

Energising development with *Jatropha curcas*?

Policy and institutional frameworks in the
promotion of sustainable biofuels in Mali



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Cover image: Dry Jatropha seeds, Koulikoro

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List Of Acronyms

AEDD	Environment and Sustainable Development Agency
AMADER	Agency for the Development of Domestic Energy and Rural Electrification
ANADEB	Mali's National Biofuel Development Agency
CDM	Clean Development Mechanism
CNESOLER	Mali's National Centre for Solar and Renewable Energies
ENI	Mali's National School of Engineers
GoM	Government of Mali
IER	Institute of Rural Economy
IPR/IFRA	Rural Polytechnic Institute
MA	Mali's Ministry of Agriculture
MDGs	Millennium Development Goals
MESSRS	Mali's Ministry of Secondary and Higher Education and Scientific Research
MFP	Multifunctional Platform
NGO	Non-Governmental Organisation
PAC	Practical Action Consulting
PISCES	Policy Innovation Systems for Clean Energy Security
SREP	Scaling-up Renewable Energy Program for Low Income Countries
UNDP	United Nations Development Programme
US\$	United States Dollar

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Executive Summary

Biofuel investments have proliferated in the developing world with a view to enhancing access to energy, substituting imported oil and contributing to rural development.

This briefing note is based upon PhD field research carried out in Mali between 2010 and 2011. It provides assessments of the potential of the non-edible, oil bearing tree *Jatropha curcas* (hereinafter termed *Jatropha*) to improve rural development and energy security. It addresses knowledge gaps on the role of national policies as well as multi-stakeholder engagement in the uptake of biofuel related activities. Policy recommendations are provided in order to better link policies to local level practices.

Different organizations have undertaken a range of projects linked to the production, extraction, transformation and utilization of *Jatropha* in Mali. These initiatives offer promising potential to provide renewable energy and foster development.

Nevertheless, major constraints in oil production – both at local and national level – need to be overcome in order to maximise local benefits and meet national fossil fuel substitution policy targets. A cohesive policy mix, institutional integration and farmer support are required to realise win-win opportunities for energy production and rural development.

Policy pointers

In the development of sustainable biofuel initiatives, governments should consider the following:

1. There is no “one-size-fits-all policy”. A cohesive mix of country-specific policies that integrate rural development concerns with the private sector needs and international policy / donor priorities is required to address a variety of climatic, environmental and socio-economic development needs.
2. Adoption of coherent institutional frameworks as well as strong partnerships and effective dialogue between government departments, the private sector and NGOs are vital to achieve shared policy goals and ensure replication and upscaling of successful initiatives.
3. The elaboration of national biofuels strategies and prescriptive sustainability criteria alone do not guarantee the sustainability of the operations and industrial activities to be implemented in the achievement of ambitious fossil fuel substitution targets.
4. Establishing and enforcing adequate legal and regulatory frameworks governing private investments and access to land and water resources is key to avoiding threats to food security and land tenure disputes.

Background

- Ensuring access to energy is vital in advancing development;
- Biofuels such as *Jatropha* represent one route towards renewable energy, particularly in developing countries such as Mali;
- Biofuels nevertheless remain controversial.

The 2015 deadline for achieving the Millennium Development Goals (MDGs) is fast approaching. As such, the interplay between energy, climate change and poverty has received growing attention from policy makers, with, for example, the year 2012 being declared the “International Year of Sustainable Energy” under the UN’s “Sustainable Energy for All” initiative (UN, 2012a). This is particularly relevant to sub-Saharan Africa, where substantial welfare gains can be promoted by tackling fuel poverty (Bailis, 2011).

In Mali – which ranks among the countries with lowest Human Development Index (HDI) (UNDP, 2011a) – traditional biomass (i.e. wood and charcoal) fuels comprise 81% of total energy use. Of the rural population, 93% lack access to electricity, and household energy consumption accounts for more than 70% of the total energy consumed (GoM, 2007). Mali’s energy sector is dependent on outside sources for the supply of conventional energy, and in 2007, the national bill for imported fossil fuels corresponded to 66% of the Malian export revenue (GoM, 2007).

