BEFS
Bioenergy and Food Security Project

Project Brief

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1. The Bioenergy and Food Security Project

Recent years have seen growing interest in bioenergy within the developing world. This has been driven by a need to reduce dependency on fossil fuels and improve energy security and as part of wider global efforts to mitigate against the effects of climate change. Compared to other sources of energy, bioenergy potentially offers poor countries many advantages if properly managed. Firstly, a bioenergy sector can create a new market for producers as well as offer new forms of employment that will positively impact on agricultural and rural incomes, poverty reduction and economic growth. Secondly, bioenergy developments offer the opportunity for enhanced energy security by reducing the dependence on fossil fuels. Thirdly, bioenergy has the potential to contribute to environmental objectives including the reduction of green house gas emissions. Not surprisingly, bioenergy has been placed high on the policy agenda of developing countries. However, the rush to develop bioenergy alternatives to fossil fuels has tended to take place in the absence of a proper understanding of the *full* costs and benefits of bioenergy. The impacts of bioenergy, and more specifically biofuels, on food prices, economic growth, energy security, deforestation, land use and climate change vary by feedstock and by the method and location of production. This makes it difficult to draw *general* conclusions about the net impacts of bioenergy for countries, particular groups and households. Sound bioenergy policy development therefore needs to be the outcome of a context or country specific analysis of the net costs and benefits.

While there are a number of issues that surround bioenergy, the focus of the Bioenergy and Food Security project (BEFS) is to examine how bioenergy development may affect food security through two key instruments:

1. **The BEFS Analytical Framework** (AF) which examines the relationship between food security and bioenergy;
2. The development of the **BEFS tool box** to help improve understanding of the dynamics of the bioenergy and food security interface through a quantitative analysis.

These two instruments provide the means for examining the many varied consequences of bioenergy developments on **food security, poverty reduction and rural development** in specific country contexts. Policy-makers, mindful of possible tensions between bioenergy developments and social objectives, can use the BEFS tools to answer specific questions in order to guide bioenergy policy development. The BEFS technical analysis can help many questions and the following set provides an illustration of the types of issues that can be addressed by the BEFS tools.

- How will agriculture markets evolve and what are the likely impacts of bioenergy developments on this?
- How can bioenergy crops production represent an opportunity for rural development and poverty reduction?
- Where could bioenergy crops be produced without encroaching on protected areas or adversely affecting biodiversity? Which is the best land to use?
- Is it feasible to increase agricultural production in order to accommodate bioenergy and food markets? How could this be done sustainably?
- If not, is there potential for land expansion avoiding competition with agricultural land and food production?
- How will biofuel developments affect water resources?
- Can smallholders be involved in bioenergy production without compromising profits and costs?
- What are the likely trade-offs in choosing a particular bioenergy development path?
- Are prices of key food crops likely to change and if so, how would this affect household food security and vulnerability?

It is the answers to these sorts of questions through a quantitative analysis that provides strong support to policy makers in making informed decisions regarding bioenergy policy.

To date, the project has helped to inform better the bioenergy policy debate in the partner countries of Peru, Tanzania and Thailand. The analyses in these countries can be a useful starting point for countries in similar positions. Moreover, the BEFS tool box is available for use by any country wanting to understand the food security implications arising out of bioenergy developments.

There are four main avenues through which the BEFS project supports policy:

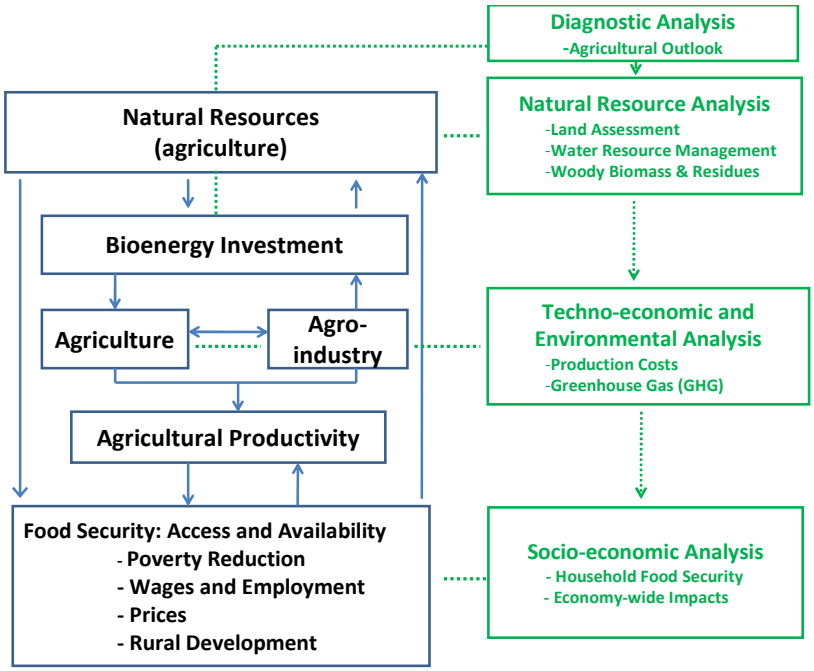
1. Analysis and knowledge development
2. Capacity building
3. Institutional building
4. South-south co-operation

