PROJECT OVERVIEW

Mainstreaming food security concerns into assessments of bioenergy potential through targeted analysis and field activities that support rural development

Project Summary

This three-year project will provide guidance to policy-makers and other stakeholders to assess the potential effects of bioenergy production on food security in developing countries. The project will develop national strategies, strengthen national (and local) capacities and formulate suitable downstream projects with national counterparts. The proposed activities will help ensure that linkages between food security and bioenergy are mainstreamed into development and poverty reduction strategies, that the linkages to the right to food are established and that the food needs of vulnerable people, particularly in rural areas, remain paramount. Project activities will focus on the elaboration of a quantitative and qualitative framework to analyse land use, bioenergy production potential and the relationship(s) to food security and poverty alleviation concerns in participating countries in Latin America, Asia and sub-Saharan Africa.

The first two years of the project will elaborate the analytical framework at the global and national levels in participating countries, plus address capacity building, policy formulation and the collaborative process necessary to ensure that project results are sustainable. In the final year, the project will formulate bioenergy strategies that have mainstreamed food security considerations, and identify a preliminary set of sustainable bioenergy projects that will be suitable for investment, support rural development and readily adaptable to other countries and communities. The results of this project will provide the technical guidance, analytical and knowledge management tools necessary to ensure that food security remain central to the development of sustainable bioenergy policies. Planned training workshops ensure that project outreach extends beyond the participating countries.

This project contributes to Millennium Development Goal (MDG) targets related to halving the proportion of the hungry poor (MDG 1) and ensuring environmental sustainability (MDG 7), and provide a better understanding of how to operationalize the right to food in the bioenergy context through mainstreaming food security considerations into appropriate bioenergy policy and project initiatives.

PROJECT DESIGN

Some 70 percent of the 854 million hungry people in the world live in rural areas, often concentrated in regions that are particularly vulnerable to environmental degradation and climate change.[1] Global progress towards halving the proportion of hungry people by 2015 remains slow and uneven, according to recent FAO reports. Only Latin America and the Caribbean, amongst developing regions, have reduced the prevalence of hunger at a rapid enough pace to reach the Millennium Development Goals (MDG) target.

Developing countries, such as Brazil, China and India, have emerged as key drivers of the increasing trade and consumption of agricultural products, and are central to the future outlook for global agricultural production. Population growth in developing countries, roughly double that of

[1] The State of Food Insecurity in the World (SOFI), FAO Rome, 2005. There are clear linkages between the use of solid fuels, such as wood gathered from forests, to a higher prevalence of undernourishment – in fact, for those countries with 35 percent or more undernourished, more than 80 percent of the population relies on solid fuels to prepare meals and support livelihoods. FAO has completed several studies related to forests, solid fuels and deforestation within the context of agricultural production, climate change, gender and food security. Globally, some 350 million people are also dependent on forests as the primary source of income and food. There are fewer studies to date, however, that explicitly link bioenergy and food security from an agricultural and livestock production perspective. Thus, this project is intended to have a much less pronounced focus on the role of wood-based bioenergy systems in food security, and concentrate on the role of farming systems relative to bioenergy and food security.

industrialized countries, plus rising per capita incomes, economic growth and increased urbanization, are driving the increased demand for animal products, feedstuffs, higher value processed foods and horticultural crops. Growth rates of agricultural production and consumption in developing countries, have in fact, outpaced that of industrialized economies.[2]

Growth in the agricultural production of Least Developed Countries (LDCs), however, has not kept pace with population growth and increased domestic demand (OECD-FAO 2006). LDCs also have the highest proportion of chronically undernourished populations, and have become increasingly reliant on imports of basic commodities from international markets to ensure food security.[3] For many, this has also resulted in increased exposure to international market price fluctuations, increasing overall food insecurity.

Current and expected (future) trends in energy prices may catalyse further growth in bioenergy production and more rapid adoption of biobased fuels. Biofuels[4], as part of the bioenergy-food security nexus, represent an important and growing source of demand for agricultural commodities. Major producers of biofuels, such as Brazil, the United States, the EU and Canada are either expected to reduce exports of basic feedstock commodities (cereals or oilseeds) and/or increase biofuel imports. This has serious socio-economic, environmental and food security implications for many developing countries, particularly countries that have large proportions of poor and food insecure people living in rural areas.

There are also significant gender considerations in terms of bioenergy and food security. According to FAO, agriculture has become increasingly feminized, particularly in the poorer and more food insecure countries of the world. As the rate of male participation in rural agriculture declines (rural to urban migration, war, illness and death due to HIV/AIDS, particularly in sub-Saharan Africa), women increasingly bear the primary and dominant role in agricultural production. An estimated one-third of all rural households in sub-Saharan Africa are now headed by women, and these households are often forced to make adjustments in cropping patterns and farming systems due to lack of access to capital, credit and labour. FAO research also indicates that these households also suffer disproportionately from environmental degradation, declining crop yields, water and fuel shortages – all of which result in increased vulnerability to chronic and transitory food insecurity.

Rural development policies have often tended to favour large-scale agricultural and livestock production to foster economic growth at the industrial level, often at the expense of more sustainable mixed farming systems typically employed by poorer people. Dedicating large tracts of land to single crop industrial output often contributes to deforestation, land degradation, contaminated surface and groundwater, and loss of biodiversity. There are also growing concerns about the global energy balance of bioenergy systems that depend upon large-scale agro-industrial crops as a source of biomass feedstock. These systems may have a negative effect on food security due to competition for rural resources, increased need for cash-based instruments to access credit, land and productive inputs. Female smallholders are often excluded from accessing the cash and resources necessary to focus on single crop output, and may be excluded from any potential benefits of bioenergy production.

The possibility of increased competition for agricultural, water and other natural resources and production factors for bioenergy systems instead of food production is already evident and an

---

[2] OECD-FAO, 2006. *Agricultural Outlook 2006-2015*, OECD-FAO, Paris.

[3] Food security exists when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, stability of supply, access and utilization.

[4] Some definitions may be helpful to clarify various types of bioenergy systems: bioenergy is energy produced from various biofuels; biofuel is fuel produced directly or indirectly from biomass, such as fuelwood, charcoal, bioethanol, biodiesel, biogas (methane) or biohydrogen; biomass is material of biological origin excluding material embedded in geological formations and transformed to fossil, such as energy crops, agricultural and forestry wastes and by-products, manure or microbial biomass. Bioenergy includes all wood energy and all agro-energy resources. Wood energy resources are fuelwood, charcoal, forestry residues, black liquor and any other energy derived from trees. Agro-energy resources are energy crops, for example, plants purposely grown for energy such as sugar cane, sugar beet, sweet sorghum, maize, palm oil, seed rape and other oilseeds, and various grasses. Other agro-energy resources are agricultural and livestock by-products such as straw, leaves, stalks, husks, shells, manure, droppings and other food and agricultural processing and slaughter by-products.

increasing demand for biomass derived fibres is adding to the pressure.[5] FAO projections to 2050 note that there may be declines in the growth of global agriculture, driven by lower population growth rates and the gradual attainment of medium to higher per capita food consumption in an increasing number of countries. The outlook also notes that the potential for world agriculture to be a significant source of feedstock for biofuels may offer development opportunities for countries with sufficient land and water resources as well as conducive trade policies. However, given potentially significant markets for bioenergy, the competition for resources could induce price increases that adversely affect the ability of lower income consumers to economically access food.

