

FUELFREEDOM™

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FUELS FOR SUSTAINABLE DEVELOPMENT IN SUB-SAHARAN AFRICA

**WORKING PAPER FOR DISCUSSION
September 2013**



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EXECUTIVE SUMMARY¹

It is now well recognized that there is a strong correlation between levels of energy consumption per capita and levels of development. The low development levels in sub-Saharan Africa are reflected in its low rates of energy consumption: this region uses only about 2% of the world's energy. Access to affordable fuel is essential for overcoming poverty and effectively addressing sustainable economic growth in sub-Saharan Africa: fuel for transportation; fuel for cooking, lighting and heating; fuel for electric power; fuel for fertilizer and pesticide production; fertilizer as fuel for improving agricultural capacities; and fuel for irrigation.

The price of oil-based fuels has increased dramatically in the last 10 years, with analysts foreseeing a continued acceleration in this trend. The current trajectory in oil prices is nothing short of catastrophic for poorly resourced sub-Saharan African countries, leaving them highly vulnerable to oil price shocks. Therefore a key challenge is to improve access to fuels at affordable prices and in a manner that promotes sustainable development.

Sharper focus on the challenges and opportunities of fuel marks a crucial strategic shift in speeding up the pace of development in sub-Saharan Africa and opens up an additional framework for addressing these challenges. This entails an expanded view of “energy”, a term often only used to refer to the production of electricity. It requires a redefinition of the term “fuel” that moves beyond the prevailing definition—fossil fuel. It necessitates a change in the mode of fuel production.

REDEFINING FUEL: The idea of fuel diversification is crucial. There are two key ways of achieving this: to make more efficient use of existing fossil fuel sources, eliminating waste and harnessing oil by-products; and to more fully develop capacities to produce fuel from multiple biomass inputs (biofuels). Like oil by-products, these potentially valuable resources are often wasted. These possibilities are being continuously multiplied by technological advances. Much of the existing fuel infrastructure (engines, motors, cookstoves, generators, and so on) can use many types of fuels with no adaptations whatsoever, or with only small modifications.

CHANGING MODES OF PRODUCTION: It is essential to recognize that solutions modeled on large-scale, mega-sized approaches to fuel production are likely to fall short of their promise. More effective solutions can be found in small and medium-sized production facilities that are designed to supply fuel on a localized basis. Emphasis on small-scale local fuel production for domestic consumption is one of the missing links in a comprehensive and cost-effective approach to fuel production in sub-Saharan Africa.

The advantages of small-scale production are multiple. Construction of these production facilities requires relatively small investments. Because the quantity of fuel that can be produced is too limited to have large-scale international commercial value, these fuels are more likely to remain in the local area. The huge cost savings on transportation mean they will be more price competitive and affordable in the local marketplace. And a smaller scale approach allows for localized solutions: closer attention to local fuel needs and tighter linkages with locally available resources to meet those needs.

MISSING LINKS: Increased availability of biofuel is closely related to the transformation of Africa's agricultural sector. While a wide range of agricultural initiatives are underway, these efforts overlook key opportunities when it comes to comprehensively transforming the agricultural sector. Although a significant increase in the use of fertilizers is recognized as necessary for improving agricultural productivity, almost no attention is given either to the potential of small-scale, local fertilizer production or

¹ The authors would like to thank Yossie Hollander and Peter Goldmark from the Fuel Freedom Foundation for comments on earlier drafts.

the use of alternative fuel sources for fertilizer production. This is particularly relevant for improving subsistence farming practices.

Present initiatives also make no link with biomass production for fuel diversification, nor do they encourage better utilization of biomass resources that are already available. It is therefore necessary to build on existing agricultural initiatives in a way that more tightly connects access to affordable fuel as a critical component of agricultural reform.

The primary intent of this working paper is to stimulate discussion about the need for a new approach to fuel production in sub-Saharan Africa.

INTRODUCTION

Sub-Saharan Africa is the poorest region of the world. World Bank estimates show that 70% of the population lives below the poverty line, life expectancy at birth does not exceed 55 years and less than two thirds of children complete primary education, a figure that is even lower for girls. The UN Human Development Index indicates that a large majority of sub-Saharan African countries belong to the low human development category.

