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The status of bioenergy development in developing countries

Irini Maltsoglou *, Tatsuji Koizumi, Erika Felix

Climate Change, Energy and Tenure Division, Natural Resources Management and Environment Department, Food and Agriculture Organisation of the United Nations, Rome, Italy

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ABSTRACT

Following a period of increasing oil prices, bioenergy received a wake of renewed attention by policymakers as an alternative renewable energy strategy due to the potential for improving country level energy security, for increasing overall access to energy, stimulating rural development and for curbing greenhouse gas emissions. Nevertheless, concerns about the viability of this strategy and potential conflicts with food demand soon dampened the enthusiasm and raised a number of questions concerning environmental and social sustainability and, more specifically, food security. In reality though, with the exception of the US, Brazil and some European countries, production of modern bioenergy and more specifically liquid biofuels around the world is still limited, especially in the case of Africa where the sector is still in its infancy. The paper gives a detailed overview of production in the African, Asian and Latin American regions illustrating how the three regions of the developing world are working toward bioenergy development, the strategies and policies, and the main hurdles being encountered.

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1. Introduction

Following a period of increasing oil prices, bioenergy received a wake of renewed attention by policymakers as an alternative renewable energy strategy due to the potential for improving country level energy security, for increasing overall access to energy, stimulating rural development and for curbing greenhouse gas emissions. Nevertheless, concerns about the viability of this strategy and potential conflicts with food demand soon dampened the enthusiasm and raised a number of questions concerning environmental and social sustainability and, more specifically, food security (FAO, 2008; Maltsoglou et al., 2011; Headey and Fan, 2008).

Historically, agriculture has been recognized as being an engine for economic growth that can have a strong impact on poverty and hunger reduction (Pingali, 2006; FAO, 2010a; Christiaensen et al., 2011). Bioenergy[1] could be an option for stimulating agricultural sector growth and thus poverty reduction if smallholders are involved (Thurlow, 2010). But increasing agricultural productivity in developing countries is not always straightforward given the many constraints faced such as low levels of human capital, imperfect financial markets and inadequate legal systems (Pingali et al, 2008; FAO, 2010b).

Thus, in order to ensure sustainable bioenergy development that is competitve and smallholder inclusive and that food security constraints are fully understood and managed, evidence-based decision making and policy formulation is required (FAO 2010a). In addition, due to the complexity and cross disciplinarity of bioenergy issues, coordination across disciplines and ministries is essential (UN Energy, 2010; FAO, 2012a). In fact, as illustrated in the subsequent sections, countries are struggling to meet feedstock demand, production is not always economically viable and smallholder involvement is not necessarily ensured and coordinated with large scale production, an essential element to ensure poverty reduction.

Although recognizing the broad scope of energy options bioenergy can cover, this article mostly focuses on liquid biofuels (bioethanol and biodiesel) as recent country efforts have been mostly tied to liquid biofuels for transport. Thus, the main objective of this paper is to outline how the three main regions of the developing world are working toward biofuel development, including discussion of strategies, policies, and the main hurdles being encountered. The paper proceeds with three regional sections outlining bioenergy development in Africa, Asia and Latin America, followed by some concluding remarks.

2. Biofuels development in Africa

Although hotly debated in the media, bioenergy development in Africa is very much in its infancy (Lerner et al. 2010; Kgathi et al., 2012). While the region has some potential, production has

* Correspondence to: FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy. Tel.: +39 06 570 53639.
E-mail address: irini.maltsoglou@fao.org (I. Maltsoglou).

[1] Bioenergy is not solely biofuels but covers a much broader spectrum of biomass based energy (REN 21).

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not really started because of lack of capacity, infrastructure, investment and food security concerns (FAO, 2010c).

In recent years, in the wake of surging oil prices, a large number of investors have ventured into Africa looking for opportunities for natural resource exploitation (ADB, 2012). Some of the investment was tied to biofuel development (International Land Coalition (ILC), 2013; Cotula, 2011), especially the production of biodiesel from jatropha (Kant and Wu, 2011). This crop has been touted by many as a "wonder crop" as it was claimed it did not conflict with food production and could grow in arid areas (Hasan, 2007; Kant and Wu, 2011).

Nonetheless, the expectations for jatropha performance soon dampened (Mubonderi, 2012; Kant and Wu, 2011). Jatropha, as is the case for any other crops, needs inputs and fertile land to achieve economically viable yield levels (Brittaine and Lutaladio, 2008; Kant and Wu, 2011; Openshaw, 2000) and could therefore compete with food production (Dawe, 2010). There are a number of additional constraints, for example limited knowledge of this crop for commercial scale production (Brittaine and Lutaladio, 2008). Investors in Africa have not been successful and experts have concluded that further R&D is required for this crop before it can become viable at a larger scale (Kant and Wu, 2011; Brittaine and Lutaladio, 2008; Mubonderi, 2012). Jatropha could still be an option for small local scale energy production, especially in cases where other energy alternatives are far too costly (IFAD, 2008; Brittaine and Lutaladio, 2008; Openshaw, 2000).

