CHAPTER 1

EXPLAINING THE CONTEXT OF THE BIOENERGY AND FOOD SECURITY PROJECT (BEFS) IN PERU

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1.1 INTRODUCTION

Bioenergy, and particularly liquid biofuels, have been promoted as a means to enhance energy independence, promote rural development and reduce greenhouse-gas emissions. In principle there are many benefits offered by bioenergy developments but these need to be balanced against the impacts on food security and the environment. While there has been a rush by many governments to develop bioenergy alternatives to fossil fuels this has often been done in the absence of a wider 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 and climate change vary by feedstock, as well as the method and location of production. This makes it difficult to draw general conclusions about the net impacts of bioenergy which can hinder sound policy development. However, a critical issue lies in the ability of the bioenergy sector to use the natural resources on which it depends in a sustainable manner and for the benefit of those communities that rely on this natural resource base for their livelihoods. Policy development for bioenergy requires concerted and coordinated strategies across a number of sectors from agriculture to environment to energy to public works.

Throughout most of the developing world agriculture plays a critical role in supporting the livelihoods of the very poor. This is even the case where agriculture represents a relatively small proportion of GDP. In the last 50 years the importance given to agriculture by many developing country governments has dwindled. Perversely cheap global food prices removed the incentive for long-term investment in agriculture resulting in structural stagnation within the sector. This stagnation became painfully evident in the food crisis that started in 2005 and peaked in 2008, and represented the first serious global food crisis for three decades. What emerged was a renewed and wider recognition of the essential role played by agriculture in supporting the food and livelihood needs of the poor. Since then there have been serious concerns over the promotion of bioenergy because of the competition the sector creates for resources used for food production and environmental preservation. The effect of biofuel production on food prices remains a major cause for concern. High prices for key agricultural crops can have negative impacts on developing countries, especially those that are highly dependent on imports to meet their food requirements. The extent to which higher crop prices hurt or help poor people in developing countries varies depending on their net position as producer or consumer.

Even though agriculture contributes very little to GDP in Peru compared to other developing countries, it has a critical role in supporting the livelihoods of the very poor and ensuring their food security. However, agriculture is an untapped sector with lots of potential and its relatively poor productivity is strong argument for governments to find a range of alternative measures that boost not only this sector but rural development in general. Even though the contribution of agriculture sector to GDP is 8percent, the sector remains important for rural populations dependent either directly or indirectly on the sector. Peru has enacted a national liquid biofuel strategy. The concern is that in meeting the mandates set for ethanol and biodiesel, the poor may be bypassed. The key question is one of whether this mandate can be met simultaneously the promotion of some socio-economic objectives. The BEFS tools serve to examine if and how smallholders can play an important role in helping to meet the mandate. Peru has three distinct regions where the natural geography inevitably underpins the manner of development. All three regions practise agriculture but it is clear that a one-size-fits-all agricultural/bioenergy policy cannot work in Peru. The emphasis in Peru needs to centre on a full consideration of the portfolio of options that bioenergy presents. Thus, the bioenergy debate must extend beyond the production of liquid biofuels to consider also alternative energy sources using sustainable woody biomass and residues or by-products generated in the agriculture and forestry sectors. The creation of local energy provision using "free" biomass resources from residues can do much for poverty reduction by providing cheaper energy and also offering new income earning opportunities.

The BEFS project analyses the extent to which bioenergy can be an instrument to enhance agricultural productivity for the benefit of the poorest groups which includes smallholders. It is not an *ex ante* endorsement of bioenergy but rather an exploration into whether a bioenergy sector can be economically viable and if so, can the sector be structured in a way that delivers on socio-economic fronts. This policy compendium is structured as follows. This chapter, (Chapter 1) presents the context of the Bioenergy and Food Security Project in Peru. Chapter 2 considers the Bioenergy and Food Security Policy landscape in Peru in order to contextualise the policy setting against which the BEFS analysis takes place. Chapter 3 provides a discussion on how the use of the BEFS analysis in Peru and the tools developed. Finally chapter 4 presents a discussion that helps orient bioenergy policy for sustainable development.