To reach key energy and socio-economic development goals in the context of continuing increases in global oil prices, the scarcity of known petroleum reserves (Sorrell et al., 2010) and climate change arising from the emissions released by fossil fuel combustion (IPCC, 2007), there has been growing interest in the use of biofuels. Biofuels are energy sources produced from organic matter, ranging from starch, sugar and vegetable oil found in arable crops (known as “first-generation” biofuels), to algae and agricultural waste (“second generation”). Conversely, concerns are raised about first-generation biofuels, particularly regarding four key debates: i) “food versus fuel” (Nonhebel, 2012; Ruysenaar, 2011; Clements, 2008), where food crops are not consumed but are used for fuel; ii) emerging “land-grabbing” threats (Cotula et al., 2009), where investors appropriate land for biofuel cultivation; iii) indirect land use change (Searchinger et al., 2008), where fuel crops displace other land uses, and iv) the limited potential for biofuels to substitute fossil energy (OECD, 2007), mitigate climate change, and deliver rural development benefits (ActionAid, 2012; Nuffield Council on Bioethics, 2011).

Great hopes have been pinned on the oil-bearing, “drought resistant” non-edible tree *Jatropha curcas* (FAO, 2010; Jongschaap, 2007). However, the *Jatropha* sector is still young and empirical analyses of the claims and potential impacts on rural livelihoods and improved access to energy of this plant are lacking.

Mali is one of the few sub-Saharan countries with policies that encourage *Jatropha* cultivation. These target fuel production primarily, and a range of initiatives have been supported across the country since the 1990s by a variety of actors including development agencies, government, private sector and Non-Governmental Organisations (NGOs) (Figure 1). Mali thus provides a useful country context in which to explore the challenges and opportunities associated with *Jatropha*.

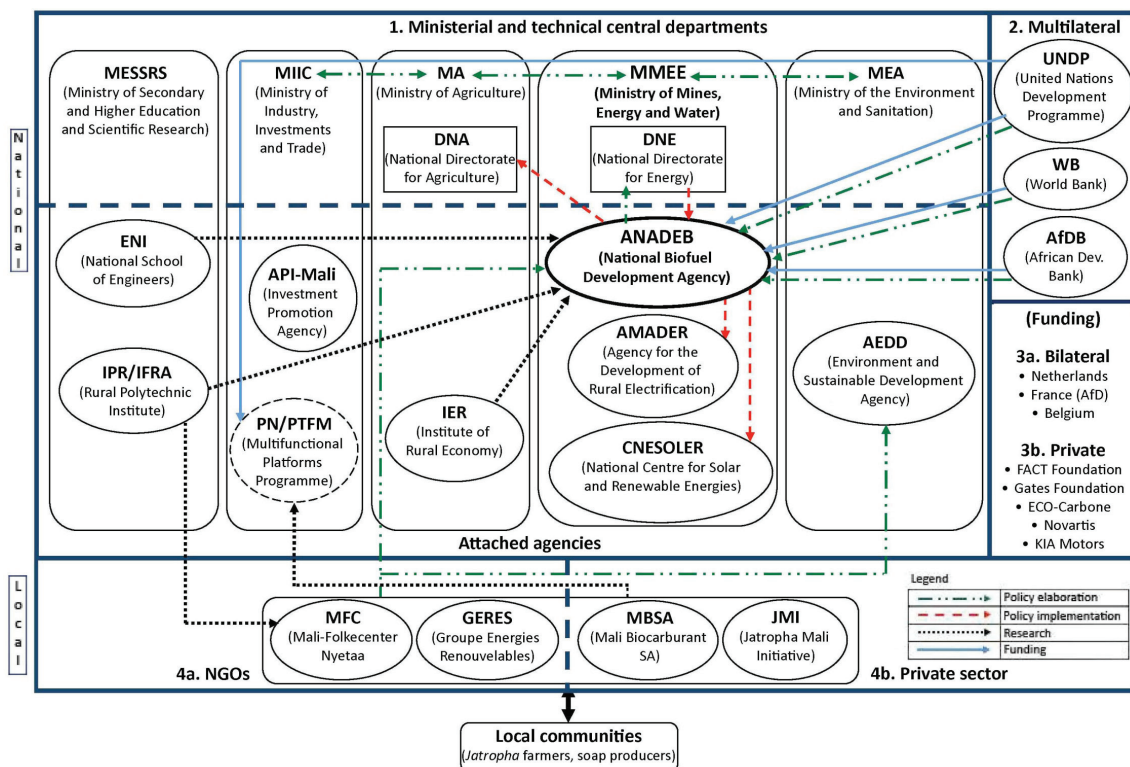


Figure 1: Key stakeholders in Mali's Jatropha activities. Arrow legends show types of links identified