Very few countries in the region have been able to establish a clear policy to guide bioenergy investment. Some countries have set up dedicated cross ministerial taskforces but few countries have delivered a final policy, and some have fallen back on the publication of interim guidelines for biofuel production or investment. The objectives of the guidelines have been to achieve benefits such as energy security, technology transfer, greater employment and income, and foreign exchange savings, while targeting sustainable investment. To some extent the slow progress may be driven by food security concerns, but it is important to stress that most African countries are price takers on world markets. Therefore domestic bioenergy development could potentially have little impact on food prices, especially on the main food staple which is corn in this region (FAO, 2010b; Dawe and Maltsoglou, 2009).

A key aspect that has not generally been addressed in the policy formulation process, is to analyze all bioenergy options more broadly, as opposed to limiting the options to liquid biofuels for transport (FAO, 2012a). In the case of biofuels for transport, Africa has generally very little domestic absorption capacity (World Bank, 2012). Overall, few people drive cars, so compared to potential biodiesel and bioethanol production, a minimal amount would be for internal consumption. Thus, if Africa were to venture into producing large volumes of biofuels for the transport sector, this would be largely for the export market, at least initially (FAO, 2010c). This would then make biofuels comparable to any other export or cash crop (Thurlow, 2010). In order to promote reduction of poverty and food insecurity, the key will be to ensure smallholder involvement and investment of the profits and rents into agricultural development (Maltsoglou et al., 2011; Thurlow, 2010).

Following the global economic crisis and the jatropha fiasco, it seems to us that interest from investors has waned (see also Kant and Wu, 2011). Currently, countries are still investigating realistic options for the sector's development but few policies are in place and most development is still at the single project or pilot project level. The rest of this section will look at developments within sub-Saharan Africa.[2]

Countries in sub-Saharan Africa are investigating bioenergy options at both regional and national levels. At the regional level, countries are first striving to develop strategies as umbrellas under which to operate. At the country level, countries will then define which crops and what level of production can be achieved.

For example, countries belonging to the Southern African Development Community (SADC)[3] adopted the Framework for Sustainable Biofuels in December 2009 (SADC, 2009, 2008) which acts as the umbrella policy framework for countries within the community and calls for country level bioenergy roadmap development. All bioenergy production currently planned is biofuels for transport.

Malawi has been producing bioethanol from sugarcane molasses since the 1980s. There is no mandatory blending in the country but traditionally bioethanol has been blended in a ratio between 10% and 20%. Following the introduction of unleaded petrol, the current blending ratio is 10%. Lerner et al. (2010) report production up to 18 million L per season per annum in 2008.[4] Bioenergy sector development has been struggling due to the lack of specific production targets, feedstock sources, and financing mechanisms, while distribution mechanisms are not in place (Pisces, 2011; Renewable Energy and Energy Efficiency Partnership (REEEP), 2012a; Licht, 2012a, 2012b).

In Swaziland, the national Biofuels Strategy and Action Plan is pending finalization and therefore biofuel investments are currently on hold, with the exception of bioethanol production from sugarcane molasses. Lerner et al. (2010) report a current producing capacity of 26 million L to be boosted to 32 million L per annum. In addition to sugarcane, Swaziland is considering sweet sorghum and cassava for bioethanol production. Biodiesel could be produced from sunflower, safflower and jatropha but production from jatropha is on hold until further R&D and expert knowledge is available with respect to this crop (REEEP, 2012b; Licht, 2012a, 2012b).

Malawi and Swaziland are cited as the two main current producers in the region (Table 1, Licht, 2012a, 2012b).

Mozambique is one of the most advanced countries within the SADC community in terms of biofuel policy development although no biofuel production was in place as of 2011 (Lerner et al., 2010). In 2011 the country approved blending mandates of 20% for bioethanol and 3% for biodiesel to commence in 2012. The proposed feedstocks are sugarcane (molasses) for bioethanol, and jatropha, soya and mafurra seeds for biodiesel (Lerner et al., 2010; REEEP, 2012d).

South Africa has traditionally been an energy exporter, but in recent years demand has started to outstrip supply and alternative energy sources are needed, especially as the country meets most of its energy demand from coal (REEEP, 2012e). In 2007, South Africa developed the Biofuels Industrial Strategy of the Republic of South Africa (Government of South Africa, 2007). The strategy proposes adoption of a five year pilot program to achieve a 2% penetration level (previously the target was 4.5%) of biofuels in the national liquid fuel supply, equivalent to 400 million L per annum. The proposed crops are sugarcane and sugar beet for bioethanol, and sunflower for biodiesel. Maize is excluded on the basis of food security concerns, while jatropha is excluded due to the need for further research (Government of South Africa, 2007).

[2] In the northern strip of Africa interest is very low. Countries in this area are relatively wealthy compared to most of the rest of the continent, some have fossil fuel resources and in the context of renewable energy are mostly focusing on other sources such as solar and wind power.

[3] The SADC community includes Angola, Botswana, Democratic Republic of the Congo, Lesotho, Madagascar (membership currently suspended), Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe.

[4] Different sources provide different estimates of production. Lerner et al (2010) state that Malawi produces up to 18 million L of bioethanol per season (May–December) while Licht (2012a, 2012b) reports annual production of 10 mln L in 2011. Exact data on biofuel production in Africa are generally problematic.

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