1.2. AGRICULTURE, BIOENERGY AND FOOD SECURITY IN PERU

The performance of the Peruvian economy is very much a function of the geography of the country. This is characterized by three distinct regions: an arid costal region (costa), the mountains of the Sierra (the Andes) dominating the central zone and tropical forest (the selva) to the north and east of the country bordering Colombia and Brazil. The metropolitan area of Lima is generally considered separately from these areas. Thirty six point four percent of the population lives in the costa areas, 38 percent in the Sierra, 23.7 percent in the Selva. Twelve percent of the total population lives in Lima. The most densely populated sub-regions are costa norte, sierra centro, sierra sur and Lima. Mining dominates the Peruvian economy and in the period 2002-2009 the growth rate moved

from 4 percent to an impressive 9 percent. High world prices for minerals and metals and a policy on sustained trade liberalization helped to stimulate the economy although this rate of growth fell slightly as a result of the global recession of 2009.

High growth rates of recent years helped reduce the national poverty rate by 15 percent between 2002 and 2008. However, there remains large disparity in income levels across segments of the population with a strong divide between rural and urban households. Poor household's income in rural areas is close to half of the urban poor. The food expenditure share for households in Peru remains a significant share of total expenditure. Overall households spend close to 40 percent of their income on food and this share increases substantively for the very poorest of the population. The poorest households spend 50 percent of their expenditure on food and in rural areas, this share amounts to three fifths of total household expenditure (see Household Analysis, chapter 8 in the BEFS Technical Compendia).

Most of Peru´s arable land is in the costa region where the bulk of agricultural production takes place in the river valleys along the costa. In the Sierra (Andean), agriculture is largely subsistence and in the Amazon (jungle) regions, agriculture has developed much more slowly although there are some exceptions[1] (see discussion in Land Suitability Analysis, Chapter 3 BEFS Technical Compendia). Total agriculture area is roughly 24 percent of total land area. Agricultural areas can be increased and there is the potential to do so but there is equally concern that this is at the cost of widespread deforestation. Forest areas cover 70 percent of total land and include the tropical rainforest of the Amazon. Climate plays an important role in Peru's agricultural development. The climate is tropical in the Amazon regions. By contrast, west of the Sierra Mountains drought is a serious problem. Agriculture is highly dependent on irrigation systems in the costa regions (See Land Suitability and Water Analyses in BEFS Technical Compendia, chapters 3 and 4 respectively). Peru's main food export crops are sugar and coffee. Potatoes, alfalfa and plantains are non-tradeables while poultry, rice, maize, and palm oil are among the main food imports. Most of the tradable crops are grown in the costa regions. The non-tradable crops are mostly cultivated in the Sierra and the Selva. Most farmers are small scale producers farming an average of 1-5 hectares and are found in the Sierra region. Small farms grow potatoes, maize and plantain while the large commercial farms and rice, sugar cane, maize, coffee, and alfalfa. Better access to financial and infrastructure services means that nearly all commercial agriculture is located along the costa.

In spite of strong macro-economic performance underemployment in Peru remains high and inflation exceeds the Central Bank's 1-3 percent target. A high dependence on minerals and metals means the economy's fortunes move with fluctuations in world prices. The extreme geography of the sierra and the Selva combined with poor infrastructure

1 San Martin in the Selva Region provides a notable exception to rural development strategies that center on raising agricultural productivity (see Chapter 3 of the Policy Compendium).

linking these regions to the costa has meant that growth has been confined to Peru's costa areas. Not all Peruvians have enjoyed the benefits of growth.

1.3 BIOFUELS AND BIOMASS

In order to stimulate demand for liquid biofuel production and use, Peru established mandates in 2007 setting mandatory blending of ethanol to 7.8 percent in 2010 and 2 and 5 percent biodiesel blend with diesel by 2009 and 2011, respectively. Bioenergy is seen as an important vehicle to diversify the country's energy sources as well as stimulate growth and employment opportunities. Bioenergy development is an important element in anti-narcotics initiatives. The development of bioenergy in the Amazon in particular is being promoted as a viable alternative to drug cultivation.

For ethanol [2] production, the main feedstock is sugar cane. Peru produces over 7 million tonnes of sugar cane concentrated in the costa region. Sugar cane in Peru is all year and yields range from 53 to 190 MT per hectare. The ethanol industry estimates that about 200 000 ha of sugar cane are under development for ethanol. Maple Energy, a biofuel company, plans to produce 30 million gallons of ethanol from over 10 000 ha in the dry areas of Northern Peru. Sugar cane will be produced under drip irrigation using water from the Chira River. The use of drip irrigation is seen as efficient. However, there are widespread concerns that sugar cane expansion may threaten environmental sustainability because of mono-cropping, soil erosion, crop disease and failure (See Water Analysis in BEFS Technical Compendia, chapter 4). Biodiesel production is also under development in Peru. The main feedstocks are palm oil and Jatropha.