Expanding bioenergy production may increase economic growth in industrialized and developing countries – growth that could alleviate some of the concern related to competition for resources to produce food versus fuel. Economic growth has a far greater effect on hunger reduction when growth occurs in rural areas that have already created conducive policy space for rural and human development. Developing guidelines to analyse how bioenergy can contribute to rural development, as well as formulate policy to ensure that the food security concerns of the rural poor, particularly female smallholders and household heads, remain central to the further development of bioenergy is critical to the success of this project.[6]

STRATEGIC DEVELOPMENT FRAMEWORK

Bioenergy production, conversion and utilization patterns are largely dependant upon the specific environmental and socio-economic conditions of a particular community, country or region. There are, however, four common elements that would be included in the development of specific strategic framework at the country level: (i) biomass production potential linked to the natural resource base and to external factor inputs; (ii) land availability and utilization; (iii) agriculture, energy and environmental policy framework, and (iv) analysis of the qualitative and quantitative linkages to social, economic and environmental indicators.

FAO ASSISTANCE

There are numerous specific examples of prior and ongoing delivery of FAO technical assistance that is highly relevant to this project, particularly given the need for a multidisciplinary and global approach to mainstreaming food security concerns into bioenergy assessments. FAO work on commodity-specific projections and agricultural markets, plus food security, nutrition and the environment, as well as more than two decades of research and project delivery in various bioenergy fields, provide the multidisciplinary expertise necessary to implement this project.

The development of normative and methodological approaches that integrate bioenergy systems into agricultural, forestry and socio-economic activities is common to nearly all the examples of relevant prior and ongoing FAO assistance. The analysis of the potential trade-offs between bioenergy development and food security, for example, could be related to the normative framework of the human right to adequate food.

The Organization has also worked to promote a better understanding of the linkages between bioenergy and food security, poverty alleviation, climate change and sustainable development. Cooperation between different technical units and departments has been instrumental in guiding and implementing these activities. For bioenergy work, there are four areas of particular focus: (i) supporting knowledge generation and transfer; (ii) providing direct technical assistance to member countries in the field; (iii) assessment of funding and financing mechanisms related to bioenergy; and (iv) development of networks with national, regional and global partnerships.[7]

---

[5] World agriculture: towards 2030/2050, Interim Report, FAO Rome, 2006.

[6] For more information, please refer to the FAO International Bioenergy Platform (IBEP). http://www.fao.org/sd/dim_en2/en2_060501_en.htm

[7] Near term activities include a bioenergy workshop to launch the tasks of the IBEP February 2007), a study on sustainability of bioenergy systems by UN-Energy, lead by FAO to be presented at the 15th Session of CSD (New York, April 2007), preparation of SOFA 2008 on Bioenergy, plus formulation and promotion of appropriate terminology for bioenergy in the context of different uses: forestry, climate change and rural development.

FAO has contributed to the generation and transfer of knowledge on bioenergy in a wide variety of ways, including development of a Wood Energy Information System (WEIS), drafting unified wood energy terminology on currently used wood fuel terms useful for forest and energy statistics, commercial trading operations and bioenergy resources balances, as well as guidance materials related to wood fuel surveys and a GIS software planning tool used to develop wood energy policies and programmes thus far applied in Mexico, Senegal and Slovenia. Technical assistance through projects and advisory services related to the design and implementation of bioenergy strategies and policies have been delivered, in recent years, to Belarus, Chile, Costa Rica, Croatia, El Salvador, Ethiopia, Fiji, Myanmar, Peru, Slovenia and Ukraine.

FAO has also played a key role in the assessment of financing mechanisms for bioenergy, contributing, *inter alia*, to improving the eligibility of agricultural and bioenergy activities for funding under the Clean Development Mechanism of the Kyoto Protocol (KP) to the UNFCCC. A guidebook to improve understanding of the opportunities for bioenergy activities under the KP is currently under preparation.

Cooperation with national, regional and international partners, including several intergovernmental organizations, is central to the technical assistance FAO delivers. Partnerships with organizations such as the International Energy Agency, World Bank, the Latin American Energy Organization, African Development Bank, Economic Commissions for Africa, Asia and the Pacific and Latin America and the Caribbean, World Energy Council and the Inter-American Development Bank. Collaboration with the Global Environmental Facility (GEF) to promote competitiveness and efficient use of bioenergy in small and medium agro-industries is ongoing, as well as with research centres, universities and UN partners, particularly in the context of the follow-up to the World Summit on Sustainable Development (WSSD). FAO was also designated as Vice-Chairman of UN-Energy, the interagency mechanism that reports to the Commission on Sustainable Development (CSD).[8]

Most recently, FAO has prepared and presented the International Bioenergy Platform (IBEP) which guides its overall approach on bioenergy matters, based strongly on the recommendations provided by FAO's Governing Bodies. Based upon an agreement (April 2006) with the Italian Government that FAO host the Secretariat of a Global Bioenergy Partnership (GBEP) established in April 2006. FAO continues to play a key role in the promotion of the IBEP and GBEP activities for recipient countries, donors and other organizations.

FAO has a definite comparative advantage to deliver the type of bioenergy and food security project that can benefit from multidisciplinary expertise related to food, agriculture, bioenergy and commodity markets. Long-term perspective studies on the production potential of bioenergy and the impacts of expanding bioenergy production on food and agricultural markets, as well as natural resources, are underway. FAO also hosts the Committee on Food Security and annually publishes the State of Food Insecurity in the World (SOFI) that serves as a food security monitoring tool at the aggregate, national level. The interagency Food Insecurity and Vulnerability Mapping Information System (FIVIMS) is also housed at FAO, and collaboration with WFP on specific food security assessments and early warning activities is ongoing. FAO is well placed to continue to deliver technical assistance to member countries, contribute to international cooperation and develop a sustainable dialogue on the important and considerable linkages between food security and bioenergy.

PROJECT RATIONALE

A primary concern relative to the ongoing development of bioenergy sectors is the potential impact on food security, sustainable agriculture and rural development. Current and future development of bioenergy, and how this development may positively or negatively affect food security needs to be analysed within a variety of bioenergy systems and food security contexts. Linkages between food security and bioenergy production are defined, in part, by competing demands for productive

[8] Research centres and universities such as Itajuba (Brazil), Utrecht (the Netherlands), Shenyang (China), San Carlos (The Philippines), UNAM (Mexico) and Imperial College (UK), and UN partners such as UNDESA, UNDP, UNEP, UNESCO, UNIDO and World Food Programme.

land. This is a simple and pragmatic approach, but an insufficient one to analyse the complex issues related to food security and underpinning the "food versus fuel" debate.[9] One of the primary aims of this project is to find ways to design clear and replicable methodologies to assess bioenergy potential within an overall framework focused on food security in developing countries. This will be accomplished through a comprehensive review of how food systems and key food security indicators may be affected by development of bioenergy.