Institutional framework within the Malian Jatropha activities

Jatropha production and use in Mali are promoted by the Ministry of Mines, Energy and Water (MMEE) through its specialised agencies (Figure 1):

- National Biofuel Development Agency;
- Agency for the Development of Domestic Energy and Rural Electrification;
- National Centre for Solar and Renewable Energies.

Essential support to the MMEE is provided by other major ministerial departments, including the Ministry of Agriculture, Ministry of Secondary and Higher Education and Scientific Research and Ministry of Industry, Investments and Trade.

The institutional context of Jatropha in Mali is complex and involves multiple groups¹. Use of renewable energy sources to tackle fuel poverty and preserve the environment has been extensively promoted by the Ministry of Mines, Energy and Water (MMEE). Mali's overall biofuel operations are coordinated by the National Biofuel Development Agency (ANADEB), created in 2009 and attached to the MMEE. ANADEB's mandate is to promote biofuels, largely produced from Jatropha, at two levels: (i) local – in order to meet the energy needs of rural communities, and (ii) national – in order to reduce the country's high dependence on oil imports.

Prior to ANADEB's creation, various biofuel activities were developed under the National Centre for Solar and Renewable Energies (CNESOLER). Between 2004 and 2009, the CNESOLER implemented the National Programme for the Energetic Valorisation of Jatropha (PNVEP), which aimed to create technical and organisational capacity to generate Jatropha-based electricity to the benefit of the rural and peri-urban population in four southern regions of Mali.

From an environmental perspective, the promotion of renewable energy is supported by the Ministry of the Environment and Sanitation (MEA) – which approves Clean Development Mechanism (CDM) projects – and the attached Environment and Sustainable Development Agency (AEDD).

Creation of the Agency for the Development of Domestic Energy and Rural Electrification (AMADER) in 2003 reaffirmed the will of the Malian government to develop a coherent institutional framework to address major energy and development priorities. The twofold aim of AMADER is to contribute to socio-economic development through increasing the population's access to electricity and reducing poverty, in line with the MDGs. In collaboration with the Multifunctional Platforms (MFPs) National Programme (Box 1) – under the responsibility of the Ministry of Industry, Investments and Trade – AMADER installs the MFPs and decentralized power grids used to provide rural villages with electricity. In 2011, AMADER signed an agreement with ANADEB which aimed to increase rural access to electricity through the use of Jatropha-based biofuel.

As concerns rural development, national promotion of Jatropha is linked with activities carried out by the Ministry of Agriculture (MA). The MA promotes Jatropha uptake through awareness-raising and farmer support to improve production at the village level. A project to support the development of the Jatropha supply chain in five southern Malian regions (PADFP) was launched by the National Directorate for Agriculture in 2008.

At the national level, a variety of Jatropha Research and Development (R&D) activities are carried out under the supervision of both the MA – through the attached Institute of Rural Economy (IER), the research of which focuses on ecotypes and production techniques – and the Ministry of Secondary and Higher Education and Scientific Research (MESSRS), which orients the work of two high education schools: the Rural Polytechnic Institute (IPR/IFRA) and National School of Engineers (ENI). The IPR/IFRA is active in agronomic research on Jatropha as well as in testing the use of the oil on engines, while the ENI carries out engine performance testing under a formal collaboration signed with ANADEB.

¹ In March 2012 President Toure was deposed in a military coup and, since April 2012, independence has been declared by rebels in most of northern Mali. The current political instability faced by the country might have an impact on the institutional and regulatory frameworks presented in this document.