Palm oil production is around 48 000 tonnes per year. Palm oil production is also expanding in the Amazonian provinces of Ucayali, San Martin and Loreto, where deforested land is being converted to palm oil plantations. Such an expansion of palm oil for biodiesel in the poorly developed Amazon region is being pushed as part of Peru's anti-narcotics strategy by creating alternatives to drug cultivation. Through the mandates, Peru has signaled a clear commitment to liquid biofuels. The BEFS analyses show however that land and water pose significant constraints to large scale biofuel development. About 40 percent of land in Peru is under forest and almost half is protected. This means the amount of actual land available for agricultural production is in fact quite limited (see Land Suitability Analysis in BEFS Technical Compendium Volume I, Chapter 3). Most arable land is used for sugar cane for sugar. Palm oil has the potential to grow on some deforested lands.

The bioenergy debate in developing countries has tended to focus much on liquid biofuels thereby ignoring the potential to develop other forms of bioenergy. Woody biomass and its conversion to bioenergy is an important new energy market. Many rural economies could potentially benefit from bioenergy developments utilizing woody and residue biomass which

2 Ethanol as discussed in this report refers to ethanol for use in transport sector.

could provide employment to those engaged in its development as well as supply energy to poor communities who have no access to energy. However, just because the potential for use of woody and residue biomass for energy production does exist in Peru is some regions, this requires regional and national government commitment for the opportunities to be realised. An important dimension on use of woody and residue biomass for development in Peru is the local benefits created that can help resolve local energy needs. Indeed, given the geography of Peru providing grid electricity is simply not a viable option across the country. Thus finding local solutions for energy access becomes an important element in poverty reduction initiatives.

1.4 FOOD SECURITY AND POVERTY

Thirty nine point three percent of the Peruvian population lives below the national poverty line- this is equivalent to 10 770.967 million people (ENAHO, 2008). Of this 3 764.688 million or 13.7 percent live in extreme poverty. Although the country ranks 82nd out of 177 countries (2006 HDI), it characterizes for its stark disparities reflected in a Gini coefficient of 0.55 (1 indicating complete inequality).The percentage of the population not having enough calories to eat is 31.6 percent (ENAHO) and chronic infant malnutrition is a staggering 21.5 percent (ENDES, 2008). 33.1 percent of children less than five suffer from anaemia (MONIN, 2008) and the figures are much higher in the highlands (60-70 percent). Insufficient allocation of public resources in the areas of health, education and infrastructure, as well as limited availability of farming land and very low yields of agricultural production in areas higher than 3 000 meters above sea level make the Southern Andean population extremely vulnerable to food insecurity. Forty two percent of the population cannot cover the minimum required caloric intake (2 100 kcal). A lack of access to food commodities, poor consumption patterns, inadequate child care and nutrition practices and poor educational levels among mothers, are the main causes of chronic undernutrition in Peru (see Escobal, 2010 for a fuller exposition on rural poverty and development).