2. Analysis and knowledge development: The BEFS Analytical Framework and tools

The impacts of bioenergy interventions are not always clear. In order to influence positively food security outcomes, it is important to consider the relationships between **natural resources, bioenergy interventions and food security**. The BEFS Project developed an Analytical Framework which captures the dynamics of these relationships. Building on this, the Project identified **four key areas of analysis** necessary to examine how food security outcomes are affected. Within each area of analysis a set of tools were developed to identify the key issues impacting on food security, poverty and rural development. These are as follows:

1.	**Diagnostic analysis**:	- Agricultural outlook
2.	**Natural resource analysis:**	- Land assessment
		- Water resource management
		- Woody biomass and residues
3.	**Techno-economic and environmental analysis:**	- Biofuel production costs
		- Greenhouse gas emissions
4.	**Socio-economic analysis:**	- Economy-wide impacts
		- Household food security
		- "Best practices" bioenergy projects

The following figure illustrates how the BEFS tools support the BEFS AF.



Each of the tools was selected to specifically support bioenergy policy in the BEFS project countries, namely **Peru**, **Tanzania** and **Thailand**.

The use of specific tools within the BEFS tool box varied across each country according to the bioenergy priority of the country.

In **Tanzania**, the main emphasis has been the consideration of liquid biofuels in order to promote energy security. However, there is understandable concern that biofuel development should not compromise the food security goals of the country so the BEFS tools have provided the basis for examining where the policy priorities should lie in pushing for a bioenergy industry.

Peru has already set mandates for liquid biofuels. In addition, the geographic diversity of Peru means that many people do not have access to grid electricity. Thus, finding local energy alternatives for local populations are seen as important initiatives to enhance energy security with positive implications for poverty reduction and rural development. In the case of Peru therefore, the BEFS tools have been used to guide policy implementation to support poverty and rural development goals.

Thailand has set an ambitious policy for biofuels and bioenergy in general. The energy plans of the country seek to increase biofuel provision for domestic use but also possibly for international markets. Enhancing energy security lies at the heart of bioenergy policy in Thailand but there is a clear recognition that bioenergy initiatives can do much to enhance rural development. The BEFS tools have been largely used to support future policy goals related to bioenergy and rural development.

2.1 Diagnostic analysis

Agriculture outlook

This part of the analysis builds on the Agricultural Markets Outlook analysis undertaken on a yearly basis within the Economic and Trade department of FAO. The component focuses on domestic agriculture markets and can assist the country in two ways: first it allows policymakers to get a feel for the agricultural baseline of the next ten years including food production outlook, import dependency and variation. Secondly, the analysis shows some of the impact of international and domestic biofuel policies on domestic agricultural markets. This component is based on the OECD-FAO outlook tool and described how the impacts of domestic and international bioenergy developments on domestic food production and how bioenergy developments may affect food production trends.

2.2 Natural resource analysis

Land assessment

This analysis identifies the fitness of a specific area of land for bioenergy crop production under a stated system of management. Land is assessed for its suitability by a consideration of climate, soil and site factors as they might affect *potential* productivity. Filters are used to identify the amount of suitable land that is available for bioenergy crop production by excluding areas already under agricultural production for food

crops or areas that are designated protected regions such as forests. Overall this will allow stakeholders to structure or further integrate their land-use planning strategy including for bioenergy developments, while identifying key food production areas.