Governments and key stakeholders are increasingly called upon to formulate bioenergy policy and appropriate regulatory framework to guide public and private sector initiatives and investment decisions. This project will provide targeted analysis, methodological guidance and lessons learned from the field to support policy-makers and key stakeholders in defining the specific linkages between food security and sustainable bioenergy systems. The voluntary guidelines on the right to adequate food could be useful as a safeguard mechanism or normative reference system for ensuring adequate consideration of food security in policy design.

Bioenergy systems – feedstock and applications

Bioenergy systems will differ according to scale, biomass, conversion technology, fuel end use, business model, policy, markets and trade. A typical supply chain for energy from biomass includes raw material production, pre-processing (for example, storage and drying) and conversion to power and heat, plus any necessary transport and related transactions. Bioenergy has three primary applications, including generation of electricity, heat and transport fuels. Services from biomass are obtained through a large number of different feedstock and conversion technologies and energy carriers. There are numerous types of biomass feedstock, such as wood fuel, energy crops (sugar cane, vegetable oils, maize and other cereals), organic by-products and/or residues and waste materials.

Wood fuels include all forms of fuelwood and firewood from forests, and are not further processed or upgraded, other than drying.[10] Charcoal is another type of biomass feedstock, typically converted by combustion to deliver heat and/or electricity. Crops grown for energy include: wood from dedicated short-rotation plantations with fast growing trees; perennial grasses such as miscanthus, Reed Canary Grass (Börjesson 1999), Mediterranean thistle, switch grass; annual crops with high starch or sugar content, mostly grown for their conversion to liquid fuels, such as maize, sugar cane and other high-sugar content crops used for ethanol; and annual crops with high oil content, such as rapeseed, soybean or palm oils for biodiesel.

Organic by-products and residues, such as waste wood from forests, plantations, pulp and timber industry or households, plus crop waste from short-rotation crops, for example, straw; sugar fibre (bagasse), fronds and husks, hulls – are all useful as a form of biomass feedstock.

Organic waste used for bioenergy feedstock is mostly characterized by very high moisture content (often liquid), and sources include animal manure from agriculture or household and industrial wastes. Generating energy from organic waste is achieved bio-chemically, through biotechnological (biogas) generation that is combusted to provide heat and/or electricity. Sewage water and recovery of gas from landfills are additional sources of organic waste. Biogas from liquid waste and fuels is typically derived from animal slurry and industrial organic waste.

Bioethanol and biodiesel are the two major liquid fuels, with three major applications in bioenergy systems: (i) biofuel use as complete fossil fuel substitution; (ii) blended with fossil fuels to be used in engines or boilers; (iii) additive to fossil fuels, in order to reduce CO and HC emissions, as well as reduce the aromatic and benzene (unregulated compounds) content of the fuel. (OECD/ENV,

[9] A number of very relevant studies or literature reviews assessing the global bioenergy potential are based on the use of global land use models (Leemans *et al.,* 1996; Fischer and Schrattenholzer, 2001).

[10] Woodfuels are a much more common source of energy in developing countries than in industrialized countries. Some 15 percent of total energy demand in developing countries comes from plantations, natural or semi-natural forests, compared to two percent in industrialized countries and 7 percent for the world as a whole (FAO 2000, WEC Nakicenovic 1998). Less than 50 percent of fuelwood is from forests in many countries.

2001). For most countries, with the notable exception of Brazil, biomass conversion to transportation fuels represents only a small part of total biomass conversion to energy.

Bioethanol is derived from the fermentation of mainly sugar and starch crops or, potentially, from cellulosic crops. Depending on climate and soil conditions, sugar beet, sugar cane and sweet sorghum are the most common sugar crop feedstock, while maize, potatoes and cereals are the most common starch crops. Biodiesel is produced when "organically derived oils (in some cases to be used directly as fuel), are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. The biomass-derived ethyl or methyl esters are blended with conventional diesel fuel or used as a neat fuel (100 percent biodiesel). Biodiesel can be made from soybean or canola (rapeseed) oils, palm oil, castor oil, animal fats, waste vegetable oils or micro-algae oils" (US Department of Energy 2002).

Electricity and heat are mainly generated from solid biomass, even though the conversion of gases and liquids from biomass to electricity represents the fastest growing bioenergy sector. The amount of electricity generated through biomass in OECD countries virtually doubled over the 1990s. The most common solid biofuels used in the world today, particularly in developing countries, are wood fuels – gathered for use as fuel or firewood for cooking or heating. Apart from impacts on natural resources, the unsustainability of wood fuel use is manifested especially in the negative health effects through high emissions of particulate matter, causing respiratory diseases and cancer. The most applied solid biofuels in OECD countries are wood residues and waste, fuelwood from coppicing (especially Salix), while the use of non-woody energy crops in electricity and heating applications is still very limited.

Clearly, bioenergy systems differ according to production chains, scale, business models and market access and integration. This project will seek to find representative types of bioenergy systems most relevant to the specific food security contexts of participating countries – focusing on the potential effects on populations in rural areas.

BIOENERGY SYSTEMS – EXAMPLES

This section will briefly describe several representative bioenergy systems that are highly relevant to developing countries: (i) household bioenergy systems for heating and cooking; (ii) process energy for farms and agribusinesses and (iii) energy crop plantations for the production of liquid biofuels.

➢ Household bioenergy systems

The types of household bioenergy systems, used for heating and cooking, are mostly linked to informal markets, remoteness or the lack of systematic market access – and predominately in developing countries, particularly some of the most food insecure. Households, those characterized by low incomes and lack of access to wood fuel, typically gather animal dung (or wood fuel where available). Women and children are typically responsible for gathering this fuel source, which usually is very time intensive and a source of significant indoor air pollution. Fuelwood consumption can often also be a significant driver of deforestation.[11] FAO has carried out integrated farm management approaches with marginalized groups in Ethiopia to address some of the problems associated with household level bioenergy systems. The introduction of vegetable production, combined with water harvesting wells to capture and store surface water flow for irrigation, enabled farmers to generate more income on a smaller land area, and dedicate former crop area to the establishment of small firewood lots. The fuelwood is eventually used to replace cow dung and other animal droppings previously been used as a fuel and in turn, the farmer, accessed supplies of organic fertilizer for vegetable plots.

➢ Process energy for farms and agribusinesses

[11] FAO provides technical assistance at the household level through supporting the use of more efficient fuel stoves and training of local entrepreneurs, distribution of these stoves is often supported by government subsidies.