1.5 BEFS - SUPPORTING RURAL DEVELOPMENT AND FOOD SECURITY IN PERU

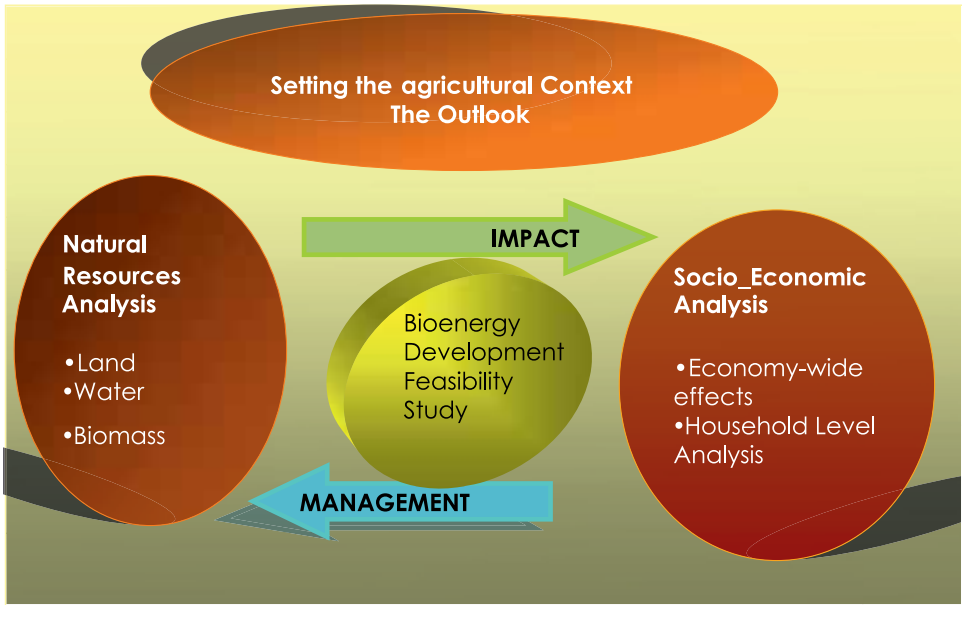
Within the BEFS analytical framework three important relationships are examined: agriculture and poverty, energy and poverty and energy and agriculture. Bioenergy has linked energy and poverty issues with the agricultural sector bringing a new set of considerations to the development agenda. It has been well-documented that agriculture remains central to poverty reduction and consequently food security in the developing world. At the same time inadequate energy access is an often overlooked dimension of poverty which locks many people into a poverty trap. Bioenergy has linked in a very direct way the energy sector with agriculture with implications for poverty and food security. In principle, bioenergy developments offer a number of advantages. Firstly, bioenergy can be developed using widely available resources that can be converted to convenient forms of energy. Secondly, the 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. Thirdly, bioenergy can contribute to green house gas emissions and other environmental objectives. Fourthly, the sector can offer direct access to cheaper forms of energy for poor households potentially thus improving the productivity of capital, both

human and physical. However, for these benefits to be realized requires careful choices in the design and implementation of bioenergy policies. The BEFS analysis emphasizes that natural resource use for bioenergy will only be able to support sustainable development, livelihood promotion and environmental protection if these goals are well-integrated into policy design and implementation. The economic viability of bioenergy tends to require extensive land area which can affect food security, social welfare, and biodiversity. In addition bioenergy can place a strain on water and forestry resources. To minimize these impacts, energy planning needs to be more integrative across other sectors involving land-use planning, forestry planning, water planning and more effective governance. Given the limited financial resources and human capacity in developing countries the BEFS project places a strong emphasis on bioenergy developments based on readily available natural resources and the prevalent technology base. Integrating bioenergy generation into existing sector policies can help minimize risks.

The BEFS Analytical Framework (AF) in Peru, Figure 1.1, identifies the potential for bioenergy development from a natural resource perspective recognising the opportunities and pressures that changes in their use may offer to the poor. This approach is articulated in the diagram below. The analysis is not limited to liquid biofuels but considers the potential of using readily available resources generated from sustainable forest management and residues or by-products generated from agricultural and forestry activities for energy use. The results of the analysis strongly support the view that it is the management and structure of the sector that is vital to ensure that the gains are maximised and the risks as far as possible minimised.

Figure 1.1

BEFS Peru Analytical Framework



1.6 USING BEFS TO SUPPORT THE POLICY MACHINERY IN PERU

There are four key ways in which the BEFS project supports policy processes in Peru. These are:

- the development of research tools that are tested using country specific data to provide an analytical starting point for bioenergy issues (technical work)
- the promotion of a policy dialogue between key stakeholders using the results generated by the analysis (policy support)
- capacity building (training)
- South-south co-operation. Using local human capital to assist other developing countries in policy effectiveness for bioenergy

The profile of the BEFS analytical framework in Peru considers a number of technical and socioeconomic issues relevant for agriculture and bioenergy. In addition the analysis is supported through the consideration of both bioenergy and food security crops as well as availability of biomass from residues generated from the agricultural, agro industries and forestry activities.

The BEFS analysis is structured as follows:

1.6.1 AGRICULTURE MARKETS OUTLOOK IN PERU

The analysis of BEFS in Peru commences with examination of the agricultural outlook for Peru. What the analysis considers is how agricultural markets will evolve over the next ten years assuming that existing policies prevail. It captures the ability of the sector to cope with changes or not and thus can help guide policymakers in understanding what needs to e done today in order for the sector to perform well in the future.