Water resource management

This analysis examines the water resource and socio-economic implications of bioenergy crop expansion using a software tool called WEAP - the Water Evaluation and Planning system. WEAP is used to create simulations of water demand, supply, runoff, evapo-transpiration, reservoir operations, and other variables to examine water usage for biofuels using different feedstocks.

An additional tool to asses the implications of water resources and bioenergy is the water footprint assessment. This tool assesses how water resources are being used by various sectors in an economy and serves as a screening tool. The approach can be used for a first level assessment to identify how water resources are being used throughout the full chain of biofuel production. The results generated by the analysis can then be used to identify areas i.e. “hotspots” that required a more comprehensive analysis.

Woody biomass and residues

This analysis considers how woody biomass and residues, as one component in the bioenergy portfolio, can be developed to create local energy sources for local use. The analysis uses the Woodfuel Integrated Supply/Demand Overview Mapping model (WISDOM) which is a spatially explicit analysis of the supply and demand of biomass residues derived from agricultural production. The results identify areas according to the balance between the supply and demand for biomass residues.

2.3 Techno-economic and environmental analysis

Biofuel production costs

This component of the analysis assesses bioenergy productions costs. Selected feedstocks are analyzed in this component depending on country indications. Each feedstock is assessed under different processing systems given the following conditions:

(i) stand alone versus integrated mill and refinery
(ii) plant scale: large, medium or small
(iii) feedstock origin: (a) commercial, (b) outgrowers (c) a mix of these two

Based on the relevant mix of (i), (ii) and (iii), the analysis evaluates the technical and economic viability of biofuel production given the local knowledge base and manufacturing capacity. This will allow stakeholders to determine which biomass supply chain is technically and economically feasible and to what degree outgrowers can be included; an important component within poverty reduction strategies.

Greenhouse gas emissions

This study uses a life-cycle analysis to establish a green house gas baseline for bioethanol and biodiesel production from different feedstock crops. The analysis considers GHG saving under land use change and under crop-to-crop changes.

2.4 Socio-Economic analysis

Economy-wide impacts

The macroeconomic component of the analysis builds on the results from the biofuel production costs component bringing them into a nation wide model. The structure of the model includes a detailed breakdown of the agricultural sector and of the other sectors of the economy. The bioenergy sector competes for resources (land, labour, inputs and capital) and is initially very small. The sector consequently grows due to investments in the sector. Biofuel scenarios differ according to their production technologies and strategies, namely feedstock, scale of feedstock production and intensive versus extensive strategies. From a policy perspective, it is important to assess whether the implementation of a new sector, such as

bioenergy, can be beneficial for economic growth and poverty reduction. In order to strategically target poverty reduction, linking the production costs results to the economy wide effects can help policy-makers consider the necessary interventions needed to include small-scale outgrowers in the development of the sector and the preferred combination of large-scale estate and small-scale outgrowers scheme.

Household food security

There has been widespread concern regarding the surge in staple food prices. Many reasons explain the rise in prices of which bioenergy is one driver. It is important to realize that, while there may have been no significant bioenergy developments within a country to date, international biofuel mandates have been gaining steam and changes in food prices derive from international and domestic supply and demand shocks which include additional biofuel demand. In the short term household food security is affected by the increase in food prices. From a policy perspective, it is necessary to understand how the price changes can impact the *country as a whole* and which price changes the poorer segments of the population are most vulnerable to.

'Best practices' bioenergy projects

Bioenergy can promote development by reducing energy expenditures and providing more effective and timely delivery of energy and its related services. This could also lead to the development of alternative opportunities for income generation. A qualitative assessment can identify key factors of success underpinning best practice of bioenergy development in rural communities. The information generated from this type of assessment can help better understand the types of challenges that need to be overcome to ensure that bioenergy developments works for rural communities.

BEFS Analytical Components	Peru	Tanzania	Thailand
Diagnostic analysis			
Agricultural markets outlook	*	*	*
Natural resource analysis			
Land Assessment	*	*	*
Water resource management	*		*
Woody biomass and residues	*		
Techno-economic and environmental analysis			
Biofuel production costs	*	*	*
Greenhouse gas emissions			*
Socio economic analysis			
Economy-wide impacts	*	*	*
Household food security	*	*	*
'Best practices' bioenergy projects			*

The set of tools developed for the BEFS project are not exhaustive and may not necessarily be the critical tools for other countries. The BEFS tool box is **adaptable** in the sense that for each of the areas of analysis identified by the BEFS AF existing tools may be modified or new tools may be added that reflect the priorities and context of specific countries. For example, environmental objectives such as biodiversity and deforestation have an impact on local livelihoods and thus food security but this is not considered in the current BEFS analyses. However, existing tools can be modified to capture some of the effects arising from decreased biodiversity and deforestation and/or new tools can be introduced that look specifically at these dimensions.