The private sector and NGO community

Major Jatropha pilot activities in Mali are carried out by the following actors:

- NGO community: Mali-Folkecenter and GERES Mali (promotion of Jatropha-fuelled rural electrification)
- Private sector: Malibiocarburant SA and Jatropha Mali Initiative (fuel production and commercialisation)

The opportunities offered by market-based instruments such as the CDM of the United Nations Framework Convention on Climate Change to generate financial resources through commercialisation of Jatropha-based carbon credits have, together with national policy drivers, led to the implementation of major Jatropha pilot activities since 2007.

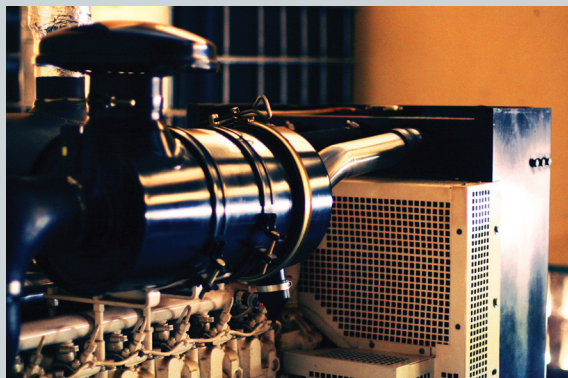
These include actors from the NGO community (e.g. Mali-Folkecenter and GERES Mali) and industry (e.g. Malibiocarburant SA and Jatropha Mali Initiative), which operate in direct collaboration with beneficiary communities.

These actors have varying approaches and motivations, including fuel production and commercialisation (industry) and rural electrification (NGOs) (see Box 1). The start-up and implementation of such activities rely on substantial financial (and often technical) support provided by major bilateral donors (i.e. French Development Agency, Netherlands and Belgian Cooperation) and private entities (i.e. Bill & Melinda Gates Foundation, FACT Foundation, Eco-Carbone, Novartis, Total and Kia Motors).

The stakeholders promoting biofuel production in Mali are outlined earlier in Figure 1. The arrows highlight the collaborative relationships among stakeholders in relation to the following types of links: funding, Jatropha-related research, policy elaboration (where the stakeholder affects the decisions taken in the elaboration of energy policy) and policy implementation (where the stakeholder is directly in charge of implementing concrete actions in the achievement of energy policy goals).

Box 1 – Fuelling rural electrification with Jatropha oil?

Since 2007, the NGO Mali-Folkecenter project “Garalo Bagani Yelen rural electrification using Jatropha oil” has provided public lighting and refrigeration to the village of Garalo, as well as favoured the development of small-scale business activities.

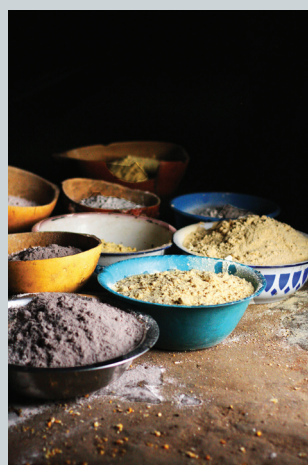


Power generator, Garalo, 2010

Between 1996 and 2011, the Multifunctional Platform (MFP) National Programme promoted by UNDP has installed 1,000 platforms. The MFPs are owned and managed by women and can generate electricity as well as power a cereal mill, husker, battery charger, pump and welding equipment. According to UNDP (2011b) about 10 hectares of Jatropha plantation can produce enough oil to operate one platform each year. The examples of Dongorona and Tiekumana show that, when used for grinding cereals, the MFP can reduce the time spent by women on domestic chores.



MFP, Dongorona, 2010



Cereal grinding, Tiekumana, 2010

Full achievement of rural electrification potential is nevertheless hampered by major institutional, financial and organisational constraints. Project developers and institutions have limited ability to support smallholder farmers adequately (both technically and financially) in Jatropha agriculture. This translates into low available feedstock and consequently processed oil on the market. To date the MFC’s power generator is predominantly fuelled by regular diesel and Jatropha oil has been used only for testing and demonstration. Similarly, among the 1,000 MFPs installed as of 2011, less than 30 were operating on Jatropha oil due to feedstock shortages (UNDP, interview data, 2011).