Accelerating sub-Saharan Africa's development is a major challenge in today's world.² Looking ahead to the next two decades, this challenge will become even more daunting. At least two parameters help explain this. First, population growth in sub-Saharan Africa continues at a rapid pace, far outstripping growth rates on all other continents. According to UN estimates, Africa's population will jump from nearly 1.2 billion today to about 4 billion at the turn of the next century. Second and closely related, it is predicted that the massive disparity in development between sub-Saharan Africa and the rest of the world will continue to increase.

The strong correlation between levels of energy consumption per capita and levels of development³ is reflected in the fact that sub-Saharan Africa uses only about 2% of the world's energy.⁴ This is a key factor in the slow pace of transformation, which is further exacerbated by conflict and poor governance. It is commonly accepted that sub-Saharan Africa will not eradicate poverty without a significant increase in energy consumption. Even those countries that are beginning to make progress, as reflected in per capita GDP growth and food self-sufficiency, are crippled by the high cost of energy, especially oil-based fuels.

A key challenge, then, is to improve access to energy sources—for people, businesses of all sizes (but especially small and medium-sized enterprises), agriculture and industry, as well as for public services—at affordable prices and in a manner that promotes sustainable development. Renewable sources of energy are widely promoted as the solution for sub-Saharan Africa, with a recent focus on solar and wind potentials, in addition to hydropower.⁵ However, these alternatives remain limited in scope and have not been able to transform people's lives and lift them out of extreme poverty.

Although the decentralized and modular (off-grid) capacities of solar and wind have benefits in the sub-Saharan African context, especially in meeting rural needs over the medium and long term, investment in these sources of energy remains expensive and their unsubsidized cost remains high.

This poses significant hurdles. It is not feasible to implement such solutions on a scalable basis, nor on timetable that will be swift enough to effect much-needed change. Moreover, these alternatives are largely limited to the production of electricity. Expanding access to reliable and affordable electricity is a critical

² As a BRICS economy, South Africa cannot be compared with any other sub-Saharan African country and is intentionally excluded from this discussion.

³ The link between energy services and poverty reduction was explicitly identified by the World Summit on Sustainable Development in the Johannesburg Plan of Implementation in 2002. Among others, see: International Institute for Applied Systems Analysis. *Global Energy Assessment 2012: Toward a Sustainable Future*. Laxenburg, Austria: International Institute for Applied Systems Analysis; Advisory Group on Energy and Climate Change (2010). *Energy for a Sustainable Future*. New York: United Nations; and Modi, Vijay, Susan McDade, Dominique Lallement and Jamal Saghir (2005). *Energy Services for the Millennium Development Goals*. Washington, DC and New York: International Bank for Development and Reconstruction, The World Bank and the United Nations Development Program.

⁴ Although this working paper for discussion focuses on sub-Saharan Africa as a whole, it is necessary to acknowledge that the countries in this region are by no means uniform. On the contrary, there are stark variations in terms of human development, economic progress and available natural and economic resources. However, this heterogeneity does not undermine the central arguments herein.

⁵ Producing approximately 70% of the electricity in sub-Saharan Africa, hydropower is also a renewable source of energy that is already being relied upon, with scope for expansion on both micro and macro scales.

part of the sustainable development equation in sub-Saharan Africa, regardless of whether this electricity comes from renewable or non-renewable sources—but it is not sufficient.

FUEL: DEVELOPING A NEW FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

It is equally essential to address the fuel deficit that is part of the overall energy equation in sub-Saharan Africa: fuel for transportation; fuel for cooking, lighting and heating; fuel for electricity production; fuel for fertilizer and pesticide production; fertilizer as fuel for improving agricultural capacities; and fuel for irrigation. Sharper focus on the challenges and opportunities of fuel marks a crucial strategic shift in speeding up the pace of development. Looking at the intractable problems of poverty from the perspective of fuel opens up an additional framework for addressing these challenges.

This framework is defined by two primary assumptions. First, it is necessary to rationalize and diversify fuel production to facilitate increased consumption. Second, there must be greater emphasis on local fuel needs and better, more efficient utilization of available local resources. This new framework therefore advocates for an expanded view of “energy”, a term often only used to refer to the production of electricity. More importantly, it requires a redefinition of the term “fuel” that moves beyond the prevailing definition—fossil fuel. In this framework, the idea of fuel diversity is crucial. There are numerous sources and potential sources of fuel (both fossil and non-fossil, or biofuels). Diverse types of biofuels fuels can be produced from a range of different biomass inputs that are locally available or can be easily grown. These possibilities are being continuously multiplied by technological advances.