A fuller discussion on the BEFS AF, the tools and the application of tools within the project countries can be found in the **BEFS Analytical Framework** document and all the **country** analyses respectively (see references).

3. Training: capacity building

Capacity and institution-building is crucial to long-term development. Lack of capacity is sometimes the greatest obstacle to development. Capacity building through training is an important aspect of how the BEFS project has transferred its knowledge base to the project country in order to enhance ownership of the tools. Training occurs at two levels: technical and policy. The **technical training** serves two purposes: 1) to develop the skill set of in-country expertise in the use of specific BEFS tools and 2) to ensure that technical experts understand how the information generated can be used to support policy. **Policy training** is essential because it allows decision makers to understand the complex links between bioenergy and food security. Through policy training decision-makers can see how the BEFS tools allows them to make or reject certain choices related to bioenergy development and how these choices align with pre-existing national strategies vis-à-vis food security, poverty reduction and economic growth.

4. South-south co-operation: knowledge transfer beyond BEFS

South-south co-operation has been an important dimension of the development agenda for some years. Principally south-south co-operation is seen as an important mechanism for ensuring better aid effectiveness, driving forward the regional development and a learning mechanism that can boost national capacities. A core process in the BEFS project has been training at the technical and policy level. Training within countries creates a critical mass of local expertise placing the BEFS countries in an optimal position to offer support to other developing countries, within the sub-region and across regions.

To date, the opportunities for increased south-south co-operation within the BEFS project have not been fully exhausted. However, the National University of Manizales in Colombia, which developed methodologies relating to technical capacity assessment, took part in the technical training program in Tanzania. The University also provided support to the technical work for Peru. In particular, the National University of Manizales lead the training and capacity building activities in Tanzania with the College of Engineering and Technology, University of Dar es Salaam.

5. Institutional building: policy dialogue

Identifying risks associated with bioenergy development are multi-faceted. The BEFs tool box contains tools that span across many disciplines to examine some of the numerous interactions between bioenergy and food security. The BEFS AF illustrates very clearly the need for bioenergy planning to be integrative across sectors. Just as the technical experts need to work together in order to understand the technical links across analytical tools, so the policy machinery needs to work across sectors, ministries and involve numerous stakeholders. An important element of the BEFS project has been institution building-by **bringing together** various actors and players to have joint discussions on the bioenergy issues relevant for the country. This has occurred through various **seminars** and a number of **high level meetings** in all the BEFS countries. The bioenergy debate in individual countries has been enhanced with information derived from technical analyses and so supporting the project countries to identify better where priorities need to lie. Full details of activities in the project countries can be found in the country briefs.

6. Regional policy dialogue

The BEFS AF is capable of being implemented in any country interested in assessing the impacts of existing or planned bioenergy developments. As bioenergy feedstock commodities and bioenergy outputs can be traded there is also potential for bioenergy developments to impact beyond country borders. These impacts are likely to be most pronounced at the regional level due to a range of factors including proximity, shared borders and transport corridors and regional trade agreements. As a result, there is considerable value in sharing the findings of the BEFS project in other countries with developing bioenergy industries; particularly at the regional level. To coincide with the BEFS Thailand Policy Consultation, a Regional BEFS Policy Dialogue was held bringing together bioenergy policy makers from across South and Southeast Asia to review the findings of BEFS project in Thailand and discuss bioenergy development and BEFS at the regional level. The Dialogue was used as a platform to launch new BEFS related activities in other Asian countries.

