STRATEGIES FOR BUILDING A PLATFORM FOR HORIZONTAL COOPERATION ON AGRO-ENERGY AND BIO-FUELS

(A Proposal)

IICA

Executive Committee
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STRATEGIES FOR DEVELOPING A PLATFORM FOR HORIZONTAL COOPERATION ON AGRO-ENERGY AND BIO-FUELS

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FOREWORD

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In response to the mandates of the Summit process, and following lengthy discussions and consensus building among the 34 member countries of the Institute, the Ministers of Agriculture signed the *"AGRO 2003-2015 Plan of Action for Agriculture and Rural Life in the Americas,"* a hemispheric strategic framework to be used in drafting and implementing national and regional strategies. The Heads of State and Government endorsed the Plan at the Special Summit held in Nuevo Leon, Mexico, in January 2004.

For the 21st century, IICA has embraced a new style of technical cooperation that emphasizes operational efficiency, prudent financial management, better use of human resources, expanded international strategic partnerships and a new relationship with Member States based on participation, transparency and accountability. This integrated, results-based management framework allows IICA to help the countries implement their respective work programs under the AGRO 2003-2015 Plan of Action. As part of this effort, IICA now permanently monitors the State of Agriculture and Rural Life to provide a point of reference and input for national, regional and hemispheric strategies and actions.

The management model which emerged during the process of leading change and institutional reform at IICA between 2002 and 2005, is a process that will be consolidated in coming years, and is documented in the 2005 IICA publication, *"A 21st Century Model for Technical Cooperation: Leading Change and Institutional Reform at IICA-Support of a Common hemispheric Agenda for Agriculture and Rural Life in the Americas".*

Under the new model, IICA attaches special importance to information, communication and the projection of its institutional image in order to position itself as an international development agency that is recognized and respected as a strategic partner, one that

is capable of making a key contribution to the development of agriculture and the rural milieu in the Americas. It was therefore agreed that in the 2006-2010 Medium-Term Plan, IICA should consolidate its role as a major player in the promotion of the sustainable development of agriculture, food security and the prosperity of rural communities in the Americas.

Based on the modern use of strategic planning tools as a process of institutional repositioning, the Institute undertook the preparation of technical cooperation agendas at the national, regional and hemispheric levels. This process, which included directly approaching Member States, has led to a higher standard and quality of the delivery of service resulting in IICA becoming a *"partner of choice"* for Member States and clients.

This new results-based management style adopted by IICA's administration to approach its Member States, and its decision to develop a proactive agenda of mutual interests reflects, in many ways, the new vision required to face the challenges of agriculture and rural life in the Americas. The driving force behind this new IICA model is a commitment to lead and manage a process for the creation and sharing of knowledge about agriculture and rural life in the Americas, and to consolidate in the Institute a culture of excellence that results in the provision of information, knowledge, leadership and delivery of technical cooperation that is more closely related to the needs and priorities of the Member States.

In this respect, IICA is focused on becoming a more modern and business-oriented organization that is driven by the needs of the Member States, and where technical excellence, full participation, financial prudence, transparency and accountability, and working together with strategic partners are emphasized. The management model implemented reflects the vision first presented in 2002, to the Institute's Member States in the document, *"Repositioning IICA to Meet the Challenges of the 21st Century."* The reform process was based on the need for the Institute to maintain its place of technical excellence and technical leadership in the agricultural community of the Americas. The

Institute took the view that organizations such as IICA must assume a higher responsibility of service to stakeholders and social responsibility to society.

In order to continue to ensure that the Institute plays a strategic role in assisting the Member States in their search for progress and prosperity through modernization of the agricultural and rural sectors, IICA will promote the incorporation of new technologies such as agro-energy in the agricultural sector.

INTRODUCTION

CHAPTER 1: Introduction

At the Inter-American Board of Agriculture (IABA) and the Executive Committee meetings held in Guayaquil, Ecuador, and in Ribeirão Preto, Brazil, respectively, in 2005, the ministers and delegates of the Member States decided to promote, with cooperation from IICA, horizontal cooperation actions aimed at the development of the agro-energy sector in the Member countries.

The Executive Committee Resolution 429, entrusted the General Directorate of the Institute with the presentation of a draft resolution on horizontal cooperation in the area of bio-fuels for the consideration of the Thirteen Regular Meeting of the IABA, in Guayaquil.

Consequently, the IABA Resolution 410, requested IICA to:

1. Ask the Institute to serve as a platform for hemispheric cooperation, with a view to drawing on the successful experiences in the area of agro-energy of countries in the region that produce alcohol from sugar cane and other bio-fuels;

2. To instruct the Director General, in consultation with the Member States:

    a. To convene meetings to discuss the importance of agro-energy and bio-fuels and their potentially favorable impact on agricultural development and the economies of the Member States; and

    b. To set up a task force comprising experts from the Member States appointed by the Ministers of Agriculture, IICA personnel and strategic partners, and task them with drawing up a hemispheric program on bio-energy and bio-fuels, to be presented to the Executive Committee at its Twenty-sixth Regular Meeting.

3. To instruct the Director General to submit a proposal to the Executive Committee, at its Twenty-six Regular Meeting, on the resources required to support activities to be carried out under the aforementioned Program.

At the General Assembly of the Organization of American States, held in Dominican Republic, on June 6, 2006, the delegates of the Member States, recognizing the efforts of IICA as a forum for discussing experiences in the field of agro-energy, resolved to enhance cooperation between the OAS, IDB, IICA, and other international and regional agencies in support for the use of new and renewable energy resources.

The OAS Resolution 2253, requested IICA and the other partners to:

a. Implement renewable energy measures and energy efficiency projects that lower dependence on fossil fuels while promoting the development and efficient use of local natural resources to produce fuels for electricity generation and transportation; and
b. To promote increased provision of novel energy services to neglected communities, particularly rural and indigenous communities, as a means of promoting economic development, sustainable management of natural resources, and capacity to deliver community services, including education, health, and agricultural extension services.

The proposal being developed at IICA take into consideration the mandates received from the IABA and the Executive Committee and the requests from the General Assembly of the OAS. At this stage, is based on primary data from international and regional entities such as the International Energy Agency (IEA), the Organization for Economic Co-operation and Development (OECD), the Economic Commission for Latin America and the Caribbean (ECLAC), the Worldwatch Institute, FAO, governmental agencies, and others at national, regional and international levels. Hence, the information provided in this document is the result of a thorough review of the literature, interviews with experts and internal consultations.

As such, IICA undertook an in-house evaluation of agro-energy as a viable option for renewable energy, and established an oriented direction for the future, proposing, as the next stage, the formulation of a strategic platform for the development of an agro-energy program in the hemisphere. This future initiative, in addition to addressing the technical, economic and social aspects of agro-energy, with recommendations for the development of the agro-energy and bio-fuels in the hemisphere, will also promote and sustain IICA's image as an innovator and promoter of new thought, and the leading Institute for agriculture and rural development in the hemisphere.

THE RATIONALE

CHAPTER 2: The Rationale

1. A Platform for Horizontal Technical Cooperation

Agro-energy is based on the conversion of biomass produced by the interactions of vegetation, solar radiation, water and nutrients into energy. The high energy prices for petroleum in the late 1970s (first global crisis) and the 1980s (second global crisis), catalyzed interest in the derivation of energy from the dedicated production of crops such as sugarcane, for transportation, and fast growing forestry species for heat.

IICA, with a mandate for the promotion of rural development, recognizes that increasing energy prices poses a threat to rural development by reducing access to energy services that are a prerequisite for improving household income. Secondly, it takes increasing amounts of capital out of rural areas. Agro-energy has the potential to minimize this situation and at times reverse this situation, and in the process address a number of social and environmental issues. As a first step in implementing this mandate, the Institute has developed this initial strategy document for building a platform for horizontal technical cooperation on agro-energy and bio-fuels for the hemisphere.

The rationale for advocating greater attention in agro-energy is that this approach builds the economic resilience of countries during a period where the international energy supply outlook forecasts continued high and rising cost of petroleum fuels in the future. In addition, it represents a potentially sustainable source of employment for workers with limited skills. The main objective of this proposal is to guide IICA in its efforts to help the Member States to establish agro-energy initiatives toward the development of bio-fuels to meet national energy needs, whilst at the same time helping to modernize and diversify agriculture and rural sectors in the hemisphere.

The future platform for horizontal technical cooperation on agro-energy and bio-fuel initiatives in the hemisphere falls within one of IICA's thematic areas and it is aimed at helping to reposition agriculture and rural life by developing sustainable and viable rural initiatives.

Development of agro-energy and bio-fuels initiatives, at a country and regional levels, provides an excellent opportunity for generating employment and revitalizing rural economies, as well as improving diffusion of technologies. It would involve the provision of training to existing and prospective entrepreneurs in starting and managing business activities relating to biomass-based energy conversion, supply and maintenance services; providing training to other end-users in various uses of biomass energy; interfacing with research and development institutions engaged in biomass technology development, to provide ready access to relevant technological information, and; interfacing between local governing bodies/representatives, suppliers of biomass-based technologies, local financing institutions, entrepreneurs, and other end-users.

2. IICA as a Leading Strategic Organization on Horizontal Technical Cooperation on Agro-energy and Bio-fuel in the Hemisphere

IICA proposes to assist member countries in drafting integrated agro-energy policies to provide a framework for meeting growing energy needs in an economically, socially and environmentally sustainable manner. This would lead to identification of capacity needed for planning and implementation of agro-energy and bio-fuels policies.

IICA would also foster joint initiatives with the member countries to facilitate dialogue with private sector representatives about the potential of agro-energy, as well as other stakeholders and civil society in order to provide scientifically sound and politically unbiased analyses and conclusions needed for strategic decisions related to policy issues.

IICA's aim is to provide countries with comprehensive information to assist with the development and deployment of bio-fuels industries by providing information on the development of emerging technologies, industry best practices and business opportunities in the agro-energy industry.

To achieve successful implementation of agro-energy initiatives in the hemisphere will require IICA to ensure that it is proactive, and that it increases its capacity in agro-energy management by training its professionals located in the Institute's Headquarters and its member states. Given the limited institutional capacity that exists in the agro-energy sector in the majority of the countries across the region, its development will require the provision of systematic long-term technical assistance. This support function is critical and one that IICA is uniquely positioned to play.

The proposed IICA's role would be more in a capacity building and support role – providing information, facilitating exchange of experience and expertise and technology transfer. In countries where there are no activities focused on the production of energy by the agricultural sector, IICA's role would be to sensitize, demonstrate, and foster public education on the importance of agro-energy and bio-fuels for their societies.

Initiatives to educate consumers about the benefits of agro-energy and bio-fuels industries is intended to help them make wise energy choices and to contribute to the effort as a whole. The public education and awareness initiative proposed would educate key public officials and the general public about bio-fuels and would also build national coalitions that would form the nuclei of support groups that would promote and eventually lead to bio-fuels production and use nationally. Additionally, staging of an annual hemispheric conference would provide the mechanism for the exchange new ideas, analyze strategies, and allow agriculture, environment and energy professionals and other stakeholders within the hemisphere to meet with each other.

In addition, IICA will magnify the effectiveness in achieving its goals by forming partnerships with other national, regional and international organizations. By joining

efforts with other rural development organizations and stakeholders, IICA can provide standardized, high-quality data to inform the decision-making process for rural development resources management.

In April 2006, IICA and the FAO entered into a new partnership in which the two organizations decided to strengthen ties on issues related to each organization's mission and thus beef up their resources and the cooperation they provide to countries in the hemisphere, in line with the eighth Millennium Development Goal, which calls for a global partnership for development. IICA and FAO will also be helping the countries to implement the AGRO 2003-2015 Plan, prepared and approved by the hemisphere's ministers of agriculture.

IICA also increased horizontal cooperation by encouraging the countries to share their experiences, such as Brazil in the area of agro-energy. The "Working Together" approach was strengthened by means of joint activities with organizations such as the WTO, ECLAC, the OAS, FAO, United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Labor Organization (ILO), the IDB, the World Bank, CATIE, the CTA, PAHO, USAID, AECI and the GTZ. These joint efforts yielded important results under our programs related to rural development, trade negotiations, agricultural health and food safety, information, agribusiness promotion, technological innovation, investment projects, environmental management and training.

In conclusion, this current document contains background on the future IICA agro-energy platform, how it fits within the institution's established programs and how it would enable the Institute to become the leading strategic Institution on agro-energy in the region. It lays out the background to the IICA initiative and the rationale that:

a. helps explain why agro-energy is considered to be a sustainable option to help address rural development and energy security;

b. provides information on the current status of agro-energy development in the hemisphere to provide a proven basis for consideration by stakeholders in the countries that are interested in exploring the potential;
c. identifies challenges and opportunities for agro-energy development in the hemisphere, specially those countries that have sugarcane and oil seeds as their major agricultural commodities or countries with adequate land space, and;
d. recommends some actions to the development of agro-energy industries in the hemisphere.