Farms and agribusinesses have significant potential regarding the treatment and *'valorization'* of its livestock by-products, wrongly termed *'wastes'*. The aerobic or anaerobic (in contact with the atmosphere or not, respectively), treatment of these materials can provide energy and environmental services. China, India and other developing countries, and industrialized countries such as Germany and the Netherlands, have progressed in the wide spread utilization of biomass residues towards biogas production for direct use in cooking and lighting or for electricity generation, with parallel benefits regarding reduced water pollution and greenhouse has emissions and the production of *'green fertilizer'*. Biogas development requires not only technological knowledge but also an appropriate agricultural and energy policy and financial framework, particularly in the case of the more advanced systems for electricity generation. Potential failure of these systems due to a lack of resources for appropriate maintenance might be addressed through regular carbon revenue flows generated by respective CDM projects (biogas projects represent a significant share of projects in the CDM pipeline). While the economic and energy access related benefits of smaller installations are limited to the respective farm or agribusiness, larger installations can produce sufficient access energy to be fed into the local grid. In intensive livestock producing countries such as Denmark dedicated biogas power plants already exist and are economically highly competitive (Groscurth *et al.* 2001).

- **Energy crop plantations for the production of biomass for liquid biofuels**

Crops grown for liquid biofuels have so far been primarily established in Brazil. Abundant literature is available on related policy measures, financial feasibility, environmental and employment effects of the very important Brazilian experience and the learning curve of that country is a useful reference to others, although not directly adaptable. Brazilian bioethanol is said to be competitive with oil on the world market at an oil price of USD35/barrel. With oil prices of USD70/barrell and above, the break-even point for an increasing number of countries and business models has been reached and production is expanding rapidly, for example, oil palm for biodiesel (Indonesia/Malaysia). Production systems for biodiesel and bioethanol vary in particular regarding their fixed costs. While ethanol production, with high capital costs, is only economic on a large scale, biodiesel can be produced on a small scale and apart from production for national or export markets it is also common for farmers to produce vegetable oil (the less refined and less expensive pre-product in the biodiesel production chain) for their own, on-farm use. Small scale production lends itself to the joint production of food and oil crops.

LINKAGES BETWEEN BIOENERGY AND FOOD SECURITY

Agricultural diversification, the need to reduce fossil fuel dependency and climate change provides important incentives to use biofuels but the possible negative effects of biomass use and development of biomass/biofuel markets, particularly in developing countries, make more thorough analysis of the direct and indirect linkages to food security very important. A careful evaluation of the whole range of potential benefits may, however, highlight the possible benefits of investment and policy decisions that favour bioenergy. Most important for this project is a balanced analysis of the food-fuel nexus. Table 1 lists some major potential benefits and possible negative effects of bioenergy systems and key food security indicators.

Table 1

Potential Benefits of Bioenergy Systems	Food Security Indicators	Potential Negative Effects of Bioenergy Systems
➢ Diversification of agricultural output to feedstock crops for bioenergy ➢ Development of infrastructure and employment in the agricultural sector, particularly rural areas ➢ Competition for land and other production factors	➢ Proportion chronically undernourished (measured by prevalence of stunting amongst children under five years old) ➢ Adult literacy, particularly female ➢ Proportion of household income directed to food	➢ Decreased access to food due to increased food commodity prices driven by competition between biomass for energy and food production ➢ Decreased food availability due to replacement of

➢ Diversification of domestic energy supply and increased energy security ➢ Rural women have more time to dedicate to income earning activities as household energy burden potentially reduced, less child labour ➢ Access to energy for rural small and medium enterprises (SMEs) improved ➢ Technological development through investment in new bioenergy technologies, using lignocellulosic biomass ➢ Climate change mitigation ➢ Mitigation of local environmental concerns - water pollution, loss of biodiversity, land degradation ➢ Revenue from payments for environmental services (PES) and monetization of carbon credits	➢ Population growth ➢ GDP growth per capita ➢ Agricultural contribution to GDP ➢ Health expenditure as a proportion of GDP ➢ Proportion of adults infected with HIV ➢ Number of food emergencies ➢ UNDP Human Development Index ➢ Degree of import and/or export dependence ➢ Domestic food production (food availability) ➢ Purchasing power (food access) ➢ Access to water and sanitation facilities (food utilization)	subsistence farm land by energy plantations ➢ Increased environmental pressure due to introduction or expansion of unsustainable bioenergy systems, leading to water pollution, loss of biodiversity, land degradation ➢ Pressure on prices of other goods and services related to land-use and biomass

There are substantial indirect linkages between bioenergy, food security and economic development. Energy is fundamental to rural development and economic activity, and there are important linkages between economic growth, as measured by gross domestic product per capita (GDP), increased incomes, purchasing power and improved food security.
Bioenergy production systems are often highly labour intensive and generate employment opportunities.[12] These employment effects, however, differ between types of biofuels and types of production systems, for example, the degree of mechanization for production of biomass feedstock. Different biofuel systems will have varying degrees of "multiplier effect" or economic benefit in which an increase in expenditures produces an increase in national income and aggregate demand greater than the initial amount expended. For example, if a new bioenergy facility is constructed, it will generate employment and income for workers as well as suppliers, with indirect effects on other sectors when increased spending is circulated through the local/national economy.[13]

An important component of bioenergy assessment will be to discover what proportion of this estimated 80 percent of residues, or indeed the relative proportion in other regions of the world, that is available for biofuel production at economically feasible price levels, and without disrupting important non-energy activities that currently rely upon biomass residues. This may be particularly the case in rural communities, where energy needs are often poorly documented and less understood by non-community members relative to the needs of large-scale industrial users.

LAND FOR FOOD, FEED OR FUEL?

Energy crops may compete for land with other uses, such as food crop production or raising livestock on rough grazing land. The competition for land used to produce fuel or food may well be avoided by cultivation of feedstock crops for bioenergy production on marginal or abandoned lands – although this may entail high productive factor input costs in order to achieve economically

[12] Generally speaking, tree crops normally are much less labour intensive than agricultural crops (Saxena and Srivastava 1995; Saxena 1989; Kartha and Leach 2001). Energy crops that involve tree growing as biomass feedstock displace other crops in regions where there is little on-farm mechanization, the transition from agricultural to tree crop typically involves a reduction, and sometimes a very significant reduction, in local employment opportunities

[13] For further discussion of how the multiplier effect is linked to energy and productive factor inputs (Brazil), please see Carlsson 1999 in Hillring 2002.

feasible crop yields. Conversely, the best net returns and profits for energy crop producers may arise from using higher quality, though potentially expensive, crop land.

New biofuel crops may well be suitable within conventional farm production systems, although sustainability concerns may need to be addressed. FAO/SREN studies (2000) have demonstrated that integrated food and energy farm system models are feasible for temperate climates, although highly sensitive to market conditions and location. Careful design of an entire production and use system, however, could be used to reduce overall farm costs, improve rural infrastructure, lower transaction costs, improve access to markets, and generally raise or stabilize farm incomes.

Given the many divergent contexts and conditions for bioenergy production, projects and policies related to biofuel crops must base the design and site selection on sound, local information about the relative merits of bioenergy and alternative crop production, utilizing broad, rural development perspectives that incorporate food security considerations. This design process will often require careful consideration of fuel and alternative crops, relative to tradeoffs between land quality, land cost and crop yield in the context of local development needs and food security. Land availability, especially in most OECD countries, is often perceived as a constraint to large-scale production of biomass. For the United States and countries in the European Union, however, there may be more land available for biomass production in future (OECD/ENV 2002).