BEFS in Peru

Agriculture contributes about 8 percent to GDP in Peru. Even though this is a modest contribution compared to many developing countries agriculture plays a critical role in supporting the livelihoods of the *very poor* and ensuring their food security. Agriculture in Peru remains an untapped sector with lots of potential. This has provided strong argument for the government to find a range of alternative measures that boost not only agriculture but contributes to wider rural development in general. Bioenergy developments offer one avenue to regenerate the rural economy. Peru has already enacted a national biofuel strategy. A concern however is that in meeting the mandates set for ethanol and bio-diesel, the poor who rely on agriculture may face new pressures if biofuel developments do not involve them in feedstock production. A key question is whether this mandate can be met and also meet important socio-economic objective related to poverty, food security, income and inequality. Peru has three distinct regions- the *costa* (coastal area), the *selva* (jungle area) and the *sierra* (the mountainous areas of the Andes Mountains). The natural geography within each region inevitably underpins the manner of development. All three regions practice agriculture but it has been evident for some time that a one-size-fits-all agricultural/bioenergy policy cannot work in Peru because of the diverse nature of problems characterizing the agricultural sector in each region. The emphasis in Peru thus needs to centre on a full consideration of the portfolio of options that bioenergy represents. The bioenergy discussion must extend beyond the production of biofuels to consider alternative bioenergy sources using waste residues from agriculture and forestry. The creation of local energy provision using "free" waste resources can do much for poverty reduction by providing cheaper energy and offering new income earning opportunities. The BEFS analysis in Peru has examined how bioenergy developments can be structured to support rural development through livelihood support and through alternative energy provision.

1. Analysis and knowledge development

Technical work

The profile of the work in Peru considers a number of technical and socioeconomic issues relevant for agriculture and bioenergy. The analysis is supported by a consideration of both bioenergy and food security crops and also considers the availability of biomass from residues generated from agricultural, agro industries and forestry activities. Bioenergy and especially biofuel developments, in principal, hold much promise for improving agricultural growth for the benefit of the poor. However, while a mandate has been already set in Peru feedstock production for biofuels can have serious consequences on food production because they compete for the same resources. Thus, an important question is whether the mandate can be met without compromising the food security status of Peru.

The BEFS analysis in Peru identifies the potential for bioenergy development from a natural resource perspective recognizing the opportunities and pressures that changes in their use may pose to the poor. The analysis is not limited to biofuels but considers the potential of using waste resources from agricultural and forestry activities for energy use. This is an important dimension in the Peru analyses because the discussion on bioenergy is not limited to a consideration of liquid biofuels. It is important that the entire range of bioenergy options is considered if rural development potentials are to be correctly analysed. Whilst the BEFS analyses are not fully comprehensive in this consideration it does emphasize the importance of alternative bioenergy options.

The analysis considers the following feedstock: ***Sugar Cane, Palm Oil and Jatropha.*** The most important **food security crops** in Peru are ***Rice, Maize, Wheat, Potato and Sugar.***

Key messages

- Agriculture in the coastal regions of Peru faces an enormous challenge in terms of water access in the future. Agricultural production whether for food or for biofuels will have to be produced with less water because of the pressures that come from urbanization, industrialization of the agricultural sector and climate change. In the future agricultural producers need to increase water use efficiency and improve agricultural water management. The increase in irrigation efficiency would also require irrigation infrastructure in terms of water storage capacity and will need to be accompanied by better crop programming that optimizes the use of water.
- Many of Peru's regions having important volumes of sustainable woody biomass and residues that could potentially be used to provide local energy solutions in rural areas. Further analysis is required to determine what proportion of this biomass will actually be feasible for energy generation in each region. There is a high potential for energy use from agricultural residues, but policies are required to promote such use. National and regional policies to promote high density forest or shrub plantations for energy used are required for areas that exhibit supply and demand balance deficits, especially in the Sierra region.
- Including smallholders in the supply chain can under some conditions be competitive with biofuel production systems that are purely large scale. This requires policy interventions and appropriate institutional constructs to support collective action by smallholders so that they can access more of the financial dividends offered from the bioenergy sector.

2. Capacity building

As part of its capacity building activities, the BEFS team trained experts in the country on the components of the analysis outlined. Contacts and institutions are listed in the box below.

Land assessment		
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1 The participation of the Ministry of Agriculture was coordinated by office of Ing. Noriega, Director of Dirección General de Competitividad Agraria.

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[2] Two trainings were carried out, first a STATA course to refresh participants in the use of the program followed up by a course on the Household Food Security analysis methodology.