ENERGY, BIO-ENERGY AND BIO-FUELS

CHAPTER 3: Energy, bio-energy and bio-fuels

Economic development and rising living standards throughout the 20th century were been fuelled by an abundant and affordable supply of fossil energy. Continued growth of the world's population, combined with sustained economic development, will imply an enormous increase in the demand for energy in the 21st century.

According to the International Energy Agency's "*World Energy Outlook 2005",* energy demand, under a 'business-as-usual' scenario, will grow by more than 50% to 2030. Under this scenario, world primary energy consumption will increase from 14.2 terawatt hour (TW.h) in 2003, to 21.6 TW.h, in 2030. Long term 'business-as-usual' predictions are similar for the rest of the 21st century.

Just as a matter of clarification, terawatt hour (TW.h) is a comprehensive unit of energy, equivalent to 1,000 billion watts, which shows how much energy is used per hour.

Such tremendous growth in energy demand will have direct implications for the security, affordability and environmental sustainability of the energy supply. Although the world's fossil resources will be sufficient over this timeframe, the world will, in the absence of changes in policy, depend more and more on the oil and gas resources of the Middle East and Northern Africa, the two largest remaining reserves of abundant oil in the world.

Petroleum is a highly concentrated energy resource, and the world's current transportation systems are almost completely dependent on it. As a result, the world economy is (or could be) at risk if oil supplies are disrupted in any of the relatively few countries that are significant oil exporters. As a result of concentrated wealth, social tensions, and inadequate political institutions, many of these countries are less-than-

secure suppliers of the world's most vital commodity. In addition, speculative movements of oil suppliers and traders only add more uncertainty in this sensitive market (Worldwatch Institute, 2006)

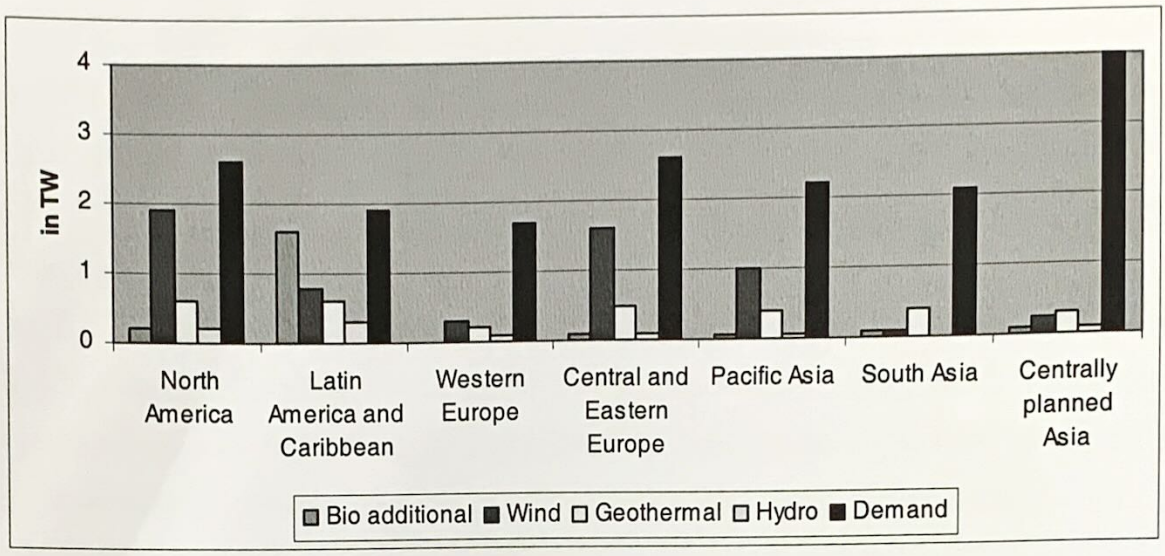
A desire to lessen this dependency could lead to a shift in policies toward the use of other energy resources. An obvious candidate would be a return to coal. At current oil prices, converting coal to liquid fuel is a competitive proposition, although coal releases serious levels of carbon into the atmosphere. The other feasible candidate for the future is bio-energy, particularly agro-energy.

By definition, bio-energy is energy derived from all organic material from plants, trees and crops and from municipal and industrial waste streams. It is very diverse and provides energy for three different sectors: transport, electricity and heating.

Bio-energy as a source of bio-fuels promises to bring a much broader group of countries into the liquid fuel business, diversifying supply and reducing the risk of disruption. Furthermore, because they can be produced in most regions of the hemisphere, the risks inherent in transporting these fuels over long distances will be reduced as well.

As a matter of illustration, the estimated potential of the bio-energy, compared with other renewable energy sources, excluding solar energy, at global level is presented in **Figure 1.**

Figure 1: Resource Availability and Projected Demand for Renewable Energy Sources



Source: OECD Report (2006)

Latin America and the Caribbean have the greatest potential for the production of bio-energy in the world. However, this potential is very limited vis-a-vis the regional and global demands for energy.

BIO-FUELS: A POTENTIAL AND RELIABLE ALTERNATIVE

CHAPTER 4: Bio-fuels: A potential and reliable alternative

There are a number of potential crops that can be cultivated by farmers to provide raw material for bio-fuels production. The most well-known worldwide is sugarcane, and several trees such as eucalyptus and leucaena.

The land resource base is suitable to a range of crops as shown in **Table 1**. Each crop does, however, have its differences in terms of labor requirement, inputs, and nature of the raw material produced. The major differences between agro-energy crops and conventional food crops include tolerance to adverse climatic and weather conditions as well as relatively non-perishable compared to food crops, for example.

This characteristic of the raw material is very attractive given that vulnerability to weather and post-harvest losses are significant reducers of the economic benefits derived by farming households on their investments.

Table 1: Potential Biofuels Feedstock Substitutes for Petroleum Fuels

Crop/Plant	Petroleum product Substituted	Primary Biomass Yield	Secondary Biomass Yield	Farmers Experience with Crop(s)
Seed bearing shrubs -- Jatropha C Castor	Diesel for Transport or for generation	Seeds	None of Consequence	Very limited
Cassava	Gasoline	Starch tubers	None of Consequence	Grown traditionally for food
Coconut	Diesel for transport Diesel for power generation	Oil	Shells	Grown widely
Oil Palm	Diesel for transport Diesel for power generation	Oil	Shells	No experience
Fast Growing Trees	Diesel or Fuel Oil Power generation	Wood	None	Very limited
Fast Growing Legumes trees	Diesel or Fuel Oil Power generation Liquid Petroleum Gas	Leaves	Wood	Very limited
Sugarcane	Gasoline Diesel for transport Diesel or fuel oil for power generation	Sucrose	Fibers and Trash	Long experience
Energycane	Gasoline Diesel for transport Diesel or fuel oil for power generation	Fibers and Trash	Sugars	Very limited

Source: Binger (2006)

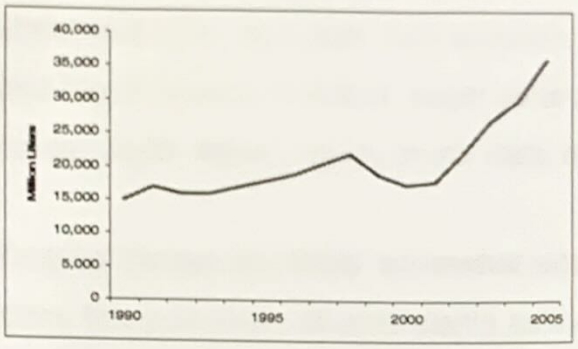
After more than 30 years of research and development, the production and use of bio-fuels have entered a new era of global growth, experiencing accelerated growth in both the scale of the industry and the number of countries involved. Rising investment in bio-fuel production is being driven by a variety of factors, from the continuously rising price of crude oil and the development of more efficient conversion technologies, to strong new government policies in support of the agro-energy.

Bio-fuels production has led to a significant increase in demand for agricultural commodities. The two primary bio-fuels in use today are ethanol and bio-diesel, both of which can be used in existing vehicles. Sugar cane, cereals and sugar beet are currently used to produce ethanol, which has become a ready replacement for oil-based gasoline. Bio-diesel, on the other hand, is produced from vegetable oils and has the potential to be used instead of oil-based diesel. Ethanol accounts for about 90 percent of total bio-fuel production, with bio-diesel making up the rest.

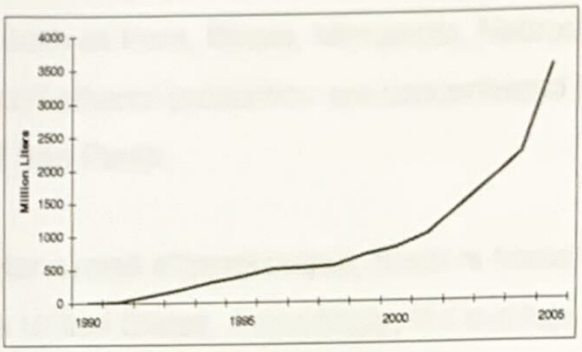
The increased interest in bio-fuels can be explained by a number of ecological, economic and geo-political reasons. The recent pace of advancement in technology, policy, and investment suggest that the rapid growth of bio-fuel use could continue for decades to come and that these fuels have the potential to displace a significant share of the oil now consumed in many countries.

Figures 2 and 3, show that global fuel ethanol production more than doubled between 2000 and 2005, while production of bio-diesel, starting from a much smaller base, expanded nearly fourfold.

World Fuel Ethanol Production, 1990-2005



World Bio-diesel Production, 1990-2005



Source: Worldwatch Institute (2006)

Tables 2 and 3, show the top five global fuel ethanol and bio-diesel producers in 2005.

Top Five Fuel Ethanol Producers

	Production (million liters)
Brazil	16,500
United States	16,230
China	2,000
European Union	950
India	300

Source: World Watch Institute, 2006

Top Five Bio-diesel Producers

	Production (million liters)
Germany	1,920
France	511
United States	290
Italy	227
Austria	83

Source: World Watch Institute, 2006

Regarding the fuel ethanol production, Brazil has been at the forefront of efforts to produce ethanol from sugar cane, the leading feedstock to date. Three decades of government support and private investment have allowed Brazil to steadily improve the efficiency of its production processes and to make ethanol economical for consumers. During the same period, the United States has been the leader in converting grains (mainly corn) into ethanol fuel, improving efficiency and lowering costs.

According to the literature reviewed, ethanol fuel production has tended to be more geographically concentrated than bio-diesel, but it is typically broadly distributed among different facilities within a specific production region.

In the United States, this production is concentrated predominantly in Midwestern states that have abundant corn supplies, such as Iowa, Illinois, Minnesota, Nebraska, and South Dakota. In Brazil, sugar cane and ethanol production are concentrated in the center-south region, mainly in the state of São Paulo.

Despite the two countries' somewhat similar overall ethanol output, Brazil is home to three times as many ethanol plants as the United States. Accordingly, the average capacity of plants in the U.S. is three times greater than the average capacity of those in Brazil. The largest plant in Brazil produces 328 million liters per year by crushing sugar cane, whereas in the United States the largest corn dry-milling ethanol plant produces 416 million liters per year.

There are various reasons for the differences in plant capacities. One key reason corn-to-ethanol plants can be larger is because substantial amounts of harvested corn can be stored for long periods of time, whereas sugar cane must be processed shortly after it is harvested (preferably within 24–48 hours) to avoid deterioration of the sugar.

Europe, on the other hand, has been at the forefront to produce bio-diesel from crops, with Germany being a leader in the large-scale production of bio-diesel fuel from rapeseed and sunflower seed, crops commonly used to produce vegetable oil for human consumption.

According to the Worldwatch Institute (2006), in the coming years, the international development of bio-fuels and bio-based co-products has the potential to increase energy security for many nations; to create new economic opportunities for people in rural areas; to protect and enhance the environment on local, regional, and global scales; and to provide new and improved products to millions of consumers.

However, according to an OECD report (2006), while bio-fuel will be a useful and cleaner addition to liquid fuel in many countries where it can be produced cheaply (such as ethanol in Brazil), it is highly unlikely that it can replace fossil fuel completely,

due to the production costs higher than those of fossil carbon fuels, and limited availability of land.

Furthermore, according to a recent report from the National Academy of Sciences (2006), even if all the corn and soybean produced in the United States were diverted to the bio-fuels local market, it would cover only 12% of the national demand for ethanol, and only 6% of demand for bio-diesel.