1.6.2 NATURAL RESOURCE ANALYSIS IN PERU

There are three main components:

1.6.2.1 Land suitability for production of bioenergy crops: The analysis identifies the extent and location of areas suitable for bioenergy crop production under different agricultural production systems and input levels.

1.6.2.2 Water Resources: The analysis permits a better understanding of the effects that an increase in liquid biofuel production may have on water resources.

1.6.2.3 Biomass resources from residues: considers the spatial distribution of biomass residues supply and biomass consumption for fuel uses.

1.6.3 LIQUID BIOFUEL PRODUCTION COSTS IN PERU

This analysis looks at productions costs from a social perspective through an explicit consideration of how liquid biofuels production set-ups can incorporate small scale farmers and still be profitable. In essence, the study carries out a feasibility analysis but given the consideration of competitiveness through smallholder participation, the analysis lends support to governments in their dialogue with the private sector. Specifically, it

permits some degree of harmonisation between profit- motivated interests of the private sector and the wider social objectives.

1.6.4 SOCIO ECONOMIC ANALYSIS IN PERU

1.6.4.1 Economy-wide Effects in Peru: 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, this module considers how the various liquid biofuel set-ups analysed in the liquid biofuel production cost analysis can contribute to wider socio-economic goals.

1.6.4.1 Household-level Food Security in Peru: this analysis examines how bioenergy may result in the price movements of key food crops with implications for household food security. The analysis offers profiling of vulnerable groups that may experience food insecurity as the agricultural sector adjusts and adapts to the demands of the bioenergy sector.

This technical work provides the "building blocks" for examining bioenergy and food security. They offer a number of analytical tools, the robustness of which is tested using country data. The results generated by the data should not be seen as definitive but instead as illustrative of the use of the tool. The analysis carried out in each country has two significant roles. First, the results represents a springboard for future analyses using the BEFS tools so that the information generated can be used to guide and fine-tune policy developments as the sector evolves. Second, the actual results of the current country analyses represent an important contribution to the debate on how policy should evolve in each country. It should also be noted that these analytical tools represent the basis of an analysis that can be extended and/ or complemented by adding other components that reflect the policy objectives of individual countries. Over time some of these components may become less important while new ones are added to reflect the prevailing policy climate surrounding bioenergy and food security.

Finally, it should be noted that the results presented by the analysis are not intended to be definitive nor do they represent an end-point in the contribution made by BEFS to the bioenergy debate in Peru. The analysis has two main functions. First, it illustrates the use of the tools and secondly, the results, offer a starting point for policy-makers on some key issues surrounding bioenergy development in Peru. It is stressed that continued use and extension of the BEFS tools are essential to provide a more comprehensive analysis for policy development.

1.7 POLICY CONSIDERATIONS

Promoting a sustainable bioenergy sector that also seeks to enhance social welfare requires the development of policy constructs involving a range of stakeholders across a number of institutions and ministries. There are numerous economic, social, and environmental implications of bioenergy. In Peru, many policies already exist for managing natural resources but it is clear that for sustained bioenergy attention needs to be given to better enforcement of existing regulation, especially those covering deforestation. In addition, new

pressures on agriculture generated by the competition over natural resources will require quite specific policies to protect the resource base and vulnerable households. The BEFS process has involved a number of dimensions to support and guide policy development. The analytical framework has provided a number of tools that can be used for ongoing analysis so that policy can be fine-tuned so that opportunities from the sector are better optimized and greater knowledge on the risks permit the placement of mechanisms to deal with them. In particular policies have to be promoted to support small farmers in accessing the financial dividends that arise from bioenergy and promoting the development of locally produced bioenergy such as biomass. The Sierra region emerges from the BEFS analysis as having quite limited bio-physical suitability for bioenergy. Significant bioenergy opportunities are unlikely to develop in this region. Given the divergence in regional growth rates where the Sierra is the poorest of all three main regions, it needs to be strongly understood that bioenergy must remain within a broader rural development plan that promotes other activities to redress some of these regional inequalities. The following points highlight the key areas for attention emerging from the BEFS project in Peru. Chapter 3 of this volume discusses the BEFS results and these points in more depth.