CO-PRODUCTION OF BIOENERGY AND FOOD

The classic example of how biomass can be utilized for energy production is the integrated sugar-cane facility that produces the optimal mixture of sugar, alcohol (ethanol), electricity, animal feed or industrial fibre from bagasse and other sugar-cane residue. Co-production also applies to forestry or agroforestry schemes that are designed to produce non-energy products such as timber or fruit, but that are also designed from the start to favour the production of bioenergy as a joint product from tree thinning plus pruning and harvest residues. [14] The use of biomass residues and co-products, despite its intuitive attractiveness, could lead to a long-term depletion of nutrients and a decline of productivity over time, if the maximum sustainable extraction rate is exceeded.

ECONOMIC LINKAGES

The relationships between food security and bioenergy are varied, complex and dynamic. Rising oil prices and the need to reduce greenhouse gas emissions have resulted in an intense global focus on bioenergy, particularly biofuels, to mitigate climate change, address higher energy costs and provide potentially new market outlets for agricultural products. The development of biofuels poses risks and difficult trade-offs, however, as the potential impact of increased use of land and water resources in developing and industrialized countries for bioenergy, particularly, biofuel production are unclear (von Braun, 2006).

Further development of bioenergy systems will increasingly highlight the direct linkages between food security and energy security. These linkages function as an additional source of uncertainty in global production and marketing systems; markets that are already more susceptible to greater variability in pricing and production due in part to trade liberalization and structural adjustments in food and agricultural sectors. Natural disasters and lack of productive input factors, such as fertilizer or water resources, also constrain and/or result in the loss of agricultural output, and lowers overall food availability. The competition for more arable land and water resources directed to biofuel production may lead to higher and less stable food prices, for countries that are both net food importers and exporters. This may be particularly true for low-income, food deficit countries (LIFDCs) that already have a large proportion of undernourished and are net importers of basic foods, and may face serious problems of food access within vulnerable populations. Poor households tend to spend a larger proportion of income on food than other items, including energy

[14] Further information on multiproduct agro-forestry can be obtained from organizations such as Agro-forestry Net (www.agroforestry.net), the World Agro-forestry Centre (www.worldagroforestrycentre.org), and the International Center for Research in Agro-forestry (www.ciesin.org/IC/icraf/ICRAF.html).

(von Braun, 2006), and thus, may be particularly challenged by rising food prices, globally and locally.[15]

This may be particularly true in the case of some countries, for example, Guatemala or Kenya that may be dependent on export income from tropical products, such as coffee, fruits and vegetables or sugar, to finance imports of basic foods. For more developed countries, such as the USA or those in the European Union, while not challenged by food insecurity, the need to find alternative energy sources may alter the amount of land and water available to produce food crops, and in turn, reduce exports, particularly cereals and oils, and pressure global commodity prices.

Furthermore, for countries with sufficient levels of bioenergy feedstock, for example, palm oil (biodiesel) in Colombia or Malaysia, or sugar cane (ethanol and co-generation of electricity) in Tanzania, Guatemala or Thailand, increased use of land for biofuel production could result in market opportunities that increase incomes of poorer rural households and in turn, help alleviate food security concerns. However, the potential environmental damage and loss of biodiversity, particularly in regions with tropical forests, may preclude large-scale production of biofuels.

EXAMPLES OF LINKAGES FOR RESEARCH AND ANALYSIS

The primary task of project activities is to carefully evaluate all relevant linkages between bioenergy and food security, including some of the most relevant listed below:

- development of rural infrastructure, employment generation, and crop diversification, with a net positive impact on access to food;
- climate change mitigation through the substitution of fossil fuels and energy intensive materials, as well as carbon sequestration (conserving existing carbon sinks and developing new sinks), mobilizing carbon finance for rural investment and contributing to the mitigation of climate change impacts (on, *inter alia*, food security);
- better return on investment from bioenergy business models as compared to conventional agriculture, could lead to an overall increase in rural investment, making capital available for enhancing agricultural productivity levels of all rural, including food, production systems;
- the diversification of domestic energy supply leads to increased energy security and independence from imports and provides for a hedge against energy price fluctuations, energy access shortages and resulting negative effects on overall development;
- environmental degradation and loss of biodiversity can be reduced or aggravated, depending on the bioenergy system. The effect on food security would be negative or positive, depending on either an increased vs. decreased overall resilience of rural agro-ecosystems.

Overall, context and sector specific analysis is required to find ways to ensure that further development in the sector will support food security goals while ensuring sustainable bioenergy production. Smaller-scale, rural-based production may benefit the rural poor more than large-scale, industrialized output and provide market outlets to smallholders, reduce transport costs for remote populations and achieve greater environmental and socio-economic gains for the most vulnerable populations.

Bioenergy and co-production systems create many opportunities for significant innovations in conventional cropping and harvesting practice, most of which currently treat potential energy

[15] Countries with more than 20 percent of the population considered undernourished include Angola, Bangladesh, Bolivia, Botswana, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Dem People's Republic of Korea, Dem. Republic of the Congo, Dominican Republic, Eritrea, Ethiopia, Gambia, Guatemala, Guinea, Haiti, Honduras, India, Kenya, Lao People's Dem. Republic, Liberia, Madagascar, Malawi, Mali, Mongolia, Mozambique, Namibia, Nicaragua, Niger, Pakistan, Panama, Philippines, Rwanda, Senegal, Sierra Leone, Sri Lanka, Sudan, Tanzania, Thailand, Togo, Yemen, Zambia and Zimbabwe (FAO SOFI 2005).

feedstock as waste residue to be minimized, with the significant exception of sugar-cane bagasse. Further innovation in crop production can provide opportunities for bioenergy initiatives to simultaneously meet energy feedstock needs, as well as the multiple other needs of local communities. At the same time, food security has an increased likelihood to increases as countries become more energy self-sufficient. Clearly, there exists a very significant need and an enormous scope to analyse the various problems and potential opportunities inherent in the "competition" for resources between food and fuel needs. This project aims to address these problems from the perspective of possible effects attributable to the expansion or start-up of a variety of bioenergy systems on a diverse set of food security contexts.

TARGET BENEFICIARIES

Three primary sets of stakeholders will utilize the results of this project, as follows:

- **Policy-makers in developing countries** who will be able to use the results of this project to design a national strategy to harmonize food security and bioenergy policies and in turn, mainstream bioenergy into rural development initiatives;

- **Public and private sector stakeholders** in developing countries who will have a common regulatory framework and policy environment to base food policy and investment decisions in optimal projects, investments and business models for production, processing and end-use equipment for bioenergy;

- **Policy-makers in OECD countries** who will be able to make informed decisions on policies and investments related to domestic energy production relative to the food security concerns, costs and security of supply of bioenergy imports from developing countries.