In conclusion, bio-fuels should be seen as a valid alternative for reducing dependence of fossil fuel, but not for replacing them completely. Key to shaping such a future, in which bio-fuels are produced in a sustainable manner and used on a large scale, is defining clear goals and enacting the policies necessary to achieve them.

THE ECONOMICS OF THE BIO-FUELS

CHAPTER 5: The economics of the bio-fuels

Production costs for bio-fuels vary widely from process to process and from region to region. While the technology to produce ethanol from grains and sugar crops, or bio-diesel from vegetable oils, is well established, the differences in bio-fuel production costs are due mainly to the costs of the feedstock, the type of energy used (both heat and electricity) and the prices received for by-products derived from the production process.

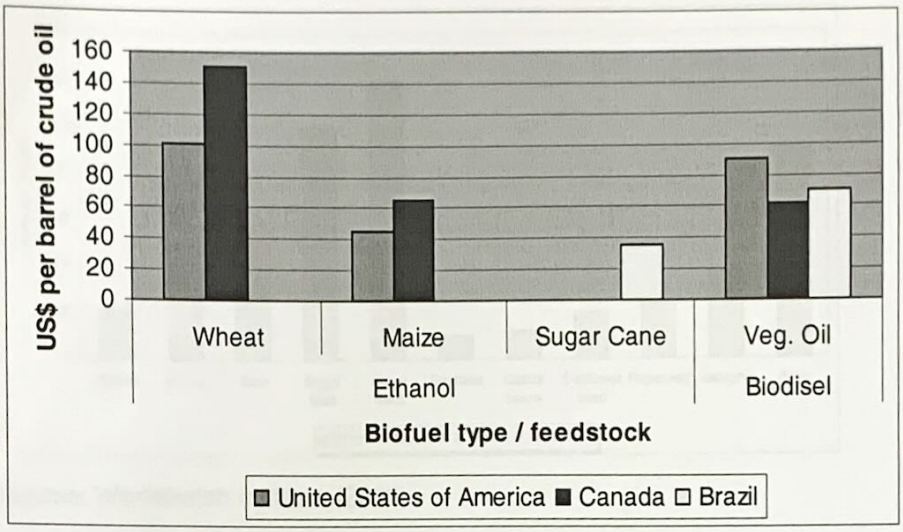
An important factor to consider is the threshold prices for crude oil, at which the production of bio-fuels become sustainable and competitive.

Threshold prices, or a minimal price, represent estimated crude oil prices at which domestic tax-free gasoline and diesel prices are equal to the production costs of ethanol and bio-diesel, respectively, taking into account the differences in their energy content.

Although estimates of bio-fuel production costs are subject to substantial uncertainty, the available data in the literature suggests that costs per unit of Brazilian ethanol from sugar cane, at around US$ 29.00 per equivalent barrel of crude oil, are far below those of most other production systems. For the USA and Canada, production costs are higher, at around US$ 44.00 and US$ 66.00 per barrel, respectively, suggesting that the production of bio-fuels is economically sustainable only in the presence of oil prices higher than these (**Figure 2**).

Threshold prices for bio-diesel are substantially higher, ranging from US$ 66.00 per barrel in Canada, to over US$ 80.00 per barrel in USA (OECD Report, 2006).

Figure 2: Threshold Prices, based on 2004 data (estimated)



Source: OECD Secretariat (2006), based on 2004 data.

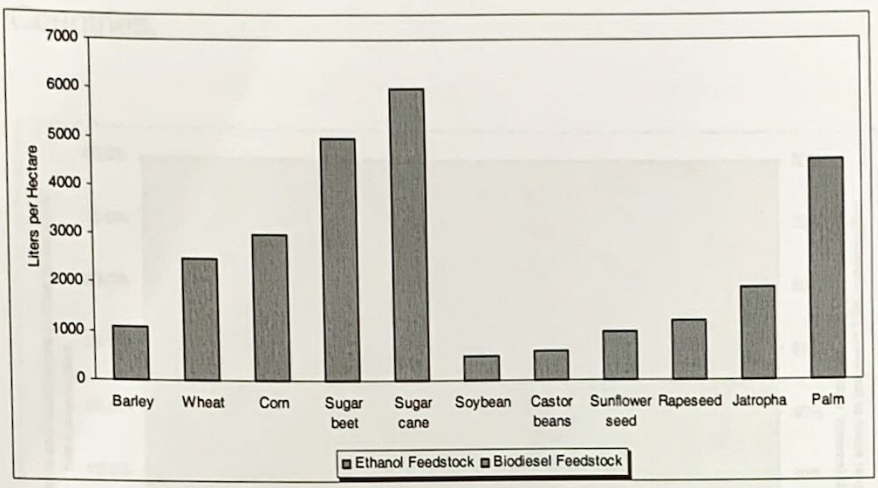
Costs and prices for all bio-fuels are expressed in US$ per equivalent litre of gasoline, so as to take into account the differences in the energy content of various fuel types.

A crucial factor that affects bio-fuel production costs is the price of the commodity used as feedstock during the industrial process of the bio-fuel production.

In the case of ethanol, more than fifty percent of the production cost is represented by the value of the feedstock. Consequently, the price of the commodities used as feedstock, and their respective sugar and starch content, are crucial for the viability of the bio-fuel production.

Similarly, in the case of bio-diesel, the cost of the vegetable oil used often represents more than three quarters of the total production cost. Technical progress is likely to further reduce production costs for bio-fuels. However, the use of a relatively cheaper biomass feedstock continues to be the best option for reducing bio-fuel production costs in the medium term.

Figure 3: Bio-fuel Yields of Selected Ethanol and Bio-diesel Feedstock



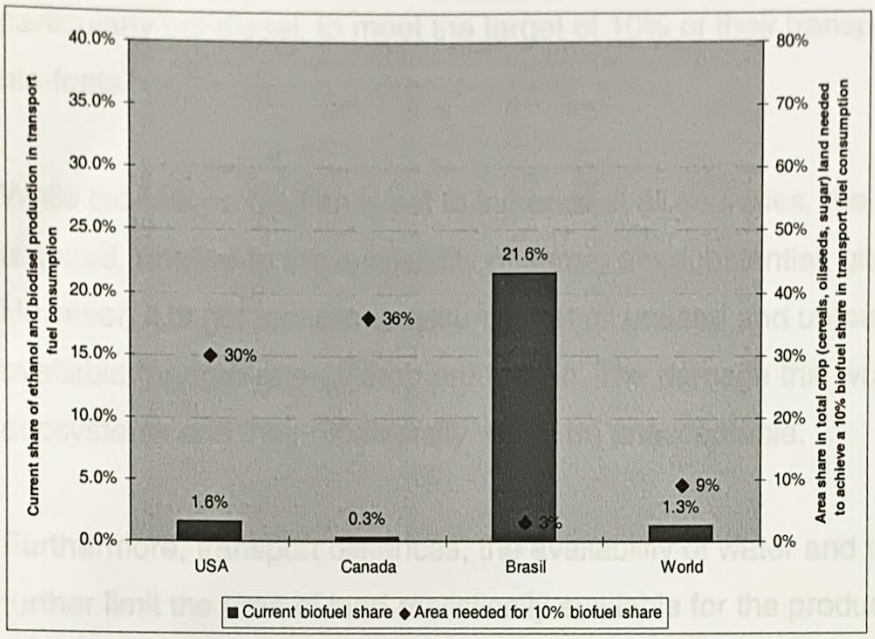
Source: Worldwatch Institute (2006)

The different biomass feedstock used for producing bio-fuels can be grouped into two basic categories. The first is the currently available "first-generation" feedstock, which comprises various grain and vegetable crops. These are harvested for their sugar, starch, or oil content and can be converted into liquid fuels using conventional technology. The yields from the feedstock vary considerably, with sugar cane and palm oil currently producing the most liters of fuel per hectare (**Figure 3**).

The "next-generation" of bio-fuel feedstock comprises cellulose-rich organic material, which is harvested for its total biomass. These fibers can be converted into liquid bio-fuels only by advanced technical processes, many of which are still under development. Cellulosic biomass such as wood and crop residues is much more abundant than food crops and can be harvested with less interference in the food economy and potentially less strain on land, air, and water resources. Another potential "next-generation" feedstock is the organic portion of municipal solid waste.

On the other hand, when assessing the technical potential of agro-energy, assumptions must also be made as to the availability of land (given competing land uses), and to the suitability of the land for crop production.

Figure 4: Land Requirements for a 10% Bio-fuel Share in Three Bio-fuel Producing Countries.



Notes: Current bio-fuel shares include ethanol and bio-diesel only – shares are on an energy basis. World area shares are calculated relative to land used for cereals, oilseeds and sugar globally (World) All areas requirements are calculated on the basis of average crop area and yield data for 2000-2004 and transport fuel consumption in 2004. For these calculations, the 2004 shares in the feedstock mix are assumed to remain unchanged.

Source: OECD Secretariat.

The data on this chart, from an OCDE report (2006), suggests that the USA and Canada, for example, would require between 30% and 40% of their respective current crop area if they wanted to replace 10% of their transport fuel consumption by bio-fuels. In these countries, the production of ethanol and bio-diesel is equivalent to less than 2% of total transport fuel consumed in 2004.

Currently, Brazil is producing about 22% of its total transport fuel energy consumed, in the form of ethanol. Due to its vast agricultural area, but also because of relatively low transport fuel consumption per capita, only 3% of the available cropping area (total of cereals, oilseeds and sugar crops) would be needed to produce additional bio-fuels, particularly bio-diesel, to meet the target of 10% of their transport fuel consumption with bio-fuels.

While bio-fuel production is set to increase in all countries, the amounts of land required, relative to the availability of same, are substantial, given current technologies. However, it is not realistic to assume that all unused and untouched land will be available for agro-energy crop production. The damage this would cause to remaining ecosystems and their biodiversity would be unacceptable.

Furthermore, transport distances, the availability of water and the need for fertilizers will further limit the area of land realistically available for the production of agro-energy feedstock. These constraints may likely encourage many industrial countries to consider importing bio-fuels and to push for elimination of the tariffs and other trade barriers that have so far limited bio-fuel trade.

THE IMPACT OF RESEARCH AND DEVELOPMENT ON NEW TECHNOLOGIES

CHAPTER 6: The impact of research and development on new technologies

According to the OECD (2006), and the Worldwatch Institute (2006), for bio-fuels to reach their full potential in meeting future transportation needs, it is critical to develop and deploy economically competitive technologies that can convert abundant cellulosic biomass resources into liquid. Development efforts to date have demonstrated that it is possible to produce a variety of liquid fuels from cellulosic biomass for use in existing vehicles.

As of mid-2006, however, the costs of producing liquid fuels from cellulosic biomass were not competitive with either petroleum-derived fuels or more conventional bio-fuels. Various government and industry-sponsored efforts are under way to lower the costs of making liquid fuel from cellulosic biomass by improving the conversion technologies.

Therefore, the impact of bio-fuel production on agricultural markets is expected to change significantly once “advanced” bio-fuels become competitive.

National and international research and development are therefore essential to foster modern bio-fuel industries.

To date, our hemispheric technical and scientific skills have not been focused coherently on the challenges associated with large-scale bio-fuel development and use. Thus, there is enormous potential for dramatic breakthroughs in feedstock and technologies that could allow bio-fuels to play a major role in enhancing energy security, reducing greenhouse gas emissions, and providing much of the world community with economical transport.

There has been an important surge in private-sector investment in bio-fuels in recent years, particularly in the USA and Brazil, but this investment tends to be oriented towards short-term and high payoff research. There are many long-term research

needs that governments are best suited to address; governments and international organizations, such as IICA, should help coordinate public and private efforts by bringing together the best minds and resources in national research facilities, universities, civil society, and industry.

Research is needed to develop feedstock and sustainable management practices, as well as technologies for harvesting, processing, transporting, and storing feedstock and fuels. Research is also required to better understand the potential environmental and societal impacts of bio-fuels throughout the entire supply chain.

New technologies to produce ethanol from cellulosic and lignocellulosic materials being developed in the USA, Canada and Brazil, or synthetic fuels from biomass, may change the economics of bio-fuels supply significantly.

Other remarkable examples of new agro-energy technologies under development include **H-Biodiesel**, in Brazil, which consists of adding vegetal oil from crops such as soy, palm oil, castor oil, etc, at a ratio of 10%, to the blend with mineral oil (diesel) before hydro finishing. Another example is **Bio-butanol**, in England. Under a partnership between BP and DuPont, efforts are made to develop a new bio-fuel from crops to be blended with the gasoline, but using old ethanol fermentation facilities.

Rather than increasing demand for food commodities, these new technologies would, in many cases, reduce competition for the use of land between farmers and energy producers.