- Improved and effective coordination of public institutions is needed to orient and monitoring bioenergy developments. Because of the diverse impacts arising from the sector diverse government offices e.g. agriculture, forestry and natural resources, energy. BEFS has contributed actively to the promotion of this coordination with the establishment of a Multisectorial Bioenergy Commission. The functions of such institutions need to be pushed further to ensure greater dialogue across ministries.
- Land Policy needs to recognize the issues arising from changing land use and improve property and tenure rights. This is especially important for land belonging to indigenous communities.
- Regional bioenergy development should be underpinned by more disaggregated analysis, building on the BEFS tools, to determine crop selection so that no unnecessary pressures are placed on food crops. Regional development bioenergy and food production plans need to be harmonized to better promote community development.
- All regional and national policies need to be sensitive to environmental degradation arising from specific agricultural activities.
- Increased investment for infrastructure, agricultural extension and research is vital to create win-win situations for those involved in agriculture including bioenergy.
- Public-private partnerships can generate important investments but requite consideration of mechanisms such as tax exemptions.
- Feedstock and biofuel production involve risks related to fluctuating prices generated in global commodity markets including oil. Price supports should be considered to protect small holders from swings in income.
- Technology transfer through south-south co-operation can encourage best use of natural resources across regions and sub-regions by identifying best practices in technology and agricultural “know-how”.

1.8 USING THE TECHNICAL WORK AS A BASIS FOR ORIENTING POLICY

Training is provided to build in-country capacity in the use of the BEFS tools so that the analysis may be repeated and extended to reflect the prevailing policy priorities and also to support policy adjustments as the bioenergy sector evolves.

In the development of the BEFS project, the country work in Peru has instigated processes which enable policymakers to access important information that informs thinking on bioenergy, builds consensus around a course of action through dialogue and promotes capacity across a range of expertise: natural resources, environmental and industrial economics, agriculture, energy technology, food security and rural development. This has been done through a series of technical seminars, roundtable discussions and high level consultations which bring together technical experts, policy makers and key stakeholders. BEFS does not advocate prescriptive policy recommendations at the country level but seeks to shed light on key areas that stakeholders should pay attention to. By beginning the process of dialogue and sharing the use of tools to support decision-making, policy makers in Peru are in a stronger position to consider how best to develop a *sustainable* bioenergy sector that considers the welfare of the most vulnerable at its heart.

1.8.1 KEY OUTPUTS IN THE BEFS PROJECT IN PERU

1. Technical Compendium. this consists of two volumes:
   Volume I. This provides a detailed presentation of the analytical tools of BEFS and a discussion of the results and how these contribute to the policy dialogue.
   Volume II. This provides a detailed presentation of the methodologies used for each analysis and the data sources.
2. Policy Compendium. This consists of four chapters:
   Chapter 1:
   Explaining the context of the Bioenergy and Food Security Project inPeru
   Chapter 2:
   Understanding the Bioenergy and Food Security Policy Landscape in Peru
   Chapter 3:
   Using the BEFS analysis to orient bioenergy policy development
   Chapter 4:
   Rural development and bioenergy: An alternative approach

   The purpose of the policy work is to provide an analysis of the range of strategies needed in supporting rural development through bioenergy building on the results of the technical compendium.

3. Technical training. An integral element of the BEFS project is the transfer of knowledge in the use of the tools so that the policy machinery in Peru can guide future analyses of bioenergy, rural development and food security.

1.9 CONCLUDING REMARKS ON BEFS IN PERU

BEFS does not advocate prescriptive policy recommendations at the country level but the analyses do shed light on key areas that stakeholders should pay attention to. A broader message emerging from the BEFS project is the need for policy to support a wider range of public goods in order to facilitate rural development through bioenergy. There needs to be a focus on education, agricultural research and development, investment in transport and infrastructure in order to optimize the incentives that derive from private sector investment in bioenergy. Policy planning should avoid serious competition with food production. This does not mean that bioenergy should not be promoted in areas where food is produced but that the fundamentals of food production should be understood in order to determine the true nature of competition posed by bioenergy on food production. It is important in many cases to consider whether improved agricultural productivity especially for food crops can offset some of the competition over resources.

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ENDES - Encuesta Demográfica y de Salud Familiar, Peru – The Demographic and Family Health Survey, Peru.

MONIN - El monitoreo nacional de indicadores, Peru – The National Monitor for Indicators, Peru.