Policy framework for biofuels promotion

Use of Jatropha oil has been prioritised with the aim of achieving a variety of policy goals linked to the main debates surrounding biofuels outlined earlier (Box 2). These priorities have been formulated in key national and sector-specific policy papers where Jatropha development is of cross-cutting relevance (Box 3), including the National Energy Policy (PEN) (GoM, 2006a), National Strategy for the Development of Renewable Energies (NSREN) (GoM, 2006b), and National Strategy for Biofuels Development (NSBD) (GoM, 2008).

The NSBD aims to increase local energy production by developing biofuels to meet the country's socio-economic needs and substitute imported oil. Three specific objectives are to:

1. Increase vegetable oil-based biofuel production;
2. Create the village-level and industrial infrastructures required for biofuel production, transformation and commercialisation; and
3. Establish institutional, legal, regulatory and financial frameworks for biofuel development.

The NSBD strategy sets ambitious quantitative targets including the substitution of 20% of fossil fuel consumption with Jatropha biofuel by 2023, via production of 84 million litres/year of refined oil from a total cultivated surface area of 50,000-70,000 hectares (GoM, 2008). Intermediate substitution targets are set for the year 2013 (10%) and 2018 (15%).

Box 2 Why is Jatropha prioritised in national policies?



Jatropha farmer, Zena, 2011



Press for oil extraction, Garalo, 2010

Jatropha has been promoted since the 1990s by the Malian government to:

- a) Increase energy security and reduce poverty: The NSBD states: “The use of vegetable oil [from Jatropha] will not only substantially contribute to the improvement of energy access ... but also to the increase of revenues and employment” (GoM, 2008: 29). Under the Multifunctional Platforms National Programme – and as supported by the PEN and NSREN – strong focus on gender empowerment is given through promotion of MFPs fuelled by locally-produced Jatropha oil (UNDP, 2004).
- b) Promote food security: Ensuring food security “to preserve and improve the population’s living conditions” is a priority of the PNPE, SDDR, LOA and G-PRSP. In achieving this objective, the NSREN (GoM, 2006b: 28), and similarly the NSBD, state: “the energetic valorisation of biomass and the Jatropha tree [will directly contribute to the achievement of] food security and agricultural diversification”.
- c) Preserve the environment: According to the NSBD, Jatropha agriculture will sequester carbon and restore degraded land, while the SDDR and NAPA reaffirm Jatropha’s potential for restoring and maintaining soil fertility as well as combating soil erosion.

Box 3 Key policies and strategic documents where Jatropha development is of cross-cutting relevance

Year	Acronym	Title
1998	PNPE	National Environmental Protection Policy
1998	NAP	UNCCD National Action Programme
2002	SDDR	Rural Development Master Plan
2006	LOA	Agricultural Orientation Law
2006	PEN	National Energy Policy
2006	NSREN	National Strategy for the Development of Renewable Energy
2006	G-PRSP	2007-2011 Poverty Reduction and Growth Strategy Paper
2007	NAPA	National Adaptation Programme of Action to Climate Change
2008	MDGs Plan	Ten Years Action Plan to Achieve the MDGs 2006-2015
2008	NSBD	National Strategy for Biofuels Development
2011	PNCC/SNCC	National Climate Change Policy, Strategy and Action Plan

Towards the achievement of sustainable biofuels: key policy implementation challenges

- The adoption of a comprehensive approach at political, institutional and technical levels is required to promote biofuels successfully and attract international support;
- Lack of financial resources and organisational capability hamper the implementation of Jatropha activities and the achievement of policy goals;
- Establishment of appropriate legal frameworks, with key support provided by development cooperation, is vital in avoiding unsustainable practices.