There is a firm believe that, due to the expected economic advantages of advanced bio-fuels technologies, the production of renewable fuels will increase substantially in the longer run.

ENVIRONMENTAL CONCERNS

CHAPTER 7: Environmental concerns

According to the Worldwatch Institute report (2006), the global transportation sector is responsible for 25 percent of the world's energy-related greenhouse gas (GHG) emissions, a share that is rising. Petroleum fuels have exacted a heavy environmental toll on the planet, and their impact is likely to worsen as "dirtier" energy supplies, such as heavy oil and coal, are tapped.

As an alternative, bio-fuels offer the opportunity to reduce the emissions of both greenhouse gases (GHGs) and urban air pollutants. Their cultivation could cause huge disruptions in land use, but, if managed properly, the cultivation of energy crops could also facilitate the sequestration of carbon in the soil and provide an economic incentive to protect and restore ecosystems previously degraded by human activities.

A significant increase in the production and use of bio-fuels has the potential to significantly reduce those emissions, particularly with the development of advanced bio-fuel technologies that rely on agricultural wastes and dedicated cellulosic crops. However, if bio-fuels are produced from low-yield crops, are grown on previously wild grasslands or forests, and/or are produced with heavy inputs of fossil energy, they have the potential to generate as many or more GHG emissions than petroleum-based fuels do.

On the other hand, widespread cultivation of bio-fuel crops has the potential to contribute to soil depletion and erosion, habitat loss, and reduced biodiversity. These are fundamental environmental challenges that countries face when considering the expansion of their agro-energy sector.

In conclusion, any plan to promote the production and use of bio-fuels on a large scale must be part of a broader strategy to reduce risks of environmental degradation, and

must be accompanied by a new generation of clear and strict land use laws, particularly in countries with tropical forests that are at risk of destruction.

IMPACTS ON AGRICULTURE AND RURAL DEVELOPMENT

CHAPTER 8: Impacts on Agriculture and Rural Development

Continued expansion of bio-fuel production will increase global demand for agricultural products and result in the creation of new jobs at every stage of the production process, from harvesting, to processing, to distribution. As more countries become producers of bio-fuels, their rural economies will likely benefit as they harness a greater share of their domestic resources (Worldwatch Institute, 2006).

But not everyone will benefit equally. Of all the participants in the bio-fuel economy, agribusinesses are most assured to profit, since mechanized harvesting and production chains are the easiest option for rapidly scaling up bio-fuel production.

Large-scale agricultural processors and distributors will be responsible for supplying most of the refined fuels as well. The development of cellulosic and lignocellulosic conversion technologies will only further exaggerate the advantages of those interests with large pools of financial capital.

One critical point in any future national, or regional, initiative to increase the bio-fuel production in the hemisphere with bio-fuel programs, is to decide to what extent governments want to encourage small farmers or laborers to share in the profits. If this is a priority for our governments, then policy options include well-enforced labor standards and profit-sharing agreements, learned from policies implemented in some of our Member States, particularly in Brazil and in the U.S.A., where farmer cooperatives have been established for ethanol, and now bio-diesel, production. On the processing side, governments can support smaller-scale producers and cooperatives by requiring fuel blenders to purchase fuel from them at fair prices.

The Worldwatch Institute report (2006), suggests that when considering bio-fuel programs for their capacity to promote rural development, decision makers in industrial

countries must remain mindful of just how important agriculture is to the economies of the developing world.

Advocates of rural development in industrialized countries might consider to what extent they also care about development in other countries. Restrictive tariffs can benefit rural communities in industrialized countries while disproportionately harming those in less-wealthy countries.

The international experiences show that the establishment of national agro-energy programs is very challenging, requiring a degree of inter-governmental cooperation and partnership with the private sector and supportive national policies and capacity development to achieve success.

Most of the social and rural development benefits are due to the increased employment and income generation opportunities provided by the production of agro-energy crops, or by products and their conversion in local industries. Higher agricultural production resulting from the production of bio-fuels is a labor-intensive activity in most developing countries, so it increases employment and wages in the rural population. The result is increased disposable income, communities with more money positively impacts on the rural economy.

As the industry develops, there is increased usage of residues from food crops which helps improve the food security of communities. The complimentarity of the production of biomass for fuel and food crop production holds significant promise for improved efficiency and sustainability in the way land is used.

Some indicators of socio-economic sustainability of agro-energy and bio-fuels initiatives are given in the **Table 4**.

Table 4: Selected indicators of sustainability of bio-energy programs

Category	Impact	Quantitative indicators, based on assessment of:
Basic needs	Improved access to basic services	Families with access to energy services (cooking fuel, basic services. pumped water, electric lighting, milling, etc.), quality, reliability, accessibility, cost.
Income generating opportunities	Creation or displacement of jobs, livelihoods	Volume of industry and small-scale enterprise promoted, jobs/$ invested, jobs/ha used, salaries, seasonality, accessibility to local laborers, local recycling of revenue (through wages, local expenditure, taxes), development of markets for local farm and non-farm products.
Gender	Impacts on labor, power, access to resources.	Relative access to outputs of bio-energy project. Decision-making responsibility both within and outside of bio-energy project. Changes to former division of labor. Access to resources relating to bio-energy activities.
Land use competition and land tenure	Changing patterns of land ownership. Altered access to common land resources. Emerging local and macro-economic competition with other land uses.	Recent ownership patterns and trends (e.g., consolidation or distribution of landholdings, privatization, common enclosures, transferal of land rights/tree rights). Price effects on alternate products. Simultaneous land uses (e.g., multipurpose co-production of other outputs such as traditional bio-fuel, fodder, food, artisanal products, etc.).

Source: Binger (2006)

Binger (2006), highlights the fact that an enlightened political leadership seeking to implement sustainable development would realize that many of the obstacles to new initiatives posed by international agreements, for example, on the export of agricultural goods and services, restrictions on incentives for the development of new export industries such as textiles do not apply to agro-energy industries.

First, since there are no international agreements on how nations can provide energy services or the prices at which they provide these services, governments have a lot more latitude in deciding how energy investments occur and what interests are paramount.

Second, the net foreign exchange earning potential of bio-fuels for most countries is significant, which makes the economy more resilient with agro-energy industries than without them.

Third, a number of the international environmental agreements would be addressed through the implementation of bio-fuels production; these would the United Nations Framework Convention on Climate Change (UNFCCC), United Nations Convention on Combating Desertification (UNCCD) and the United Nations Convention for the Conservation of Biological Diversity (UNCCBD).

A number of factors are leading some of our governments to create policies aimed at encouraging the development of renewable energy sources, as alternatives for finite supplies of the oil-based fuels that currently predominate in motor vehicle transportation.

Supportive government policies have been essential to the development of modern bio-fuels over the past three decades. Establishing blending mandates, enacting tax incentives, government purchasing policies, support for bio-fuel compatible infrastructure and technologies, facilitating public-private partnerships and increasing public awareness have been the most successful in fostering bio-fuel production.

If bio-fuels continue their rapid growth in this hemisphere the impact on the agricultural sector will be dramatic. Increased jobs and economic development for rural areas will be possible and desirable if governments put the appropriate policies in place and enforce them. The more involved farmers and farm associations are in the production, processing, and use of bio-fuels, the more likely they are to benefit from them.

In this regard, a bio-fuel industry that is locally oriented - in which farmer-owners produce fuel for their own use, is more likely to guarantee benefits to a rural community.

Enabling farmer (and farm association) ownership over more of the value added chain will improve rural livelihoods. This not only helps improve the well-being of farm families, but it increases the positive effects as greater farm income is circulated in local economies and jobs are created in other sectors. As bio-fuel industries grow, this multiplier effect will have impacts on the regional, national, and international levels.

As highlighted by the Worldwatch Institute report (2006) in regions where access to modern forms of agro-energy is limited or absent, government and development agency support for small-scale bio-fuel production can help provide clean, accessible energy that is vital for rural development and poverty alleviation.

There are some incentives to bio-fuel production, from some of our Member States, as Brazil, for example, that should be better analyzed and shared with other countries, such as:

a. cooperatives and small scale ventures – how governments are providing support for cooperatives and small-scale bio-diesel production facilities—for example through tax structures that give preference to small-scale feedstock and fuel production, or preferential government purchasing from farmer/cooperative owned facilities;

b. purchasing from small producers – legislations that require fuel purchasers and distributors to buy a minimum share from farmer or cooperatively owned facilities;

c. technical and materials assistance – how governments, civil society, and others can provide assistance to small landholders in obtaining materials (energy crops seeds and seedlings), know-how, and market access; and

d. appropriate fiscal policies – how governments can implement policies that allow for local approaches to be developed.

At IICA, we are convinced that government action to assure markets for bio-fuels and for energy crops (e.g. mandates, preferential purchasing, etc.) helps give producers and consumers the confidence to adopt new crops and crop management systems and the new bio-fuel available in the market. In addition to providing markets for their products, ensuring fair prices for farmers is also essential to improving rural livelihoods.

GLOBAL LESSONS LEARNED IN THE PRODUCTION AND USE OF BIO-FUELS

CHAPTER 9: Global lessons learned in the production and use of bio-fuels

There are three countries which implemented policies for bio-fuel development that should be conveniently analyzed to serve as examples of lessons learned in the production and use of bio-fuels. Two (Brazil and United States) are developing their bio-fuel sectors for over 25-30 years and one (Philippines) has just started in 2004.

1. Brazil

Brazil is globally recognized as the leading country in the world in terms of bio-fuels production, particularly ethanol, and it has, over the last few decades, served as an example of the associated cost and benefits of bio-fuels.

1.1. Ethanol

Brazil was an oil importer and the two oil shocks of the 1970s and 80s had an enormous impact on the Brazilian economy. In order to make fuel prices less susceptible to international petroleum price oscillations and reduce petroleum imports, the Federal Government started the "Proalcool" program in 1975, to produce ethanol from sugarcane juice and use it for two different applications:

a. to introduce gasoline blended with ethanol in the market, and;
b. to promote the development of pure ethanol-fueled vehicles.

Now, thirty years later, the Brazilian alcohol program is the world's largest commercial biomass program, and Brazil has a complete mastery over the whole alcohol production and consumption chain. In a similar way to the sugarcane industry, Brazil has reached a high level of technology for establishment, management and utilization of eucalyptus forests. Advanced technologies such as gasification and combined

cycles for electricity and hydrolysis and fermentation for ethanol production have made it possible for Brazil to produce some of the cheapest bio-energy in the world both from sugarcane and eucalyptus.

All gasoline sold in Brazil is blended with 20 to 26 per cent ethanol (anhydrous) on a volume basis and is called gasohol. Ethanol production has increased from around 0.5 billion liters in 1975, to over 16,5 billion liters in 2005, and comprises of 14.8 per cent of transportation fuels (gasoline and diesel), with hydrous ethanol having a market share of 6.3 per cent, and anhydrous ethanol blended with gasoline having 8.5 per cent. Ethanol is used both as an octane enhancer in vehicles, replacing lead and/or Methyl Tertiary-Butyl Ether (MTBE), and as a fuel substitute for gasoline. At current production costs, ethanol is cheaper than gasoline if oil prices are above US$35 per barrel (Binger, 2006).

Currently, the ethanol-fueled vehicle fleet in Brazil is composed of:

a. 15.5 million gasohol-fueled vehicles;
b. 2 million hydrated ethanol-fueled vehicles;
c. 606,000 flex-fuel vehicles; and
d. 3.5 million motorcycles.

Hydrated ethanol vehicles run only on a 95 per cent ethanol – 5 per cent water mix, but cannot run on gasoline alone or gasohol, while gasohol vehicles cannot run on hydrated ethanol. A few years ago, there was a shortage of ethanol that put some vehicle owners in a tight spot.

To increase the range of fuels that a vehicle can run on, Brazilian car manufacturers developed the flex-fuel vehicle (FFV) that can run on ethanol, gasoline or any blend of the two, and launched it in March 2003. FFV vehicles have changed the fuel market by introducing full flexibility for the consumers to decide the fuel they want to buy at the gas station based mainly on the fuel price even though they are aware that ethanol is

better for the environment. Future developments will include a Flex-Fuel Engine that can run on 3 fuels: gasoline, alcohol and natural gas.

According to Binger (2006), in 2004, Brazil produced 350 million tones of cane; the sugarcane agro-industry generated around 700,000 direct jobs and about 3.5 million indirect jobs. The rapid growth of this industry has been characterized by fast transition to commercial energy plantations, lower domestic utilization and improvement in transportation and industry. By 2010, this industry will provide direct employment to 840,000 persons with over 50,000 additional jobs being created every year. The success story of the Brazilian ethanol industry is the result of a long road that began with first experiences with alcohol-fueled automobiles in the country in 1912. By 1925, there were ethanol-fueled vehicles on the roads. The year 1931 saw the beginning of five percent (5%) anhydrous ethanol blends with gasoline and the Brazilian Government made this compulsory in 1938.