Most importantly, this project establishes an overall analytical framework through targeted analysis and field activities that aims to highlight that the food needs of millions of people who are chronically undernourished and food insecure must remain of primary concern in the design and implementation of bioenergy policies and projects in developing and developed countries. The overall objectives and three-year timeline of this project are designed to create the foundation for sustainable analysis of the bioenergy/food security nexus, and lay the groundwork for future food security assessments that could link bioenergy output to household income, food utilization, economic access to food and food availability.

SUSTAINABLE PROJECT RESULTS

After having developed an appropriate analytical framework, methodological guidance, as well as identified field activities and needs for capacity-building and knowledge transfer, a sufficiently large numbers of stakeholders will have acquired the skills to effectively mainstream food security concerns into the analysis of potential and existing bioenergy systems in participating countries. Coordinated activities at the national level will have been initiated for the mainstreaming of food security sensitive bioenergy systems into country-specific rural development strategies.

FAO will have integrated the lessons learned from this project as well as guidelines and tools developed into other partnership-based programmes, such as IBEP, GBEP, UN-Energy and other programmes with specific emphasis on food security, sustainable market and rural development. The results of this project will enhance the sustainability of other similar technical assistance projects, delivered through national stakeholders, partnerships and other UN partners, with a particular focus on food security sensitive bioenergy projects formulated to support rural development.

Normative regular programme activities on the development of knowledge networks and communities of practice related to bioenergy have recently been initiated at FAO, and these activities will help ensure continued support for targeted beneficiaries, as well as the sustainability of project results. The capacity building, data sets and information tools provided through the project will be sufficient to enable national stakeholders to make effective use of communication

and knowledge management and transfer tools. The mix of capacity building and development of actual, country specific tools, will buffer the ultimate project success against changes in personnel, a significant risk in capacity-building projects. The knowledge infrastructure will remain, and based on FAO expertise at headquarters and in field offices, and the project has been designed to ensure that guidance, tools, capacity-building strategies and project formulation methods are accessible and replicable to other countries with similar bioenergy potential and/or food security contexts.

Overall, the project aims to develop an analytical framework and methodological guidance for the formulation of sustainable bioenergy policies and projects that are guided by food security concerns, rather than a limited focus on bioenergy production and usage. The latter will require further investment at different scales and the project intends to assist with the search for and preparation of project drafts for such investment. The project will pay particular attention to ways in which institutional structures within the public and private sectors can be supported to ensure that development of bioenergy potential supports food security priorities at the national and subnational levels.

PROJECT STRATEGY

The strategy of this project is based on three central components: (i) development of an overall bioenergy and food security analytical framework and methodological guidance; (ii) estimation of bioenergy potential and food security implications within specific national and subnational contexts, and (iii) development of field activities that are replicable, sustainable and will strengthen both institutional capacities, as well as that of key national stakeholders. The activities are interdependent, and successful results will rely on an iterative process based on close integration and explicit feedback loops between the conceptual, analytical, empirical and operational levels between field activities, FAO Country Offices and headquarters. Increasingly, and through the project activities (particularly capacity-building), responsibilities for knowledge transfer, analysis and capacity-building will be shifted to national stakeholders, with attention to the different roles of the public and private sectors.

Figure 1 (following page) illustrates how the major project elements link through feedback loops and the various project components to the development of an overall framework for the analysis of food security and bioenergy. The project is designed to ensure that methodological guidance, capacity-building activities and recommendations for regulatory frameworks and supporting institutions (private and public) help develop sustainable bioenergy systems that support and enhance food security.

The normative aspects of the project, in terms of developing policy guidance and related tools, will be supported by the multidisciplinary approach of the International Bioenergy Platform (IBEP), as well as the specialist skills of technical advisors and national staff. The involvement of national staff and key stakeholders will strengthen subnational and national capacity in the field to analyse the food security-bioenergy nexus, as well as support the development of national expertise beyond the end of the project.

INSTITUTIONAL FRAMEWORK

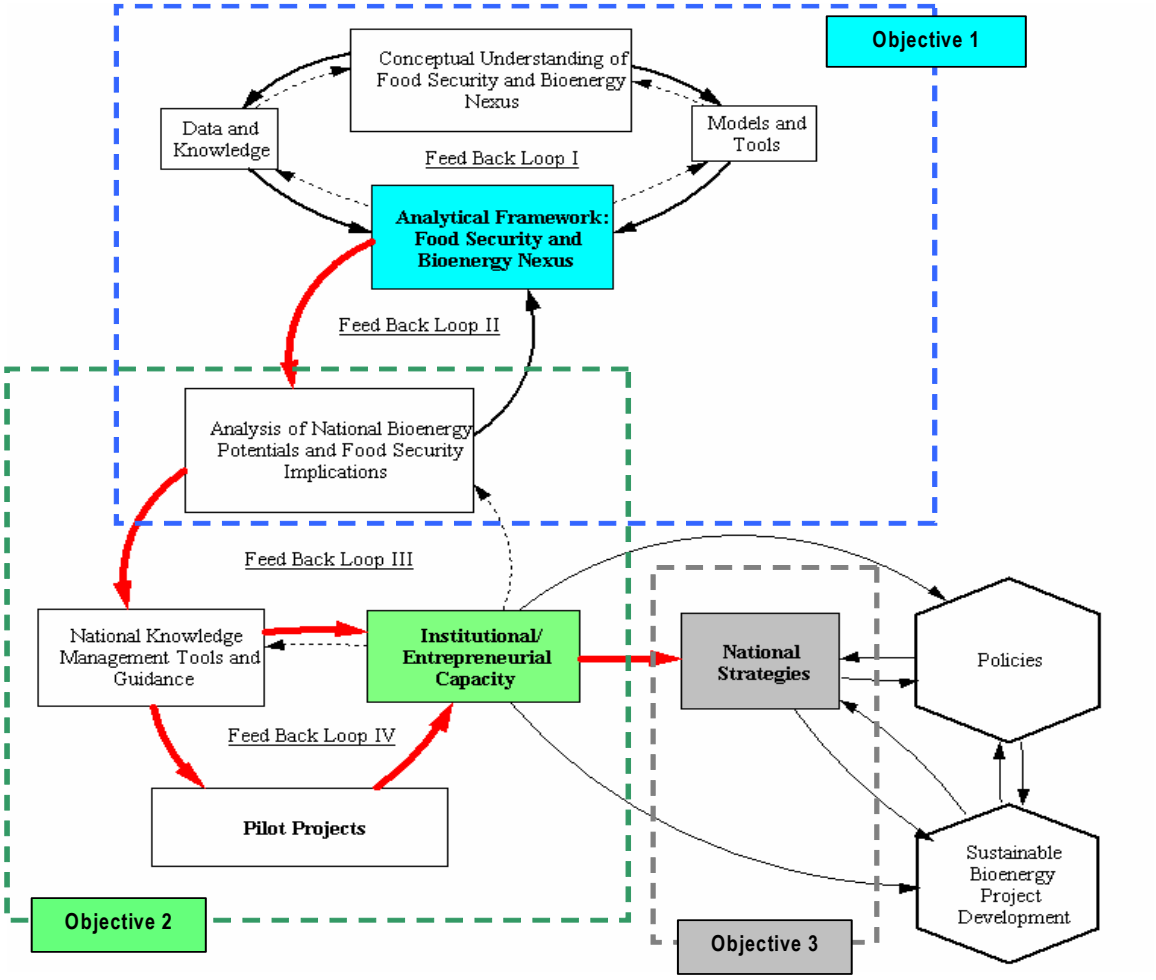
The identification of optimal national stakeholders and partner institutions is very important to the overall success, and sustainability, of project outcomes. Participation of national government counterparts, such the Ministries of Agriculture, Planning, Energy, Environment, Social Affairs or Trade, will vary based on the participating country, context-specific policies, available institutional support and private-public sector partnerships. Networks and partnerships with universities, research institutes, other UN partners (such as UNEP or WFP) and NGOs will support assessment and analysis at the national and subnational levels, and complement Government counterparts. Industry and business associations will be particularly important in terms of sustainability, and in the identification of successful and sustainable bioenergy business models. The role of private-public relationships is critically important, and could facilitate technology transfer into participating countries. To support development of a national bioenergy and food security strategy , a