Since the 1990s, the commitment of Mali to expand renewable energy production and use so as to fight the major environmental, socio-economic and energy challenges faced by the country has been expressed at political, institutional and technical levels. Relevant policies have been approved, and ambitious national programmes for both rural and national energy access expansion, have been implemented. Between 2008 and 2010, national spending in the renewable energy sub-sector rose from US\$3.3 million to US\$6.7 million (representing 0.23% of the national budget) (WB and GoM, 2011). In this context Jatropha-based biofuel has played an increasingly relevant role, with government spending accounting for roughly US\$2 million in 2010 (UNDP, 2011b). The Malian government has proven capable of integrating priorities on sustainable development and energy, as outlined in the global discourse (UN, 1992, 2006 and 2012b), into its national policies. This has placed Mali among the best candidate countries towards which the international community is willing to provide monetary, institutional and technical support towards the implementation of improved renewable energy activities. Mali was one of six countries selected to benefit from the “Scaling-up Renewable Energy Program for Low Income Countries” (SREP) under the World Bank’s Clean Investment Fund umbrella. A total of US\$40 million funding has been allocated through the SREP (WB and GoM, 2011), exceeding 2010 national spending in the sub-sector 6-fold. In 2011 this was accompanied by the preparation of a US\$6.7 million UNDP project proposal which aims to develop and promote a sustainable model for the production and use of Jatropha oil in the country.

Smallholder farmers are not replacing food production with Jatropha cultivation. Current pilot operations carried out by JMI, MBSA, GERES and MFC have promoted the establishment of agroforestry systems – intercropping Jatropha with food crops – allowing agricultural diversification and guaranteeing that land used for food is not entirely shifted to biofuel production. As shown by household level data from 30 in-depth interviews carried out in the project areas of JMI, GERES and MFC, intercropping is used as a core strategy for reducing labour trade-offs between Jatropha and food crops. Eighty-two percent of the smallholder farmers interviewed intercrop Jatropha with peanuts, cowpeas, sesame, sorghum, millet, maize, sweet potatoes and cowpea beans. No large-scale activities were reported to be taking place in the country.

Projects focusing on the use of Jatropha for rural electrification offer promising opportunities to provide easier access to fuel and reduce domestic chores by providing local pressing facilities, power generators and MFPs. However, there are difficulties in establishing successful small-scale plantations, which diminishes feedstock availability on the market. This limits the capacity to produce sufficient quantities of Jatropha oil, which to date has been mainly used only for testing and demonstration (Box 1). Financial and organisational constraints faced by project

developers hamper the capacity to meet the needs identified by farmers in household level interviews (i.e. constant and visible support from local staff at the village level, improved training, and better access to agricultural equipment and fertilisers). These activities are still in a learning-by-doing operational phase and are heavily dependent on the monetary support from external donors: “We are aware of the difficulties faced by our farmers and field staff, but unfortunately we lack sufficient resources to face all the constraints” (MFC, interview data, 2011). Lack of coordination among institutional actors and overlapping roles hamper the achievement of policy goals. Overlapping mandates on renewable energy among the MMEE, MA and MEA constrain the development and implementation of coherent frameworks of action. Information circulated among different institutions about their strategic orientations, objectives and ongoing activities was found to be dispersed, limiting the capacity to carry out harmonised on-the-ground activities in the achievement of common *Jatropha*-related goals.

At the national level, in 2011 the total *Jatropha* land cover and actual yields accounted for 5,000 ha (excluding minor ongoing initiatives and the area covered by living fences) and 1.5 T/ha. These figures are notably smaller than those foreseen in 2013 by the NSBD (respectively 70,000 ha and 3.125 T/ha). This raises concerns about the feasibility of reaching the ambitious national fossil fuel substitution targets. Interviews with government officials revealed that use of irrigation is foreseen in the establishment of commercially viable large-scale plantations. These are required to allow policy objectives to be met (ANADEB regional workshop, Sikasso, 2010). This contrasts with claims that *Jatropha* flourishes in marginal land with limited water supply and poor soil – as stated in the biofuels strategy: “(*Jatropha*) can also grow on poor lands and has a good resistance to dryness” (GoM, 2008: 17). Interviews also suggested that attraction of foreign private investors is envisaged to allow industrial activities to be developed (API-Mali, Bamako, 2010). Access to land is legally regulated by the Agricultural Orientation Law (LOA) approved in 2006. *Jatropha*-related concessions in the Office du Niger – the main area of irrigated land used for food production in the country – are observed by the Oakland Institute (2011). Woodhouse (2012) observes that large-scale foreign investments promoted by the Malian government may compete with existing water use and intensify pressures on small-scale farmers. ANADEB envisages supervising future large-scale land acquisitions in order to guarantee the preservation of productive agricultural land as well as the socio-economic and environmental sustainability of these operations. As of February 2012, prescriptive sustainability standards were being discussed and expected to be approved by the end of 2012.