In short, access to affordable, reliable and abundant sources of fuel depends on both more efficient use of existing sources of fuel and a commitment to fuel diversification that moves beyond reliance on fossil fuels. Crucially, fuel diversification can work most effectively when it is operationalized on a small-scale, localized basis (although large-scale commercial potentials cannot be ignored). This approach allows for localized solutions to fuel needs: closer attention to local fuel needs and tighter linkages with locally available resources to meet those needs. Implementation of this approach to augmenting the pace of sustainable development requires a radical increase in agricultural productivity and the adoption of appropriate policy and regulatory frameworks.

1. DIAGNOSING THE PROBLEM⁶

Rapid development has historically depended on access to relatively affordable oil-related fuels, particularly diesel, gasoline, liquefied petroleum gas (LPG) and kerosene. However, the price of these fuels has increased dramatically in the last 10 years, with analysts foreseeing a continued acceleration in this trend.⁷ On the one hand, demand for oil-related fuels will be boosted by growth in large emerging economies like China and India, which are net importers of such products. Along with others, these two countries will become increasingly important players in the international hydrocarbon market. On the other hand, exploration of new oil and gas deposits (in the face of continued depletion of existing supplies) will be undertaken in geographic areas and with technologies that require greater capital investments. Not only will this result in high prices for oil produced in new drilling fields, but this change itself will have negative second-order effects throughout the global market that determines the price of this valuable commodity.

In these shifting circumstances, most sub-Saharan African countries will not be able to compete as consumers in world oil markets. Although these countries could benefit from oil-related fuels for their socio-economic development, they cannot afford them today and will become increasingly unable to do so in the future. Crude oil related fuels, power and electricity, along with cooking fuels (other than firewood and charcoal) are already expensive and in high demand, a situation that will only worsen with time. The current trajectory in oil prices is nothing short of catastrophic for poorly resourced sub-Saharan African countries, leaving them highly vulnerable to oil price shocks.

High oil prices have a negative impact on national budgets, creating significant deficits on public accounts that are already heavily burdened. These deficits must be met by increased borrowing which in turn leads to further increases in debt service and financial un-sustainability. Increasing oil bills reduce the amount of public resources available for development programs. Explicit and implicit fuel subsidies continue to take much-needed funds away from more effective spending on social and infrastructure projects, like sanitation projects and better road systems.⁸ When budget cuts are necessary, these often come at the expense of human development and poverty reduction programs. Higher oil prices mean fewer school teachers and health services.

Those sub-Saharan African countries that are oil and gas producers may be in a different position. Given the price of crude oil, they may be able to generate sufficient resources to import refined petroleum products or invest in domestic refinery capacities. Indeed oil and gas exploration is booming both on and off-shore in some countries. Although oil and gas wealth offers advantages to those countries with such reserves, current market forces along with future price trends indicate that these fuel resources will not remain in country. Rather, as is presently the case, they will be exported—to the detriment of domestic fuel needs. Revenues from these valuable fuel resources are also at risk of being improperly invested; e.g., in pointless vanity projects that only serve national elite interests. They are likewise at risk of being privately appropriated and stolen through corruption.

⁶ There are a number of problems related to presenting an accurate overview of the fuel situation in sub-Saharan Africa. First and foremost, there is a lack of reliable data. What data do exist can be uneven and inaccurate. Second, large segments of the economy are informal. This is especially the case with electricity production and consumption, much of which is outside commercial or public sectors.

⁷ The price of oil is sensitive to international security challenges and crises, especially because a significant percentage of oil supplies come from and/or transit through the Middle East, one of the world's most volatile regions. However, political crises only tend to have a temporary effect on price increases. In contrast, the two factors discussed above will have a long-term impact and are the key determinants in upward price trends.

⁸ Not only are subsidies badly targeted, with most benefits accruing to more affluent consumers, but they have discouraged investment and maintenance in the energy sector in many countries in sub-Saharan Africa, leading to costly and inadequate energy supply that is constraining economic growth. Source: International Monetary Fund (2013). "Sub-Saharan Africa: Building Momentum in a Multi-speed World", Regional Economic Outlook. Washington, DC: International Monetary Fund, page ix.