3. Institution Building

The work in Peru has involved supporting policy-makers in the management of natural resources for energy provision and poverty reduction. While the information generated by the BEFS analysis is *not* prescriptive, it serves as an important starting point for the series of decisions that Peru will need to consider in the evolution/development of the sector. The project analysis supports decision-making in a number of ways:

1. Explains why agriculture may need to change
2. Keeps a focus on what is important while managing risks and entitlements
3. Strengthens relationships and builds capacity

This support was provided specifically by bringing technical experts, key decisions-makers and other stakeholders together in order to develop a dialogue and build consensus around the main issues arising out of bioenergy policy in Peru. The BEFS project in Peru facilitated the policy dialogue through various policy/technical seminars, high-level conferences and workshops. The purpose of the exchange has been to discuss the policy implications that emerge from BEFS analytical results in Peru.

4. Peru Outputs and outcomes

1. Bioenergía y seguridad alimentaria "BEFS", El análisis de BEFS para el Perú, Compendio técnico, Volumen I: Resultados y conclusiones, Volumen II: Metodologías, Environment and Natural Resources Working Paper No. 39- FAO, Rome, 2010
2. Bioenergy and food security, The BEFS Analysis for Peru, *Supporting the policy machinery in Peru,* Environment and Natural Resources Working Paper No. 40 - FAO, Rome, 2010 (also in Spanish)
3. Support in the creation of the National Multi-sectorial Bioenergy Commission November 2009
4. High Level Policy Dialogue and Consultations in February, April and May 2010
5. Training on the BEFS technical tools - January through August 2010

BEFS in Tanzania

The majority of Tanzania's poor live in rural areas, and continue to rely on conventional biomass for basic energy services. In common with many African countries, Tanzania's dependence on agriculture is likely to remain high for some time to come. But if agriculture is to provide the basis of future growth and poverty reduction, the sector requires urgent modernization in order to improve productivity and generate growth. Development of a bioenergy sector has brought together the energy and agriculture sectors in an unprecedented way. This creates a new dynamic and places great pressures on agriculture to provide a steady supply of inputs to the industrial sector, given the current landscape of the agriculture sector in Tanzania, dominated by low yields and smallholders. The danger is that bioenergy developments can easily bypass the poor favouring instead large-scale producers. Nevertheless, it is clear that the status quo in agriculture is not an option. The question is whether bioenergy can be a catalyst for improved agricultural productivity in Tanzania. Ex ante this is difficult to predict but the BEFS tools offer a comprehensive analysis that looks at multiple dimensions of the issues involved in biofuel development ranging from the physical and technical to the socio-economic dimensions. In this, the BEFS tools assists the government of Tanzania in finding solutions on how best to marry potentially conflicting interests and include the poor in the energy development.

During its course the BEFS project has supported and worked in close collaboration with the Ministry of Agriculture, Food and Cooperatives and Ministry of Energy and Minerals and other key Government ministries including the Bioenergy Task Force.

1. Analysis and knowledge development

Technical work

The Tanzania analysis undertaken considers a number of bioenergy and food security crops as suggested by the Government, namely ***Cassava, Sugar Cane, Palm Oil, Jatropha, Sweet Sorghum*** and ***Sunflower***. The most important **food security crops** were selected on a per capita calorie consumption basis, which in Tanzania are ***Maize, Cassava and Rice.*** These crops will be central to the analysis throughout the components, although particular components may focus on slightly different crops because of the nature of the analysis as well as issues of data availability.

It is important to stress though that the analysis is not limited to these crops, through training activities in the country, the crops of interest can be expanded. Further, Tanzania can look at other BEFS analytical components in the other BEFS countries for extensions of the technical work undertaken.

Key messages

- Tanzania has enormous potential to develop a bioenergy sector. Biofuel developments can be an important catalyst that regenerates the agricultural sector by bringing in new private, as well as public, investment.
- Dividends from investing in biofuels can have positive impacts on poverty reduction and growth. This result rests on the assumption that the necessary public investments needed to support biofuel development will be forthcoming so that profits from the sector are more equitably distributed for the benefit of poor rural populations.
- The Government of Tanzania needs to select a bioenergy development pathway that is consistent with existing plans for energy, poverty reduction and food security to avoid misallocation of public funds.
- Small-scale cassava production can be an optimal bioenergy pathway in Tanzania. It is recommended that the BEFS analytical framework is used further to explore this option.

- Concern that biofuels may compete with food production can be overcome through increased public and private investment targeted to improving the low food crop yields that have characterized the agricultural sector in Tanzania for some time.