Whether *Jatropha* will threaten food security or encourage land grabbing within the country will not depend on the presence of small-scale agroforestry systems like the ones observed in the studied project areas, but on the way in which the large-scale activities fostered by policy are developed. Establishment and enforcement of clear binding rules supported by appropriate legal and institutional frameworks – a key priority in most of the Malian policies (Box 3) and for which support is being provided by the World Bank, UNDP and African Development Bank – will play a key role in avoiding unsustainable practices.

Policy recommendations

The Malian government, particularly the MMEE and MA, should accompany development of a Jatropha biofuel industry that meets pro-poor development objectives with the following policy measures, to:

- Strengthen the institutional framework: improve integration and communication among stakeholders and clarify the roles and mandates of the main national directorates and agencies operating in the energy, rural development and environmental sectors. More frequent and better organised communication could increase coherence in the operations of different actors and facilitate the replication of successful experiences;
- Improve farmer support at the local level: facilitating access to credit and reinforcing extension networks will help farmers to address their difficulties in Jatropha cultivation and improve livelihood benefits. Training should be delivered to show all the different uses of Jatropha, beyond just the sale of the seeds (e.g. improved soap production). Improved livelihood gains would not only enhance farmers' determination in maintaining their crops, but would increase village-level productivity, where higher quantities of feedstock are required for fuelling rural power generators with Jatropha oil;
- Revise the ambitious energy policy targets in relation to land cover, yields and fossil fuel substitution based on actual achievements and feasibility of achieving future quantitative goals;
- Establish and enforce appropriate legal and regulatory frameworks governing private biofuel investments: providing clear binding rules on the conditions for access to farm land and water resources will help to ensure the socio-economic and environmental sustainability of the biofuels operations.

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Policy Innovation Systems for Clean Energy Security (PISCES)

PISCES is a six-year research project funded by the Department for International Development of the United Kingdom (UK). Project implementation started in July 2007. Through action research the project is increasing available knowledge and understanding of policy relevant trade-offs between energy, food and water security for livelihoods in relation to bio-energy. PISCES is a Research Programme Consortium whose members include African Centre for Technology Studies (ACTS, lead) Kenya; Practical Action Consulting UK, Eastern Africa, and Sri Lanka; the University of Dar es Salaam, Tanzania; M.S. Swaminathan Research Foundation (MSSRF), India; and the University of Edinburgh, UK. www.pisc.es.or.ke



UNIVERSITY OF LEEDS

The University of Leeds

The University of Leeds has expertise in integrated modelling, coupling agent-based, regional economic, hydrological, nutrient flow, erosion and biodiversity models at a landscape scale. The Sustainability Research Institute conducts internationally recognised, academically excellent and problem-oriented interdisciplinary research and teaching on environmental, social and economic aspects of sustainability. We draw on various social and natural science disciplines, including ecological economics, environmental economics, political science, policy studies, development studies, business and management, geography, sociology, science and technology studies, ecology, environmental science and soil science in our work.



DESIRE

A newly launched research project is working to fight desertification with new conservation strategies. Funded under the EU's Sixth Framework Programme (FP6), the DESIRE project is international, bringing together 28 research institutes, non-governmental organisations (NGOs) and policy-makers from around the world. The aim of the €9 million project is to come up with alternative strategies for the use and protection of these vulnerable areas.



The Royal Geographical Society

The Royal Geographical Society (with the Institute of British Geographers) is the UK's learned society and professional body for geography, founded in 1830. We are a world leader in advancing geography and supporting its practitioners in the UK and across the world.



Practical Action Consulting (PAC)

For over 40 years, PAC has provided development consultancy services as the consulting arm of the international NGO, Practical Action. PAC provides high quality, independent and professional advice to governments, NGOs, aid agencies and the private sector. We work worldwide from regional offices in the UK, Eastern and Southern Africa, South Asia and Latin America. Our vision is of a sustainable world free of poverty and injustice in which technology is used for the benefit of all. www.practicalaction.org/consulting