In 1966, the blend ratio was increased up to 10 percent on a voluntary basis. However, rapid progress started only after 1975, when the Federal Government launched the Proalcool Program in response to the first oil shock. The first commercial ethanol-fueled vehicle was introduced in 1979. The ethanol blend ratio in gasoline was increased from 15 per cent to 20 per cent also in 1979, and this was raised to 25 per cent in 2003. At present the total ethanol consumption at some 30,000 gas stations is 200,000 barrels per day of equivalent gasoline, and the sugarcane industry is strong enough to operate without governmental subsidies. By building up the capability to produce either ethanol or sugar, the sugarcane mills can produce the best mix of these two products depending on the world market prices.

Brazilian ethanol produced from sugarcane is much more effective in mitigating climate change than ethanol produced from corn as in the US. Each unit of fossil energy used to produce ethanol results in 8.3 units of biomass energy if it is produced from sugarcane, whereas it results in only 1.34 units of biomass energy if it is produced from corn. The ethanol production of over 16 billion liters in 2005 was responsible for

mitigating around 40 million tons of carbon dioxide emissions. Brazilian ethanol's contributions to reducing global warming can be replicated in other tropical countries by using appropriate plants and procedures.

One important lesson that can be learnt from the path-breaking Brazilian ethanol experience is that a properly planned and executed government program for supporting the development of a bio-fuels industry can produce substantial benefits at the local, regional, national and global levels and lead the industry to a state where it can survive without special governmental incentives.

Many aspects of the Brazilian experience could be very relevant to countries going in for ethanol production and usage in the transportation sector.

The main drivers of fuel ethanol production, use and trade have been oil import dependence, switching from oil to ethanol imports, improving local and global environments, developing non-food markets for agriculture, creating jobs along the productive chain, adding value to the rural economy, and fuel ethanol mandates and/or fiscal incentives. Strategic benefits include increasing the energy security by reducing reliance on fossil fuel and diversifying the energy matrix. Social benefits include the recovery of large deforested areas by bio-fuels crops and significant increase in employment opportunities, mainly in rural areas.

Environmental benefits include reduction of atmospheric automotive emissions from alcohol vehicles that have almost zero greenhouse gas emissions, a sustainable production cycle for ethanol from sugarcane by controlling the use of fertilizers in sugarcane fields and replacing it with by-products of industrial production (vinasse and filter cake), and a reduction in the use of pesticides and their environmental impacts by development of disease-resistant species. Environmental legislation in Brazil specifies that it be forbidden to engage in any type of deforestation; consequently, sugarcane plantations have expanded mainly in areas previously used for cattle. Environmental regulations also require the gradual introduction of green cane harvesting to allow the

recovery of sugarcane trash (leaves and the tips of the plant) and significantly increase the biomass available for energy production.

Brazilian experience also shows that vehicle adjustments are not necessary if blends of up to 10 percent ethanol in gasoline are used, but transport and storage tanks need to be cleaned properly. For blends with more than 10 percent ethanol the current vehicle fleet needs modifications or else vehicles manufactured for running on such blends must be used.

1.2. Bio-diesel

The developments in producing bio-diesel and blending it with diesel fuel are only very recent. Even though first experiences began in 1970, high vegetable oil prices prevented further development. In 1980, the first bio-diesel patent in the world was awarded to the Federal University of Ceará. However, it was only as late as 2002 that bio-diesel came into the Government Agenda and a Working Group was formed.

In December 2003, an Inter-Ministerial Executive Committee was constituted and a Management Group was made responsible for program implementation. The Brazilian "ProBio-diesel" Program was finally launched in December 2004, with the academic, industrial and government sectors working together to define the proportions, routes and technologies to be employed.

The basic objectives of the Bio-diesel Program are:

a. to reduce oil dependency,
b. to produce environmental gains, and
c. to introduce family agriculture into the raw material production process.

A Regulatory Framework is being consolidated that will allow blends up to 2 per cent; make a 2 per cent blend compulsory in 2008; increase the blend ratio to 5 per cent by

2013, and give priority to North and Northeast regions for palm and castor cultivation. A 2 per cent blend will require production of 800 million liters of biodiesel per year.

Brazil has also started a new National Program of Incentive to Electric Energy from Alternative Sources called "ProInfa," that will guarantee the purchase of 3,300 MW from small hydro, biomass and wind power plants. A minimum of 60 per cent of national equipment is to be employed in the first phase, and 90 per cent in the second. ProInfa will diversify the Brazilian energy matrix and stimulate the national engineering industries.

2. United States of America

Transportation fuel demand in the U.S.A. is increasing at a rate of 1.5 to 2.3 percent per annum mostly in diesel consumption. In 2004, bio-fuels represented about 3 percent of total current U.S.A. transportation fuel consumption. U.S.A. refineries are operating at or near capacity and the demand for bio-fuels has been increased by environmental protection regulations. For example, air quality regulations have been a major stimulus for ethanol and bio-diesel, alternative-fueled vehicle requirements for government and state motor fleets increase demand and production, and the banning of MTBE has stimulated ethanol demand (Binger, 2006).

Policy and legislation has been widely used by the US government, as instruments to increase the production and usage of bio-fuels. Recent biomass legislation includes the Biomass Research and Development Act of 2000, Farm Security and Rural Investment Act of 2002, American Jobs Creation Act of 2004, and Energy Policy Act of 2005. The Farm Bill funds Grants for bio-based procurement, bio-refinery grants, public education, and hydrogen and fuel cell technology, and new programs to help farmers, ranchers, and rural small businesses purchase renewable energy systems and make energy efficiency improvements. The Jobs Creation Act offers several tax incentives for ethanol producers and blenders, allows tax credit to be passed through to

the farmer/owners of a cooperative, and allows the tax credit to be offset against the alternative minimum tax.

The Energy Policy Act aims to enhance the national security of the US, by providing for the research, development, demonstration, and market mechanisms for widespread deployment and commercialization of bio-based fuels and bio-based products. This Act extends the Renewable Fuel Standard (RFS), until 2012.

The RFS, to be implemented and enforced by the Environmental Protection Agency (EPA), specifies that at least 4 billion gallons of ethanol and bio-diesel must be used in 2006; ramps up about 700 million gallons per year, up to 7.5 billion gallons in 2012; regulations apply to refiners, blenders, and importers, and; cellulosic ethanol qualifies for enhanced credit (1 gallon = 2.5 gallon credit).

The 2005 Transportation Bill provides funding for the National Bio-diesel Board, for bio-diesel testing in new clean diesel engines, and $10 million per year, four years, for five Sun Grant centers.

The Sun Grant Initiative of January 2004, is a concept to solve America's energy needs and revitalize rural communities with land-grant university research, education and extension programs on renewable energy and bio-based, non-food industries. The mission of this initiative is to enhance America's national energy security; promote diversification and environmental sustainability of America's agriculture; promote opportunities for economic diversification in America's rural communities, and; expected to provide significant funding for competitive university-based grants.

2.1. Ethanol

The ethanol industry has been developing in U.S. for the last 25 years, as compared to 30 years for Brazil. Since 1990, the ethanol industry has been the fastest growing industry in rural America, and in 2005, the industry added an estimated of 13,000 jobs

to America's manufacturing sector and was responsible for over 150,000 jobs in all sectors of the economy. It is estimated that it also reduced greenhouse gas emissions by 7.0 million tons, decreased petroleum imports by 143.3 million barrels, decreased the U.S. trade deficit by $5.1 billion, and gave $1.3 billion of tax revenue for the federal government, and $1.2 billion for State and Local governments.

The fuel ethanol capacity in 2004 was 15 billion liters, and the industry opened 12 new state-of-the-art production facilities during the year, increasing its production capacity to 16,2 billion liters in 2005. The potential capacity in 2025 is estimated to be 100 to 110 billion liters that is roughly 15 percent of U.S. fuel demand. Ninety percent (90%) of the ethanol is made from corn. New ethanol capacity will include grain sorghum, straw, so-called "waste" materials, cellulose, municipal solid waste (MSW), etc. There are over three million ethanol flex-fuel vehicles operating in the U.S.A.

An important part of the ethanol program is the federal tax incentive, where petroleum refiners receive a US$0.51 tax credit on each gallon of ethanol blended with gasoline domestic or imported. To ensure that the US taxpayer does not subsidize imports, a secondary tariff of US$0.54 per gallon is levied on ethanol imports. However, unilateral trade preference programs, such as the Caribbean Basin Initiative and the Andean Trade Preference Act, allows duty-free ethanol imports from those countries as long as the ethanol is produced from within their own country. The purpose of this program is to encourage economic development in the Andean and Caribbean region, and thereby help fight poverty and drug trafficking, but to date, these trade agreements and preference programs have not led to significant ethanol imports to the U.S.A.

2.2. Bio-diesel

The bio-diesel industry has been developing in the U.S. since 1991. Bio-diesel production capacity in 2005 was 290.0 million liters. The potential capacity in 2030 is estimated to be 20 to 40 billion liters. Most of the bio-diesel is made from soybean oil.

Other current and emerging feedstocks include recycled vegetable oil (restaurant grease), canola oil, tallow, yellow grease, trap greases, etc.

The American Jobs Creation Act of 2004 included the first bio-diesel tax incentive policy in the US.A. A Federal excise tax credit of about US$0.01 per percentage point of bio-diesel, blended with petroleum diesel, is expected to increase demand from 30 million gallons/yr to more than 124 million gallons/yr. The tax credit is effective for 2005 and 2006, and it is estimated that every 100 million gallons of bio-diesel demand increases soybean prices by about US$0.10 per bushel.

3. Philippines

3.1. Ethanol

Philippines is mentioned in this document as a newcomer that just embraced agro-energy and bio-fuels as alternative transport fuels for a highly dependant oil importer country. It started its Bio-ethanol program in 2004 when the sugar industry created the Ethanol Program Consultative Committee (EPCC) to "supervise the conduct and review of studies pertaining to the viability of ethanol production from sugarcane". However, due to the rapidly rising oil prices that have crossed US$70 per barrel, events started unfolding quite rapidly after that.

Several important events took place in 2004, to move the bio-ethanol initiative forward. Firstly, the Philippine Fuel Ethanol Alliance was created in order to coordinate efforts of the stakeholder industries by way of information sharing and regular dialogues. Secondly, the "Bio-ethanol Bills" were filed in the House of Representatives and the Senate with the aim of promoting the use of ethanol as an alternative transport fuel by establishing a National Fuel Ethanol Program. Thirdly, senior officials from the government, sugar industry and the oil company visited Thailand, to discuss possible cooperation between Thailand and the Philippines in an Association of Southeast Asian Nations (ASEAN) Fuel Ethanol Initiative.

In May 2005, the Philippine's government launched the Philippines's National Bio-ethanol Program during the signing of contracts for the country's first ethanol plant, with a capacity of 25 million liters per year, using 300,000 tons of cane. Construction of the plant began in the first quarter of 2006, and operations will start in the second half of 2007. Construction of a second ethanol plant with a capacity of 38 million liters per year is expected to begin in the second semester of 2006. A website has been created to provide online information dissemination and education on ethanol and the sugar industry.

The government is now formally committed "to pursue a policy towards energy independence consistent with the country's sustainable economic growth that would expand opportunities for livelihood, with due regard to the protection of public health and the environment by mandating the use of bio-ethanol as motor fuel as a measure to mitigate toxic and greenhouse gas (GHG) emissions; to provide indigenous renewable energy sources to reduce dependence on imported fuel oil, and; to increase rural employment and income."

3.2. Bio-diesel

Since 1983, several government and private institutions in the Philippines have conducted research and development experiments on the fuel application of Coconut Methyl Ester (CME). These included technology transfer of CME to Dahitri Plantation in 1991, and evaluation of a claimed "cold process" transesterification technology, at Zamboanga Research Center in 1995. The general objective of these experiments was to establish the viability of CME as a substitute for petroleum diesel fuel. These studies concluded that it is technically viable to substitute petroleum diesel with 100 per cent CME directly fed to diesel transport vehicles, but not economically viable due to high cost of coconut oil.

Standards for pure CME were promulgated and in 2004, the government signed a Presidential Decree directing all Departments, Bureaus, Offices and Instrumentalities of the Government, including Government-owned and controlled Corporations to incorporate the use of one percent, by volume, Coconut Methyl Ester in their diesel requirements.