multisectoral national task force or working group will be convened to guide the project, help disseminate project results, become a sustainable means to catalyse national and subnational action, and importantly, facilitate public-private sector collaboration.

WHY FAO SHOULD IMPLEMENT THIS PROJECT

FAO is the UN agency tasked as lead on food security concerns, and has long and extensive experience in delivering technical assistance to support rural development. From the FAO perspective, food security should be considered as a necessary pillar of sustainable bioenergy. FAO, among the UN agencies, is also the best placed to provide the relevant multidisciplinary approach and divergent technical guidance necessary to analyse different bioenergy systems: agro-industrial, agricultural and forestry residues, forests, plantations, animal waste, as well as sustainability (GHG emissions from bioenergy systems, gender and bioenergy, questions of land rights, human rights, the human right to adequate food in particular, tenure, participation, agrobiodiversity, irrigation, nutrient leaching, economic feasibility of agrobusiness models). FAO is able to provide normative and field level support to this project through technical staff in headquarters and decentralized offices.

Figure 1: Linkages and feedback loops between the project elements



The project will provide important case studies, methodological guidance and toolkits that will improve global understanding of the linkages between food security and bioenergy production, use and marketing. In this context, the normative project element (tools, models and data) will be applied and tested in three to five countries, on the national and subnational level, in order to derive insights related to the specific food security context and agronomic potential for each of the

countries, test the feasibility of the tools with key stakeholders and, once finalized, replicate project guidance/results to other countries with similar food-fuel contexts. Project outputs will also be based on targeted analysis and field activities that will support and strengthen the core work of the International Bioenergy Platform (IBEP) presented by FAO at CSD-14 to support tasks related to sustainable bioenergy. Moreover, preliminary results from the first phase of the project will provide insights and early field experience that will form part of the FAO contribution to the energy theme of CSD-15 (May 2007).

HOW THE PROJECT LINKS WITH GLOBAL ACTION PLANS

Sustainable bioenergy systems, a central theme of this project, is directly related to the MDGs, particular MDG 1 – Eradicate extreme poverty and hunger, and MDG 7 – Ensure environmental sustainability. Bioenergy is expected to positively impact rural development and food security and assist in the reduction of greenhouse gas emissions (GHG). This project therefore also has strong links with the efforts of the UNFCCC to mitigate climate change. As bioenergy as a substitute for fossil fuels is eligible for financing through the Clean Development Mechanism of the Kyoto Protocol, it is feasible that results from this project at the country level may be oriented toward the CDM channel.

Bioenergy also has a direct relationship with the World Summit for Sustainable Development (WSSD) and the Johannesburg Plan of Implementation. The Johannesburg Plan calls for an "improved access to reliable and affordable energy services for sustainable development" and for further efforts to the utilization of renewable energies. Apart from the close link to UNFCCC, bioenergy also relates to other major Multilateral Environmental Agreements (MEA) that are in turn related to Biodiversity (CBD) and Desertification (CCD). This is significant in that large energy cropping systems can negatively affect biological biodiversity, and unsustainable use of bioenergy sources such as wood fuels, can contribute to deforestation and even desertification. Given the primary development objective of the project to enhance food security through mainstreaming sustainable bioenergy systems into rural development, there are also close links to the World Food Summit Plan of Action. The impact of bioenergy systems on sustainable land management and the reduction of GHGs relates the project to the Global Environmental Facility (GEF) Operational Programmes 6 (Promoting the adoption of renewable energy by removing barriers and reducing implementation costs) and 15 (Sustainable Land Management).

The project also has links with UN-Energy, as bioenergy is a central element of its Work plan and for which FAO is leading the preparation of a document to be submitted to the 15th Session of the Commission for Sustainable Development to be held in April 2007.[16]

Finally, the project has links with two major global initiatives originally promoted by the Governments of Germany and Italy, respectively. The Renewable Energy Policy Network for the 21st Century, (REN 21) is a global policy network that provides a forum for international leadership on renewable energy. The REN 21 International Action Programme includes a number of activities on bioenergy, among which is the FAO International Bioenergy Platform (IBEP). The Global Bioenergy Partnership (GBEP), whose Secretariat is hosted at FAO, provides a forum for dialogue on effective policy frameworks and identifies ways and means to facilitate investment and transfer of technology in the field of bioenergy.

PARTNERSHIP ARRANGEMENTS

The FAO International Bioenergy Platform (IBEP), and particularly the task related to sustainability of bioenergy, will provide contextual analysis and information to support the activities of this project, including the development of partnership arrangements. Targeted analysis and ongoing

[16] UN-Energy, created by the United Nations as a follow-up to the World Summit for Sustainable Development, is an interagency mechanism to promote a system-wide approach by all UN agencies active in the field of energy

project activities will inform normative work with field activities designed to mainstream food security concerns into sustainable bioenergy options. As such, a major component of this project is the identification and development of suitable counterparts, stakeholders and private-public partnerships, as this activity will ensure the sustainability of project results. Partnerships will be developed at various institutional, agency, business and individual levels to support and deliver specific project objectives. These partnerships will help form the national task force in each participating country, and will potentially become key stakeholders in the larger global bioenergy partnerships where FAO already plays a significant role.

UN-Energy is the response of the UN system to the need for broad-based collaboration on energy related issues and provides a forum to facilitate operational and normative collaboration. FAO is the lead for coordination for bioenergy issues, and is currently coordinating the publication of a 'Bioenergy and Sustainable Development', an interagency publication. This partnership is expected to contribute to the project the perspectives and contributions of other agencies to this multifaceted food security and energy space. The project provides a focus around which collaboration will be intensified benefiting from the comparative advantages of each agency. Moreover, FAO is hosting the Secretariat of the Global Bioenergy Partnership (GBEP), an initiative funded by the Government of Italy and embraced by the G-8 and other partners, to support joint activities and field projects. The location of the GBEP Secretariat at FAO, as well as easily accessible internal technical advice from FAO staff and IBEP will provide an advantageous and supportive environment to maximize possible synergies between the project, IBEP and GBEP activities.

