed agricultural prices) which would allow them to invest and to improve their productivity (especially in developing countries). Nevertheless, farmers are well aware that this trend could have adverse effects on the livestock market e.g. meats through higher prices for animal feeds. Alternatively, if bioenergy industries produced a significant amount of protein feed as a by-product, then this would reduce costs in the livestock industries and stimulate production.

Even though farmers may be concerned by high levels of food prices, this issue should be managed by implementing sound governmental regulation policies and mechanisms looking at the whole food chain. But this should not be done at the expense of farmers.

This competition among different markets, and the interrelated effects on price, raises several questions. If the prices of feedstocks that can be used for food, feed, or energy do rise, what would be the reaction of farmers? Should only the market decide on which end use of farm crops takes priority?

Farmers, especially those in developing countries, could see increased returns for their energy crops encouraging further investments in the agricultural sector. Thus, poverty issues and rural development would be addressed.

- **New prospects from biotechnology**

One of the possible answers to this dilemma lays in scientific advancements which may reduce the conflict between food and energy. Food or feed crops are not the only sources of renewable energy. There is a need to look into the potentials of biogas, waste materials, wind power and other energy sources that do not threaten food supply or land fertility and which may be more sustainable and profitable in the long-term. If cellulosic ethanol (2^{nd} generation) becomes a cost-competitive technology, much of the pressure on food supplies would be alleviated (cellulosic energy crops could be grown on marginal soils inappropriate for food crops). These new developments would help to overcome the issue of food versus energy production and balance food and non-food needs. However, in order to develop 2^{nd} generation bioenergy, the first generation bioenergy needs to be ensured in order to provide the necessary R&D.
National governments need to enhance policy coherence and also to put in place the necessary framework and allow the market to decide on which technology to use for bioenergy production. Policies should be technology neutral.

- **Sustainability issues are a concern in both developed and developing countries**

Is there enough land to produce food and fuel? Will cultivation choices be made in ways that foster the continued fertility of the land? Questions such as these regarding the sustainable production of bio-energies have been looked at in depth. There are many academic publications from the past 30 years on the subject of "food versus fuel" and the future transition to a biomass based economy. Certainly, these historic assessments and the more modern attempts to develop sustainability and carbon balance reporting standards are becoming increasingly important as international trade in biomass commodities accelerates[9].

- One of the concerns relates to the risk to food insecurity of unbalanced choices in favour of bioenergy. Multinationals tend to take advantage of lower costs in developing countries to buy out land from farmers and invest in this new source of energy at cheaper prices, to the detriment of the local economy and the farmers. This situation could lead to the displacement of many farmers (small-scale ones in particular) from their land and place in danger the sustainability of the national food production sector. This situation will benefit large integrated bioenergy conglomerates which can then impose rigid standards on farmers, depress commodity prices and impose unfair contractual agreements on them. Governments need to ensure coherence between agricultural policies (which relate to food insecurity) and sustainable energy policies. There is also a need to address the issue of land tenure and distribution.

- Increased prices for natural resources: there is a risk of increased prices for natural resources, such as water and land, due to a diversion of large tracts of land to energy feedstock production. In particular, farmers are concerned about the price of water which should remain reasonable and affordable. Therefore, appropriate pricing policies need to be implemented.

- Environmental damage: bioenergy ventures if not properly handled may use more energy than they produce thus harming the environment and causing damage to the natural resources (land, water, biodiversity, forests…). There is also a risk that an uncontrolled development of bioenergy production backfires on farmers through uncontrolled deforestation and aggressive plantation of energy crops. Therefore, there is a need for harmonised criteria for calculations of energy balances and greenhouse gas emissions..

For all these reasons, and to prevent these risks, the development of bioenergy should be part of a global, integrated strategy which would take into account the sustainable management of natural resources. In particular, this integrated approach should make sure that water resources are managed in an integrated and rational way (IWRM)).

- **Investing on bioenergy in developing countries**

This represents a real challenge for resource-poor developing countries. Bioenergy production is a prospective tool for rural and economic development. As in developed countries, there is a need for significant investment for the feedstock or fuel to come to market and to benefit producers. However, most governments in these countries lack the resources to provide incentives to encourage their farmers to invest in bioenergy production.

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[9] Biomass, energy, and environment *a Developing Country Perspective from India* by N.H. Ravindranath and D.O. Hall, Oxford University Press, pp 216-220, Oxford, 1995,
The Biomass Assessment Handbook: Bioenergy for a Sustainable Environment by Frank Rosillo-Calle, Sarah Hemstock, Peter De Groot, Jeremy Woods (1987)
Renewable energy-sources for fuels and electricity? T. Johansson, H. Kelly, A. Reddy and R. Williams? Island Press, Washington, DC (1993). ...

Developed countries are already interested in the biomass potential of developing countries to help them satisfy their own needs. Therefore, if domestic investment capital is insufficient, it is possible that foreign direct investment (FDI) will develop the industry. What will be the consequences for farmers and the agriculture of these countries? What kind of cooperation systems could be put in place between farmers' organisations in developed countries and those in developing countries to make sure that the latter benefit from opportunities given by this new production?

IV- CONCLUSION

There are significant income opportunities for farmers in the high level of attention that is currently being given to the development of bio-energies worldwide. However, if farmers are to benefit from the development of bio-energies, there is a need for careful analysis and planning to identify real opportunities aimed at improving producers' incomes, before pursuing bioenergy programs. The potential for bioenergy to provide a better alternative to fossil fuels with environmental benefits and economic opportunities for farmers is a good reason to try and work out sound strategies along with the different stakeholders. Farmers' organisations need to push for the creation of the right incentive mechanisms that will allow their members to benefit from this new opportunity and generate complementary incomes.
Bioenergy represents a good opportunity for farmers but it is important that governments and farmers' organisations together undertake a careful analysis about the real opportunity to improve the producers' income. Further research and development are needed in order to avoid competition between food and fuel uses of certain food crops.