2. Capacity building

As part of its capacity building activities, the BEFS team trained experts in the country on the components of the analysis outlined. Contacts and institutions are listed in the box below.

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3. Institution building

An important contribution of BEFS is the information generated by the technical work. This information serves as an important guide to policymakers of the various choices that could be taken in the development of the bioenergy sector. These choices have to be balanced against the national priorities of the country. In Tanzania, the key concern for policymakers is how best to promote bioenergy development pathways that are consistent with food security and poverty reduction strategies and reject those options that could potentially bypass vulnerable population groups. The biomass potential and biofuel production costs components of the analysis consider a range of options in bioenergy development, including optimal land use planning, optimal smallholder-land scale mix, agriculture management options and industrial set up combinations.

While all the options may lead to strong national growth, specific pathways can result in more inclusive development so that the dividends from growth are more equitably distributed. This is an important

dimension of the analysis. The economic analysis components consider the dynamic interaction between domestic biofuel development and international agricultural policies at the economy-wide and household level. The key message from the analysis suggests the importance of good management of the processes that will drive the development of the bioenergy sector in order to minimize negative impacts on food security and agricultural livelihoods. The considerations involved in how best to develop a bioenergy sector are complex and multifaceted. BEFS allows the policy-maker to consider these decisions in a more systematic way.

The BEFS team worked along side the Ministry of Energy and Minerals and the Ministry of Agriculture, Food and Cooperative initially supporting bioenergy taskforce in the formulation of the bioenergy policy guidelines and, in the second phase, supporting the biofuel guidelines task force in the formulation of the bioenergy policy. BEFS has provided support in two ways. On the one hand BEFS has fostered multidisciplinary discussion considering the nature of the subject matter, on the other BEFS has provided practical policy training illustrating how the BEFS approach can be used in as evidence to support policy formulation.

4. Tanzania outputs and outcomes

1. BEFS Technical consultation February 2009, Dar Es Salaam
2. BEFS Final Consultation May 2010, Dar Es Salaam
3. Training on the BEFS components and the support offered to policy makers to the Bioenergy task force in November 2009
4. Training on the BEFS components and the support offered to policy makers for high level management in the Ministry of Agriculture Food and Cooperatives and in the Ministry of Energy and Minerals in January 2010
5. Technical training on BEFS analytical components March to May 2010
6. Bioenergy and Food Security – The BEFS Analysis for Tanzania, Environment and Natural Resources Working Paper No. 35 - FAO, Rome, 2010
7. including technical analysis from BEFS components and policy discussion section considering key issues in bioenergy and the role of policy in supporting agriculture sector growth.
8. Supporting the Bioenergy Task Force in the country
9. Technical support to the biofuel guidelines and the biofuel policy processes

BEFS in Thailand

Thailand is a middle-income country with one of the most robust economies in Asia. Agriculture has been instrumental in Thailand's economic development. About one-third of Thailand's total land area is dedicated to agricultural production. Even though agriculture in 2008 accounted for less than nine percent of GDP, the sector still continues to be important in terms of employment accounting for approximately 39 percent of the Thailand's labour force. Thai agriculture is still dominated by poor smallholder producers. Thailand has seen remarkable progress in human development in the last twenty years. However, despite this success, progress has not benefited everyone equally. Those Thais who remained in the domestic economy, such as small-scale farmers, have generally received fewer benefits, proportionately. As a result, a number of development challenges persist, particularly for certain groups and geographical regions. Farmers constitute about 30 percent of the total population of Thailand; they remain among the poorest part of the population

Thailand already has a rapidly developing biofuels sector. The Thai Government wants to encourage the use of biofuels and other alternative energy sources to strengthen energy security, foster rural development and reduce greenhouse gas emissions from the energy sector. Thailand has established ambitious targets for the further development of the biofuel sector.

Thailand's policy framework for bioenergy is underpinned by the Alternative Energy Development Plan, which covers the 15 year period from 2008 until 2022. The plan is broken into three phases (Short-Term 2008-2011, Medium-Term 2012-2016 and Long-Term 2017-2022) and aims to increase the share of Thailand's energy supply delivered from alternative energy sources to 20.4 percent by the final year of implementation. The plan includes targets for a wide range of alternative energy sources including electricity and thermal energy from renewable resources and alternative transport fuels including biofuels and natural gas.