DEVELOPMENT OBJECTIVE

Enhance food security though mainstreaming sustainable bioenergy systems into rural development and minimize the risk of detrimental impacts of bioenergy on food security.

Immediate Objectives, Outputs and Activities

The project will be implemented according to the following objectives, expected outputs and proposed activities:

Immediate Objective 1

Comprehensive understanding of the nexus between food security and sustainable bioenergy is developed; required knowledge, data and analytical tools are available.

Output 1.1 – Preliminary analytical framework is developed linking food security to different bioenergy systems.

- Activity 1.1.1 – Assess and make available (including collection, selection, adaptation and/or design) for use in the project data, models and tools required for assessing bioenergy production potentials and the bioenergy and food security nexus, identifying gaps in the focus and coverage in terms of food security, and in data and information, including integrated models (GLUE, IMAGE, BLS of World Food System, Reviews Lysen 2000, Hoogwijk 2002, Berndes 2003), plus land use, IMAGE and AEZ data, LocClim, Dynamic Atlas, and others internal and external to FAO.
- Activity 1.1.2 – – Design the conceptual framework for the analysis of expanded bioenergy production and its effects on food security, based on activity 1.1.
- Activity 1.1.3 - Carry out comprehensive desk reviews of participating countries' current and projected food security concerns *vis-à-vis* their bioenergy production potentials (current, expanding or future).[17]

[17] The country selection process requires a number of steps which will start in the first phases of the project. This will include screening of proposed countries with regard to their interest in bioenergy, agro-climatic and agronomical feasibility and their production potential; preliminary estimates of production potential (i.e. capacity) and costs at national level. These steps would identify a list of countries to be contacted to seek their interest in the project and in its technical assistance provided through FAO and its partners. The idea is to have three to five core countries and at least one for each region (sub-Saharan Africa, South

- Activity 1.1.4 - Based on a careful consideration of all relevant production factors and estimates of bioenergy demand carry out preliminary analysis of different scenarios for expanded bioenergy production and its effects on factors relevant for food security in participating countries. This will define the possible scope and scale of bioenergy and its food security implications in particular countries.
- Activity 1.1.5 – Produce summary document synthesizing results of above Activities.
- Activity 1.1.6- Hold informal headquarters/Regional Technical Consultations to present and disseminate results to other countries.

Output 1.2 – Key stakeholders at national and subnational level are identified, project management structure at the national level is established and knowledge management tools are assessed, reviewed and first adjustments made in order to best support the overall project objectives and capacity-building activities.

- Activity 1.2.1 - Identify national institutions and/or national counterparts, establish National Bioenergy Team (Task Force/Bureau/Committee), select National Officers and identify organizational processes to assure the best representation of stakeholder interests.
- Activity 1.2.2 - Assess the adaptability of the analytical framework based on the specific agronomic and socio-economic contexts of participating countries, clearly identifying the appropriate determinants of food security within different bioenergy systems, to create sustainable bioenergy sectors based on full consideration of food security concerns.
- Activity 1.2.3 - Determine how methodological guidance and capacity-building materials for participating countries and targeted beneficiaries will be developed based on the analytical framework (adapted under 1.2.2).
- Activity 1.2.4 - Design a holistic and multidisciplinary bioenergy and food security knowledge management system and platform (linked to IBEP) that will create a forum for national debate and international comparative analyses and promote south-south and north-south cooperation.

Output 1.3 – Preliminary methodological guidance and toolkits that link food security to different bioenergy systems are available.

- Activity 1.3.1 - Develop guidance and toolkits to support mainstreaming at national and/or subnational level.
- Activity 1.3.2 - Publish, present and disseminate guidance and toolkits based on results of Activity 1.3.1.
-

Immediate Objective 2
Public and private stakeholders in countries have the capacity to integrate food security concerns into appropriate regulatory framework, policies and strategies for the development of sustainable bioenergy.

Outputs 2.1 – National counterparts, assisted by partner institutions and FAO have taken ownership of the analytical tools, models, and best practice methodologies and partnerships.

- Activity 2.1.1 - Assess training and capacity-building needs of counterparts and stakeholders.
- Activity 2.1.2 - Identify and nominate suitable partnering institutions based on assessed training and capacity-building needs.
- Activity 2.1.3 - Finalize methodological and technical guidance and capacity-building strategy, develop training materials and conduct training necessary to complete project activities.

Output 2.2 – Potential for bioenergy production and the implications for food security are analysed in the national and subnational contexts of the participating countries.

East Asia and Latin Central America), but to start enabling activities in neighbouring countries, to replicate and apply lessons learned from the core countries and foster regional collaboration.

- Activity 2.2.1 - Ensure the adaptation of the analytical framework developed in Immediate Objective 1 by the national team or task force of the participating countries.
- Activity 2.2.2 - Establish the bioenergy production potential, potential market opportunities and potential impacts on livelihoods, food security and rural development.
- Activity 2.2.3 - Present recommendations at national workshop(s) open to all interested stakeholders and publish and disseminate the results and lessons learned.

Immediate Objective 3
Three to five countries (with respective regional outreach to 2-4 additional countries per project region- i.e. sub-Saharan Africa, Asia-Pacific, Latin America), initiate coordinated action regarding the mainstreaming of food security bioenergy systems into rural development at the strategic level.

Output 3.1 - National bioenergy strategy is developed in a stakeholder driven process.

- Activity 3.1.1 - Review and strengthen institutional arrangements created under Objective 1 and ensure their systematic involvement into the project activities on the national and subnational levels, to carry out the development and implementation of the national strategy.
- Activity 3.1.2 - Elaborate best strategies and regulatory frameworks, adjustments of current policies or new policy instruments in order to ensure an integrated and sustainable approach to the food security-bioenergy nexus.
- Activity 3.1.3 - Organize business fora to facilitate exchange between the private sector in OECD and project countries.
- Activity 3.1.4 - Identify business models, public private partnerships and opportunities for technology transfer.

Output 3.2 – Pilot projects on bioenergy systems are identified and designed in the context of relevant rural development strategies and activities in the project area, country and other levels as relevant.

- Activity 3.2.1 - Identify local stakeholders and establish procedures for their participation in the project design process.
- Activity 3.2.2 - Identify, select and formulate projects that support food security and rural development strategies and are feasible for investment.
- Activity 3.2.3 - Identify best institutional arrangements and public/private partnerships suitable to implement pilot projects based on the findings of outputs 3.1-3.3.

Output 3.3 – Publication of final technical report on project results, lessons learned from country case studies and overall policy recommendations.

- Activity 3.3.1 - Draft, publish and disseminate results, lessons learned and experiences throughout the project and a final technical report.

For further information, please visit our website
www.fao.org/nr/ben/befs

or contact us
BEFS-Project@fao.org