Also in 2004, the government of Philippines launched the Coco-Biodiesel Program, based on the premises that it was renewable; indigenous, thereby reduces dependence on imported fuel; supports government's poverty alleviation program, and; that it directly affects the lives of about 3.1 million farmers and 25 million Filipinos dependent on the coconut industry. The coconut industry, at its present production levels, can supply enough coconut oil for 10 per cent CME blending.

Another interesting development is a series of tests conducted by the Philippine Coconut Authority (PCA) on the use of filtered coconut oil to substitute diesel without esterifying it to bio-diesel. Initial results in running several PCA vehicles, shallow tube well pumps, and other farm equipment on 100 percent coconut oil for about two months, show that it really works. Coconut oil is cheaper than coco-biodiesel. PCA says that a one-ton mini oil mill, organized by the farmers themselves under various cooperatives, could now manage the production of filtered coconut oil that could supply the fuel requirements of their farms and their community. If this would be realized, PCA said it would have great impact on the lives of the coconut farmers, to the industry and the country.

3.3. The Biofuels Act

Another important development is the approval of the Bio-fuels Act, in 2005, which will mandate the use of biofuels in a phased manner, with a minimum of one percent biofuel mix for all diesel fuel sold in the country, for the first two years. This would be increased to two percent biodiesel in diesel fuel and five percent ethanol in gasoline after two years, and to 10 percent after four years.

The bill also calls for:

a. Zero value-added tax (VAT) on biofuels; regular gasoline at present is subject to a 10-percent VAT;

b. Government financial institutions to provide easier financial assistance to local bio-fuel producers;

c. A wide range of fiscal and non-fiscal incentives including exemption from tariff duties on importation of equipment and machinery to encourage entry of new investors in the bio-fuels sector;

d. Classification of all ethanol production and blending investments as "pioneering" or "preferred areas of investment," which would entitle them to financial incentives;

e. Tariff Commission to create a tariff line for bio-ethanol fuel;

f. Department of Agriculture, through its relevant agencies, to develop a national program for the production of crops for use as feedstock including but not limited to sugarcane, cassava, sweet sorghum and corn to ensure availability of feedstock for production of bio-ethanol for motor fuel;

g. Gradual phasing out of the use of harmful gasoline additives and/or oxygenates to begin within six months, such that within three (3) years from the effect of this Act, such harmful gasoline additives and oxygenates shall have been totally phased out nationwide.

IICA'S STRATEGY TO SERVE AS A PLATFORM FOR HORIZONTAL TECHNICAL COOPERATION ON AGRO-ENERGY AND BIO-FUELS

CHAPTER 10: IICA's Strategy to serve as a Platform for Horizontal Technical Cooperation on Agro-energy and Bio-fuel

At the last meeting of the Executive Committee, held in Brazil, in 2005, the government of that country took the initiative of presenting the Brazilian experience in this field, and offered to cooperate with other countries in the region interested in developing their agro-energy sector, which was well-received by the IICA member countries present at the meeting.

Agriculture has been an important economic alternative in helping countries to overcome the burden of increased oil prices. However, the advantages of using agriculture to generate alternative sources of energy go beyond the economic benefits.

The production of agro-energy also contributes to creating jobs and reducing rural poverty, as well as protecting the environment from pollution caused by the use of gasoline and diesel.

These potential advantages have been recognized by the Ministers of Agriculture of the Americas, who have asked IICA to assume a leadership role, serving as a platform for the dissemination of experiences in the production of bio-fuels for the rest of the hemisphere.

At IICA, in response to the request from the Member States and taking into account the projections made by several international and national entities, we are focusing our future agro-energy and bio-fuels initiative on addressing, among other issues, the following:

a. agro-energy as a feasible alternative for reducing the hemisphere's dependence on fossil fuels;

b. the technical potential of agro-energy and bio-fuels;
c. the new technologies under development;
d. the time likely to transpire before they will be available in sufficient volume to enter the market on a commercial scale; and,
e. environmental concerns.

IICA's aim is to contribute to the discussions on the subject and compile strategic information which will allow decision makers to address one fundamental question:

- Are there technical possibilities within reach that would enable us to meet expected demand for agro-energy and bio-fuels in more reliable, constant, secure and less polluting ways?

In assessing the prospects for new technologies, it is important to have a clear understanding of the strong competitive edge traditional fossil fuels still have in the marketplace. Their current abundance and affordability, and most importantly, the sheer scale of the investments made in them over several generations, make an easy move away from them hard to envisage and, to some extent, unrealistic.

Therefore, there are some expectations regarding the use of agro-energy and bio-fuels as a full replacement to the fossil fuels, which may not be realistic.

1. Objectives

The proposed strategy has the following objectives:

a. to create a platform for the dissemination of knowledge, information and experiences in agro-energy and bio-fuel production;
b. to create a specialized forum for discussions on agro-energy and bio-fuels where countries' concerns can be openly analyzed and discussed;

c. to facilitate horizontal technical cooperation between and among the member countries, helping them to better understand the complexities of the production of agro-energy and bio-fuels.

The main priority of the proposed strategy is to guide IICA in its efforts to help its member countries establish agro-energy programs toward the development of bio-fuels industries to meet national energy needs, by modernizing and diversifying the agricultural sector to promote rural development and increase global economic competitiveness.

The proposed strategy focuses on the identification and consolidation of a set of complementary activities that take advantage of IICA's current capacity and its experience in agriculture and rural development, while taking its limitations into consideration. The strategy includes a number of actions to support the development of bio-fuels industries across the hemisphere, particularly in the sugarcane and oilseed crops producing countries.

Core elements of the strategy identified that would lead to the establishment of a successful and sustainable platform on agro-energy and bio-fuels include:

a. Promoting agro-energy as an economically viable source of energy to produce liquid fuels and power;
b. Build the sustainability of IICA to support agro-energy entrepreneurial activities that lead to sustainable livelihoods and a healthy environment; and
c. Build IICA's institutional capacity to accomplish its mission.

The strategy intends to position IICA as the leading strategic institution on horizontal technical cooperation on agro-energy in the hemisphere, to help countries to strengthen linkages between the agriculture and energy sectors, and to increase opportunities for agro-energy in the hemisphere in an economical, social and environmental sustainable manner.

The proposed strategy also intends to support countries with comprehensive information to assist with the planning and development of their agro-energy sector by providing knowledge and information on the development of emerging technologies, practices and business opportunities in the agro-energy industry. Staging annual hemispheric and regional conferences would be an ideal way to exchange new ideas, analyze strategies, or for agriculture and energy professionals and stakeholders to meet and exchange ideas and experiences. In addition, it also intends to facilitate forums for stakeholders and civil society to dialogue in order to provide scientifically sound and politically unbiased analyses and conclusions needed for strategic decisions related to the identification of capacity that is required for planning and implementation of agro-energy policies.

IICA believes that citizen participation is an important element for a successful national agro-energy program. Involving citizens in the development and implementation of such a strategy helps them understand how the strategy would benefit them as individuals and the communities they live in. It also encourages input of citizen ideas and increases public confidence and support in the strategy.

Similarly, IICA is aware that education can play a key role. Educating consumers about the benefits of bio-fuels industries can help them make wise energy choices and to contribute to the effort as a whole. The public education and awareness efforts are required to help educate key public officials and the general public about bio-fuels. Public education and awareness to support building regional and national coalitions that would form the nuclei of national support groups that would promote and eventually lead to local bio-fuels production and use would also be needed to help the population understand and appreciate how the development of national bio-fuels industry can help meet the basic developmental needs of the country.

The core of the IICA strategy is to facilitate the member countries to establish modalities and institutional capacity to sustain and support agro-energy entrepreneurial

activities that lead to sustainable livelihoods and a healthy environment particularly for rural populations. Development of small and medium-size bio-fuels enterprises provides an excellent opportunity for generating employment and revitalizing rural economies, as well as improving diffusion of technologies.

However, to ensure that IICA accomplishes its mission towards the development of a platform for horizontal technical cooperation on agro-energy and bio-fuels, the Institute must undertake institutional strengthening through modalities such as the development of cooperation agreements with other technical institutions/organization, adding professional skills in agro-energy planning and policy, and partnerships with national and international organization to improve information support capabilities that would be needed to plan and implement the proposed hemispheric platform.

1.1. Priorities

Priority 1: Promote agro-energy as an economically viable source of energy

IICA believes that agro-energy and bio-fuels are alternatives to be seriously analyzed because of its multiple socio-economic and environmental benefits. The development of a bio-fuels industry in countries with feedstock production comparable to energy demand will make a significant contribution to the developmental needs of the population. Substituting imported fossil fuels for locally produced bio-fuels would channel cash back into the rural economy benefiting agricultural workers. Increased income generation opportunities would be provided at all stages of bio-fuel production from feedstock production and transportation and plant operation.

Marginal and degraded lands could become viable producers of feedstock, either as a primary or secondary crop. Farmers would have land use options as to which crops are better for the economy of the households.

Priority 2: Build the sustainability of IICA to support governmental and entrepreneurial agro-energy activities that lead to sustainable livelihoods and a healthy environment

IICA will need to ensure that it has the institutional capacity to sustain and support governmental and entrepreneurial agro-energy and bio-fuels activities that lead to sustainable livelihoods and a healthy environment particularly for rural populations. The approach to institutional capacity building would be through direct strengthening and through partnerships with regional and international organizations and institutions that would provide the range of professional expertise needed to support development of entrepreneurs in bio-fuels production and use. Development of small and medium size liquid and solid bio-fuels enterprises provides an excellent opportunity for generating employment and revitalizing rural economies, as well as a mechanism for improving diffusion of technologies.

Development of joint initiatives (IICA – Member States) to sensitize small and medium scale bio-fuels enterprises would involve the provision of training to existing and prospective entrepreneurs in starting and managing business activities relating to conversion of feedstock in energy services, and supply and maintenance services and interfacing with research and development institutions engaged in biomass technology development, to provide ready access to relevant technological information.

Priority 3: Strengthening IICA's organizational capacity to accomplish its mission – The Role of IICA

As highlighted in Chapter 2, item 2.2, in recent times, IICA has undertaken some important institutional transformations focused on strengthening the capabilities for formulating strategies and policies for agriculture and rural life, modernizing agricultural markets, promoting market access, developing institutional frameworks for technological innovation, implementing joint activities to eradicate pests and diseases,

overhauling agricultural education, disseminating information and knowledge for agricultural and rural management and addressing emerging issues.

There are four key categories of functional support that can be provided by IICA: support for development of policy and legal framework; capacity building, promoting investments; and catalyzing countries and regions research, development and demonstration programs as effective means of advocacy.

Priority 4: IICA recognized as the leading hemispheric strategic institution to provide horizontal technical cooperation on agro-energy and bio-fuels

IICA attaches special importance to information, communication and the projection of its institutional image, in order to position itself as an international development agency that is recognized and respected as a strategic partner, one that is capable of making a key contribution to the development of agriculture and the rural milieu in the Americas.

In this regard, the strategy is intended to make IICA the preeminent hemispheric institution assisting countries with the development of the agro-energy and bio-fuels industries to address energy needs of the member countries, and contribute to societal progress, especially in rural areas.

1.2. GOALS

Goal 1: Help member countries to strengthen linkages between agriculture and energy sectors in order to increase opportunities for agro-energy at national and regional levels

Based on the global experience, development of successful bio-fuels industries need supportive energy, agricultural, and environment policies that view each barrel of oil imported for land transportation or electricity generation as a loss of potential income to farmers.

IICA would work together with the member countries to build capacity to formulate, analyze, and implement agro-energy policies by providing the countries with the basic analysis tools on the functional characteristics and performances of bio-fuels industries, the estimated level of demand for bio-fuels infrastructures and services, and the way supply and demand reciprocally influence each other. IICA would provide examples of efforts to implement bio-fuels industries taken from the experiences and activities in the USA, Brazil, and other bio-fuel producing countries. These examples should provide guidance, stimulate ideas, and generate new contacts from around the world on:

a. **Formulation and Implementation of Bio-fuels Policy** – by providing tools for designing and developing the processes necessary for bio-fuels policy formulation and implementation.

b. **Guide for Policy Makers** – that provides the rationale for investing in bio-fuels industries and presents guiding principles for bio-fuels industries policies, various policy options, and elements of bio-fuels industries and gender-sensitive development policies.

c. **Advocating for Bio-fuels Industries** – Tools to help countries advocate for a bio-fuels industry, including steps in organizing campaigns and information on developing, implementing, and evaluating a successful public education and advocacy strategy.

Goal 2: National and Regional Consultations on the potential of agro-energy and bio-fuels

IICA is drafting a strategy to counter the challenge of increasing energy prices, and it would include a conscious shift to promote public-private participation in bio-fuels industries.