1. Analysis and knowledge development

Technical work

The BEFS analytical framework is for policy makers to analyze the interplay between land availability, bioenergy production potential, rural development and food security and assess different bioenergy pathways. The BEFS project in Thailand is strongly focused on issues associated with the development of the biofuels sector.

The Thailand the analysis undertaken considers a number of bioenergy crops as suggested by the Government, namely ***Cassava, Sugar Cane, Palm Oil.*** The most important **food security crop** in Thailand is ***Rice.*** These crops will be central to the analysis throughout the components, although particular components may focus on slightly different crops because of the nature of the analysis as well as issues of data availability.

It is important to stress though that the analysis is not limited to these crops, through training activities in the country, the crops of interest can be expanded. Further, Thailand can look at other BEFS analytical components in the other BEFS countries for extensions of the technical work undertaken.

Key messages

- Initiatives to sustainably improve the productivity of Thai farmers should be prioritized through R&D, extension services and incentives.
- Clear guidance should be developed and provided to Thai farmers regarding land use and crop changes to ensure that threats to food security are avoided and excessive harmful greenhouse gas emissions and biodiversity loss are mitigated.
- Initiatives to improve agricultural productivity in Thailand should include an assessment of the potential benefits, costs and barriers to the expanding sustainable irrigation practices.

- Research should be commissioned into the potential impact of ineffective wastewater treatment on water systems proximate to biofuel production facilities for the purpose of developing a sector-wide wastewater management strategy.
- Measures to improve the public perception of biofuels and develop the flexible-fuel ethanol vehicle market should be prioritized to ensure that domestic market demand for biofuels grows to meet the anticipated production.
- Further investigation and monitoring should be commissioned to better understand the impact of the biofuel sector on households and the Thai economy and develop more appropriate strategies to ensure that biofuel developments benefit poorer communities and do not lead to further incidence of poverty and a worsening of food security.
- Support and incentives to encourage biofuel producers to adopt renewable energy technologies should be continued and strengthened as instruments to improve the environmental sustainability and competitiveness of biofuels produced in Thailand.
- A regular, multi-stakeholder review of progress toward the AEDP targets should be established to ensure that the targets are being met sustainably and not at the expense of food security and the environment.

2. Capacity building

As part of its capacity building activities, the BEFS team trained experts in the country on the components of the analysis outlined. Contacts and institutions are listed in the box below.

Agricultural market outlook		
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3. Institution building

In Thailand the BEFS project focused on the institutionalization of the BEFS Analytical Framework. Thai governmental institutions and academia were selected to carry out the analysis in close collaboration with the BEFS Thailand Team. In January 2010 the BEFS Partners Consultation was organized with the purpose of bringing together the technical experts in order to discuss their technical work, findings and the related inter-linkages on the bioenergy development in Thailand. The consultation was a preparatory meeting for the BEFS Technical Consultation where the final findings were presented to a wider audience to invite for comments from experts and identifying gaps in the analysis. Policy implications were discussed in order to build consensus. Finally, the BEFS project in collaboration with the Thai National Economic Social Development Board organised the BEFS Policy Consultation to develop the platform where high level technical officers and policy-makers discussed the BEFS policy recommendations to achieve the AEDP biofuel targets in a long-term sustainable manner.

The BEFS Thailand Team worked along side the Thai National Economic Social Development Board to foster the BEFS analysis and the policy recommendations into the Eleventh National Economic and Social Development Plan where the nexus of energy and food and the climate change issues are high in the agenda.

4. Thailand outputs and outcomes

1. BEFS Partners Consultation, 26 January 2010, Bangkok
2. BEFS Technical Consultation, 11 March 2010, Bangkok
3. BEFS Policy Consultation, 15 June 2010, Bangkok
4. BEFS Regional Policy Dialogue, 16 June 2010, Bangkok
5. Technical training on BEFS analytical components, July 2009, Bangkok
6. Bioenergy and Food Security – The BEFS analysis for Thailand, Environment and Natural Resources Working Paper No. 42 - FAO, Rome, 2010
7. BEFS Thailand – Key results and policy recommendations for future bioenergy development, Environment and Natural Resources Working Paper No. 43 - FAO, Rome, 2010

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(http://www.fao.org/bioenergy/foodsecurity/befs/en/)

Further information on BEFS can be found in

http://www.fao.org/bioenergy/foodsecurity/befs/en/