In order to implement an agro-energy policy that is inclusive and encourages adoption by stakeholders, there is an urgent need to consult and promote a dialogue to foster greater understanding of the issues surrounding the production and use of bio-fuels and its implications for the lives of the rural population. The purpose of the proposed national consultations is to stimulate discussions among public and private sector, civil society representatives and decision makers on the potential of the development of the agro-energy and bio-fuels industries.

Implementation would be through the establishment of regional Steering Committee (one for each of IICA's regions) consisting of representatives from the public sector, or partner institutions, and vested interest stakeholders like the agribusiness sector representatives, to oversee the planning of the consultations and implementation of the meeting and drafting of a Technical Report, showing the national bio-fuels production potential and the stakeholders position on the potential of a national bio-fuels production.

Goal 3: Help member countries to prioritize initiatives for the development of emerging technologies, practices and business opportunities in the agro-energy sector

The causes of the prolonged period of high oil and gas prices and uncertain level of proven oil and gas reserves are now resulting in energy forecasters making predictions for crude oil prices to exceed US$100 per barrel, in the not too distant future, and to stay above a ceiling of US$50 per barrel.

As already presented in this document, international experiences with bio-fuels shows that the financial return to farmers from bio-fuel feedstock varies with oil prices, however, at an oil price of US$50 per barrel or above, bio-fuels production is economically viable in a number of cases. Using public policy, government can create the enabling environment that provides the climate for development of bio-fuels, which generated a number of economic opportunities at the national and local levels.

Government roles, as discussed previously, would be critical, but so too would be the role of the private sector, and farmers who would have to be the main feedstock producers and converters of feedstock into bio-fuels.

According to Binger (2006), the conventional energy sector has evolved the concept of energy service companies (ESCOS). These companies are usually small in nature and provide energy saving services. ESCOS therefore provides the business model of how an organization would proceed in the development of small- and medium-size private companies that would be needed to provide the different technical and management capacity required for sustainable production and use of bio-fuels. ESCOS in countries such as Jamaica, St, Lucia, and Barbados now provide a range of energy services ranging from access to technology, energy planning, energy audits, and financing.

Success in catalyzing the establishment of National Bio-fuels Program by national governments would be a prerequisite for development of the private sectors.

IICA's suggestions for the development of emerging technologies, practices and business opportunities in the agro-energy sector have its foundation in:

a. Helping member countries to establish a sustainable environment at the national policy level for agro-energy. IICA would establish partnerships through its network of national offices with a number of key stakeholders of the agriculture, energy, environmental groups responsible for biodiversity, and financial institutions. The enabling environment would be characterized by appropriate policies and commitment to capacity building development; and

b. Helping member countries to promote national agro-energy and bio-fuels production as a viable economic activity with multiple benefits for those countries whose size and existing agricultural capacity is of such a nature that they have proven capacity for sustained production. As part of this advocacy, IICA would

seek partners for annual media events to highlight research findings and successful activities and to recognize through awards, exceptional achievements. Possibilities include annual agricultural shows, and festivals.

Goal 4: Introduce Annual Hemispheric and Regional Agro-Energy Conferences

The bio-fuels production potential and interest of the various member countries shows that based on the existing agricultural sector, the majority of countries have significant production capacity based on feedstock available relative to national energy demand; the majority of these countries therefore have the potential to substantially reduce the amount of fuels imported.

Annual conferences are an ideal way to exchange new ideas, analyze strategies, or simply meet other agriculture and energy professionals and stakeholders within the hemisphere. As a result, the proposed conferences will be designed to provide agro-energy individuals with an opportunity to acquire area-specific and general agro-energy information and to increase their knowledge of available resources.

The Conferences are also intended to both promote and demonstrate IICA's agro-energy strategy and offer an ideal opportunity for:

a. Education - informative sessions on agro-energy programs, agro-energy resources, and topics of general interest;
b. Networking - a social environment whereby participants can meet other stakeholders in the region to exchange experiences and ideas;
c. Community involvement - participation from all levels of agro-energy, especially grassroots stakeholders and farmers; and
d. Information dissemination – to ensure that dialogue and decisions are made with current knowledge.

Conferences would be organized in different countries with coordination from IICA's network of national offices and in partnership with private sector organizations, development partners, government agencies, media organizations, financial institutions, and environmental groups.

Goal 5: Introduce Public Awareness & Education Initiative

The proposed Public Awareness and Education Initiative would be based on the economic challenges facing the countries, posed by increasing costly liquid petroleum fuels, the problems arising from the decline of the agricultural sector, and the growing threat posed by global climate change which require adaptation measures in order to reduce vulnerability.

The public awareness and education initiative would focus on promoting agro-energy as a source of energy for sustainable development of the hemisphere, and the pros and cons of agro-energy compared to continued dependence on fossil fuels. Citizen participation is an important element in the establishment and development of a successful agro-energy strategy. Involving citizens in the development and implementation of such a strategy helps them understand how the strategy would benefit them as individuals and the communities they live in. It encourages inputs of citizen ideas and increases public confidence and support in the strategy. Educating consumers about the benefits of national bio-fuels production, and how such industries help communities and the country to sustainable development.

IICA's public education and awareness initiative would educate public officials and the general public about bio-fuels, and would provide the context for building regional and national coalitions. These coalitions would constitute the nuclei of national and regional advocacy capacity that would promote and provide leadership for bio-fuels production and use. National programs will be developed in partnership with the private sector, farmers associations; government agencies responsible for public information and education; local media, tertiary educational institutions; and with sponsorship from

development partners, international funding agencies and local financial institutions. Actions will be implemented in cooperation with national governments as part of national sustainable development strategies where possible.

1.3. Methodology

The first phase in building a hemispheric platform for horizontal technical cooperation will consist of an assessment of the technical, social and economic aspects of agro-energy and bio-fuels of each of the member countries.

The assessment will be based on the following information:

a. country experiences – developed and developing - on lessons learned in developing and implementing bio-fuels programs;

b. assessment of Latin America and the Caribbean countries agro-energy and bio-fuels production potential;

c. assessment of the needs and priorities of the countries for meeting energy for sustainable development objectives;

d. discussions and consultations with experienced professionals in Brazil, USA, Canada and other global players to complete the information generated from the desk reviews and country studies; and;

e. review of national and international reports, particularly in sustainable development, energy, environment, and agriculture.

1.4. Lines of action

The strategy is based on the following main lines of actions:

a) **Technology and knowledge transfer,** encouraging member countries to share their knowledge and technologies and promoting horizontal technical cooperation and the sustainable use of bio-fuels. Brazil has accumulated a wealth of experience that will prove valuable for countries developing new bio-fuel programs. As other countries develop expertise in cultivating new crops and utilizing new technologies for converting these into fuels, they can expedite both the displacement of petroleum and global economic development by sharing their knowledge;

b) **Training and capacity building**, promoting and implementing, together with the member countries, training and capacity building programs related to the agro-energy and bio-fuel production;

c) **Support the member countries in the development of the agro-energy sector,** stimulating them to further develop their agricultural sector, making agro-energy production one priority in their national policies. These initiatives would have national and regional scope and would focus on increasing countries' capacity building, and the efficiency and productivity of traditional and non-traditional sources of bio-fuels; and,

d) **Adherence to environmental policies,** ensuring that agro-energy programs will be compatible with local and regional environmental policies and in harmony with the Clean Development Mechanism, of the Kyoto Protocol.

1.5. Funding the Strategy and Estimated Budget

According to Binger (2006), the principal strategy for financing the investments to develop national bio-fuels industries in countries where such industries are considered viable is to redirect government investments in the energy and agriculture sectors in

order to catalyze the development of viable industries. However, prior to that, an enabling environment has to exist and which would be characterized by government leadership and policies to support production and market in bio-fuels.

The rationale for advocating greater investment in agro-energy is that this approach builds the economic resilience of countries during a period where the international energy supply outlook forecasts continued high and rising costs of petroleum fuels in the future. In addition, it represents a potentially sustainable source of employment for workers with limited skills, with the activities outlined previously intended to help create awareness and understanding among the national stakeholders in sustainable development.

The degree of success in the development of any regional initiative is dependent on having a resource mobilization strategy that delivers the needed funding to support implementation. This proposal lays out the basic requirements for the development of this strategy by identifying potential sources of funding and providing estimates of core costs.

As stated earlier, agro-energy is expected to be a commercial enterprise and, as such, significant portions of the funding for implementation of production related activities are expected to come from private sources as debt or equity. Investments will also be coming from the public sector and may primarily be in-kind such as land, equipment, physical facilities, or debt guarantors. The resource mobilization strategy will therefore primarily focus on core costs and program activities, such as funding for consultations, support for the information and technical assistance, annual and bi-annual events, etc.

1.5.1. Potential Funding Sources

One potential funding source is the UNDP's development instrument, the Energy and Environment Thematic Trust Fund (TTF) that will operate at three levels: Country, Regional and Global. The TTF will focus on low-income countries, the Least

Developed Countries (LDCs) and the Africa region, while a small proportion of the resources will be used to fund global and regional initiatives. The funding target for the Energy and Environment TTF is US$100 million over a period of 4 years — or about US$25 million per year.

The four priority areas in energy for UNDP are:

a. Strengthening national policy frameworks to support energy for poverty reduction and sustainable development;

b. Promoting rural energy services to support growth and equity;

c. Promoting clean energy technologies for sustainable development; and

d. Increasing access to investment financing for sustainable energy.

Opportunities for stimulating private sector development could also be enhanced through partnership with the IDB, under its $1.2 billion Multilateral Investment Fund (MIF), which supports innovative private sector development. The MIF provides grants and investment mechanisms and is a major source of technical assistance grants for micro and small business development.

Another possible funding source is under the European Union Bio-fuels Strategy. The EU is supporting bio-fuels with the objectives of reducing greenhouse gas emissions, boosting the decarbonisation of transport fuels, diversifying fuel supply sources and developing long-term replacements for fossil oil. One of the three aims of the EU Bio-fuels Strategy is to explore the opportunities for developing countries – including those affected by the reform of the EU sugar regime – for the production of feedstock and bio-fuels, and to set out the role the EU could play in supporting the development of sustainable bio-fuel production.

For the Caribbean countries, the proposal by the European Commission for accompanying measures for Sugar Protocol countries affected by the EU sugar reform is an important cooperation initiative. The accompanying measures will support restructuring or diversification in the affected countries, on the basis of their strategies to face the consequences of the reform. Within this framework, the EU could support the development of the ethanol production and possibly electricity generation sector, based on thorough country-specific studies. Resources are also potentially available from bilateral sources such as the Italians under the G-8 Italy Global Bio-energy Partnership (Binger, 2006).

1.1.1. Estimated Program Budget

As already stressed in this document, the proposed strategy under development intends to position IICA as the leading strategic institution on horizontal technical cooperation on agro-energy in the hemisphere which would be capable of helping countries to strengthen linkages between the agriculture and energy sectors, and to increase opportunities for agro-energy in the hemisphere in an economical, social and environmental sustainable manner.

As such, two fundamental aspects are discussed in this item:

a. a basic budget that will allow IICA to start building the proposed platform; and
b. an extended budget that will allow countries and regions to develop their own programs and actions, based on external resources provided by the member countries and funding agencies, as highlighted in item 1.5 of this Chapter.

Table 5, shows the basic budget required to develop the strategy which is estimated at approximately US$ 250,000 per-annum, over a four-year period.

Table 5: Estimated Basic Budget

ITEM	2007	2008	2009	2010	Total
Program Coordinator	$ 100,000	$ 100,000	$ 100,000	$ 100,000	**$ 400,000**
Administrative Assistant	$ 20,000	$ 20,000	$ 20,000	$ 20,000	**$ 80,000**
Agro-energy Conferences	$ 60,000	$ 60,000	$ 60,000	$ 60,000	**$ 240,000**
Public awareness and publications	$ 30,000	$ 30,000	$ 30,000	$ 30,000	**$ 20,000**
Travels	$ 20,000	$ 20,000	$ 20,000	$ 20,000	**$ 80,000**
ESTIMATED TOTAL	**$ 250,000**	**$ 250,000**	**$ 250,000**	**$ 250,000**	**$ 1,000,000**

As presented, IICA's role would be more in a capacity development and support role – providing information, facilitating exchange of experience and expertise, and technology transfer. In countries where there are no activities focused on the production of energy by the agricultural sector, then IICA's role would have to also include sensitization, demonstration, and public education.

Table 6, shows the extended budget required to develop the full strategy, at national and regional levels, which is estimated at approximately US$ 195,000 per-annum, per region, over a four-year period. The total extended budget is estimated at US$ 975,000, per-annum.

Table 6: Estimated Extended Budget

ITEM	2007	2008	2009	2010	Total
Regional Specialists (5)	$ 450,000	$ 450,000	$ 450,000	$ 450,000	**$ 1,800,000**
Technical Assistants (5)	$ 125,000	$ 125,000	$ 125,000	$ 125,000	**$ 500,000**
Regional Agro-energy Seminars (5)	$ 125,000	$ 125,000	$ 125,000	$ 125,000	**$ 500,000**
Public awareness and publications	$ 100,000	$ 100,000	$ 100,000	$ 100,000	**$ 400,000**
Travels	$ 75,000	$ 75,000	$ 75,000	$ 75,000	**$ 300,000**
Other operational expenses	$ 100,000	$ 100,000	$ 100,000	$ 100,000	**$ 400,000**
ESTIMATED TOTAL	**$ 975,000**	**$ 975,000**	**$ 975,000**	**$ 975,000**	**$ 3,900,000**

Member countries are invited to evaluate the importance of this initiative and help IICA to fully finance this platform for horizontal technical cooperation on agro-energy and bio-fuels.

Table 7, shows the total budget required to develop the full strategy, at national, regional and hemispheric levels, which is estimated at approximately US$ 1,225,000 per-annum, over a four-year period. The total budget for the four years period is estimated at US$ 4,900,000.

Table 7: Estimated Total Budget

ITEM	2007	2008	2009	2010	Total
Basic budget	$ 250,000	$ 250,000	$ 250,000	$ 250,000	**$ 1,000,000**
Extended budget	$ 975,000	$ 975,000	$ 975,000	$ 975,000	**$ 3,900,000**
ESTIMATED TOTAL	**$ 1,225,000**	**$ 1,225,000**	**$ 1,225,000**	**$ 1,225,000**	**$ 4,900,000**

It is anticipated that with the full implementation of the proposed strategy and the establishment and development of bio-fuels industries and subsequent verification of its many advantages and associated benefits, that governments will increase their investments in the sector.

NEXT STEPS

NEXT STEPS

CHAPTER 11: Next Steps

The potential contribution of the agro-energy and bio-fuels to the hemisphere's sustainable development goal is based on potential benefits that are very substantial as shown; however there are significant challenges. The multiplicity of the challenges lies in the characteristics of the agro-energy and bio-fuels production and use.

The proposed next steps are the following:

a. to undertake a landscaping exercise at the country level to gather baseline information on the following:

- ongoing national strategies to address the changes in the agricultural sector;
- land resources previously allocated to the production of export crops that could potentially be used as bio-fuels raw material production;
- land resources that are suffering environmental degradation as a result of current uses that have potential for bio-fuels raw material production;
- land resources that are currently underutilized for agricultural purposes that potentially could be used for bio-fuels;
- water resources availability and future demand and supply options;
- approaches to waste management;
- strategies to address the increasing cost of petroleum imports and its impact on economic growth;
- electricity supply plans for meeting future demand as well as replacement of existing capacity;
- existing energy policies, pricing regime for fuels, and energy tariffs structures;
- existing agricultural and industrial and financial markets polices and incentives; and

- priority environmental and social issues in the country and the sustainable development strategies.

This exercise will provide valuable information from which IICA and member countries will be able to identify agro-energy industries that are best suited in the national context.

b. to create regional working groups, comprising national experts selected by the member countries, to conceptualize, discuss, propose and approve regional policies in support of agro-energy development;

c. to assess ongoing regional initiatives in agricultural diversification, renewable energy development and energy efficiency improvements, mitigation and adaptation to climate change, and energy resources development. This exercise will help IICA map the activities and identify where there is potential for collaboration in developing bio-fuels industries as part of ongoing or planned initiatives.

d. to identify regional investment sources and mechanisms that are now supporting agriculture and energy projects. As discussed, investment is a major constraint of on the agricultural sector; it is therefore necessary to both document sources as well as the experience of these investors, as a perquisite to the planning of activities. Unlike agriculture there has been encouraging signs for renewable energy investment.

e. to dialogue with national and regional institutions working on aspects of sustainable development to determine potential synergy between those goals and bio-fuels production. There are already a large number of regional projects being implemented with funding from the Global Environmental Facility (GEF) focused on helping the region to address barriers and or threats to sustainable development.

f. to engage in the widest possible private sector dialogue with the following potential stakeholders: producers, transporters, equipment suppliers, technical service providers, financing sources ranging from commercial banks, cooperative credit union, retirement funds, building societies, to get the private sector interested. This will be critical to the establishment and growth of national bio-fuels Programs.

g. to hold regional seminars and workshops, such as the one recently held in Sao Paulo, Brazil, to discuss, at the highest technical levels, alternatives for developing the agro-energy and bio-fuels sectors, at the regional and country levels; and,

h. to develop a network of specialists in agro-energy and bio-fuels to share information and knowledge, thus creating a critical mass that can help countries to develop their agro-energy and bio-fuel sectors.

REQUIREMENTS AND RECOMMENDATIONS FOR BUILDING A HORIZONTAL TECHNICAL COOPERATION PLATFORM ON AGRO-ENERGY AND BIO-FUELS IN THE HEMISPHERE

REQUIREMENTS AND RECOMMENDATIONS FOR BUILDING A HORIZONTAL TECHNICAL COOPERATION PLATFORM ON AGRO-ENERGY AND BIO-FUELS IN THE HEMISPHERE

CHAPTER 12: Requirements and Recommendations for Building a Horizontal Technical Cooperation Platform on Agro-energy and Bio-fuels in the Hemisphere

There are three main challenges to the development of agro-energy industry for the production of bio-fuels to replace imported petroleum fuel in the region. They are: the development of the institutional relationships between public, private and civil society; ownership at the national and local levels; the production of raw material and its effective transportation; capacity; supportive policies and legislation, and; decision making process.

Developing bio-fuels industries in the countries will require a more synergistic working relationship between a number of institutions in the public and private sectors. Public sector institutions will have to work in an integrated manner to drive the development of the local market for bio-fuels and in so doing address the growing economic vulnerability of the economy to agricultural commodity and petroleum price increases.

Private sector participation will be critical in all areas but especially in transportation fuel production and distribution. Several Government Ministries and Departments will have to work closely to address the diverse nature of the bio-fuels production and usage process including those dealing with lands and agriculture, energy, finance, transportation, industries, power and petroleum, environment and water.

Inter-sectoral policies that create linkages between the energy sector and those that impact upon the production are necessary and will prove quite challenging in light of prevailing vested interests. Effective working relationships will be required between these entities to ensure that the land resources be made available and use monitored. Significant production of bio-fuels would likely impact on government revenues, if no corresponding tariffs are placed on locally produced bio-fuels.

The finance portfolio must, therefore, be fully onboard in order to have smooth implementation. In the majority of cases, the roles required by the institutional shareholders in the development of national bio-fuels industries are significantly different from normal business. The reduction in revenue should be more than compensated for by the increased money in circulation and available for taxation.

From the initial stages of the development of a bio-fuels industry, it is important to involve the stakeholders in the process. A sense of ownership gives the initiative greater chances of success. The local rural population has to be involved in the planning and implementation so that stakeholder feedback is incorporated into project deign from the beginning. It is also necessary that local stakeholders derive maximum benefits from the project. Involving women in village-level bio-fuels projects are more likely to benefit them.

Wide public dialogue, demonstration for education and outreach are important to achieve wide possible public understanding about the cost and benefits of bio-fuels. Tough financial issues such as pricing for raw material and percentages of profits shared among the direct production by stakeholders (land owners, workers, and transport and factory operators) needs to be addressed through participatory processes. National ownership will help make the political environment more conducive to the effective use of appropriate lands for bio-fuels production. National dialogue will also provide baseline information to help in the formulation of policies on land use for bio-fuels production, the kinds of incentives and disincentives that will be necessary to ensure that land use is sustainable and there is maximum use of suitable land for bio-fuels production.

Key requirements for sustainable and reliable production of raw material are technology, research and development coupled to good extension, financial benefits linked to a secure market, and adequate land resources. Labor issues and transportation management are key challenges that will have to be addressed through

public dialogue. Incentives to encourage good worker attitude and productivity need to be devised to ensure adequate supply of raw material to the bio-fuels industry. Bio-fuels production requires significant transportation of raw material to the production facilities and economic and reliable transportation systems.

The development of natural resources based industries requires supportive policy and effective legal framework to drive the process and to provide comfort to the private sector. Bio-fuels industries need supportive energy, agricultural, and environment policies that view each barrel of oil imported for land transportation or electricity generation as a loss of income to farmers. The energy policy should support, as first priority, maximum energy from bio-fuels in the transportation, electricity generation and domestic sectors. Private sector participation in electricity generation will require policies to promote power purchase agreements between the utilities and the producers of biomass based power.

National investment policies should be formulated to encourage industry workers to be shareholders. Policy and legislation actions will be necessary to establish raw material prices, linked to certified land use to ensure environmental sustainability. Land utilization policies should give priority to identifying lands that are suitable for sustainable bio-fuels production. Where such lands are not in managed production, they should be made available to interested private sector parties with an interest in production of raw materials or bio-fuels. Agricultural research policy should give priority focus to building capacities in crop varieties with a high biomass yield such as “energy cane”, higher copra producing coconut varieties, fast growing trees and grasses, etc.

The increasing interest in the trade of carbon emissions represents one potential mechanism where farmers may be able to get additional financial benefits from bio-fuels production. This could serve as a first step to farmers getting financial rewards for sound land use. Such rewards would provide additional incentive to get farmers on very fragile lands who now tend to grow short-term cash crop, to produce bio-fuels feedstock.

The key requirements for bio-fuels production begins with clear, identifiable and quantifiable markets; the availability of land resources which would not bring about competition with domestic food production; appropriate weather and climate regime; proven experience with the production of the crop(s) by local farmers; conversion and end use, at least at commercial demonstration scale; commitment on the part of government to enact and enforce requisite policies and associated laws to ensure that the market is developed for bio-fuels.

For some of our member States that are just beginning to develop bio-fuel industries, such as Jamaica, Nicaragua, Costa Rica and Argentina, for example, many decisions will have to be made, including the type, scale, and orientation (i.e. for domestic consumption, for export, or both) of production. Policies will need to be designed appropriately based on domestic economic and resource situations, and with the rapid pace of bio-fuels development, they will need to be put in place soon.

Our decision makers will also need to consider the impacts that the policies of other nations and international trade policies (e.g. continuing trade liberalization negotiations) will have on their own bio-fuel and bio-fuel feedstock markets.

As highlighted by the Worldwatch Institute report (2006), integrated planning is necessary at the national level so that short-term or sectoral interests do not take precedence over strategic national priorities. For instance, market incentives at the microeconomic level might encourage bio-fuel exports. But when other factors, such as domestic energy and security needs, trade balance, food security and land use concerns, are taken into consideration, exports might not make sense at that point in time. In some of our nations where displacing a modest amount of petroleum could make a significant difference, production for domestic use should take precedence over export.

Efforts to commercialize new energy crops will require particular attention from our governments, many of which already possess national agricultural policies that have a significant impact on the choice of which crops to grow. Government policies can help assure that particular crops are grown on lands that are appropriate for them.

Some of IICA Member States, particularly some Caribbean countries, which depend on imports for both food and crude oil, must determine to what extent increased domestic bio-fuel production can replace imported oil – and to what degree this would drive land and other resources from food production. In the longer run, advanced bio-fuels may reduce the competition between bio-fuel and food production, but this may require substantial investments and know-how.

The current literature correctly stresses the fact that, in many cases, countries that intend to produce ethanol or bio-diesel will likely require foreign aid to do so, either in the form of capital and foreign investment, or in terms of know-how and training.

Governments and international financial institutions can play a critical role in providing financing and taking other actions to help reduce financial risks, in order to help the industry move quickly through early commercialization barriers for these technologies.

To what extent individual countries in LAC will eventually move forward in bio-fuel production remains largely unclear at this stage, even though substantial quantities of ethanol and bio-diesel are already being produced in Brazil, United States and Canada, for example.

Clearly, the answers to these concerns will differ from country to country because conditions in each are unique. Resource constraints need to be considered, not only in terms of agricultural land, but also in terms of government incentives and policies, availability of labor and capital, and environment and climate conditions, to mention only a few.

Strengthening the markets, speeding-up the transition to next generation technologies, protecting the resource base, facilitating sustainable international bio-fuel trade and providing equal distribution of benefits, among farmers, agribusiness entrepreneurs, governments and the like, are essential for accelerating the sustainable development of the agro-energy and bio-fuel sectors.

Assuming that policies will not change, higher crude oil prices will further foster bio-fuels production. The extent to which bio-fuel volumes will increase depends heavily on still unknown parameters.

Lastly, we strongly suggest the further development of this IICA initiative, and urge all member countries interested in the agro-energy and bio-fuels sectors to collaborate in the continuation of this priority action.

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