The fuel deficit has broad negative consequences that deeply affect the entire region. At the macro level, it has created downward spirals that have widened the development gap between sub-Saharan Africa and the rest of the developing world. The fuel deficit impacts economic productivity and modernization, agricultural production, industrial development, infrastructure improvement, transportation costs, time use and responses to climate change. At the micro level, the fuel deficit contributes to reduced livelihood opportunities, malnutrition and health problems, as well as to zero or minimum surplus finance among the poor. Rural poverty has sparked an accelerated process of internal displacement and urbanization, with people migrating to cities in search of jobs that are too limited in number to meet these growing employment needs. This means inequalities persist and flourish, becoming deeper and more virulent.

In addition to its socio-economic impact, the fuel deficit has significant political costs. Among other things, government performance is now linked to the capacity of those in power to provide affordable and reliable electricity to greater numbers of citizens, as well as to lower the costs of oil-related fuels through subsidy programs. Many sub-Saharan African leaders have gained legitimacy on promises of energy sector reform (affordable access to reliable electricity and fuel supplies), especially in post-conflict contexts where recovery programs are being initiated. However, these promises have been repeatedly broken through the ongoing failure of such reforms, which has given rise to popular unrest and protest; increases in transportation fares and costs have sparked riots, social turmoil and political instability in a number of countries.

Importantly, the fuel deficit has a strong gender effect in sub-Saharan African countries. Women and girls are the main gatherers of fuel for heating and cooking. Gathering fuel (or fetching water) in insecure environments exposes them to risks of injury and violence. Continued deforestation means they must travel farther to gather these increasingly scarce fuel resources, making them even more vulnerable to violent attacks. Women and girls are also most affected by the indoor air pollution caused by traditional fuels (firewood, charcoal and kerosene). This places burdens on their time, health, psychological well-being and security, resulting in fewer opportunities for learning and income generation. This has high opportunity costs and an even greater impact: it is widely acknowledged that women invest their earnings in their families to a greater extent than men do,⁹ but this valuable multiplier effect on improved living conditions for current and future generations is lost.

Conversely, access to affordable fuel is essential for overcoming poverty and effectively addressing sustainable economic growth in sub-Saharan Africa. Reliable, affordable fuel creates a chain of positive knock-on effects. Fuel powers the generators that light the lamps for girls and boys to do their homework, and keeps medicines refrigerated and operating rooms going in hospitals. Fuel sustains the small and medium-sized businesses where most people work. It gives access to safe water and sanitation services, which improves health. The fuel that powers an irrigation system increases agricultural productivity and better ensures food security. Fuel is also a critical input for the production of the fertilizers and pesticides that are in turn themselves fuel for growing better crops. Affordable fuel creates more job opportunities and reduces transportation costs, making goods and services more widely available for more people. Fuels that can be sourced closer to home better ensure the safety and security of women and girls.

In order to satisfy growing demands for more fuel and foster better, faster-paced development outcomes, it is widely recognized that sub-Saharan Africa must increase its fuel production and consumption. This requires diversification of fuel sources and the types of fuels that are produced, with close attention to

⁹ Borges, Phil (2007). *Women Empowered: Inspiring change in the emerging world*, New York: Rizzoli. According to this study, for example, women and girls reinvest about 90% of their earnings in their family, whereas men only reinvest around 30 to 40%. For similar insights, see (among others): *World Development Report 2012: Gender Equality and Development*, Washington, DC: The International Bank for Reconstruction and Development/The World Bank.

locally available resources that can meet the specific fuel needs of local populations. Net importers and exporters of oil and gas products in sub-Saharan Africa alike will have to look for a wider range of cost-effective, reliable domestic fuel alternatives to speed up the pace of development and break the vicious cycle of poverty in which the majority of their citizens are trapped.

2. SOLVING THE PROBLEM: FUEL DIVERSIFICATION

Fuel diversification must move in at least two distinct directions.¹⁰ Both of these entail a fundamental shift in how fuel and fuel production are presently understood, as well as closer attention to local fuel needs and locally available resources. This two-pronged approach to fuel diversification should be seen as complementary to the wide range of projects that already focus on access to affordable electricity, developing renewable sources of energy and energy sector reform efforts.¹¹

Re-defining Fuel: Until now most solutions to the fuel deficit have focused on oil-based fuels and direct compatibles, like biodiesel. One direction for fuel diversification is to make more efficient use of these existing fossil fuel sources, eliminating waste and harnessing oil by-products. A second direction, however, is more fully developing capacities to produce fuel from multiple biomass inputs (biofuels). Like oil by-products, these potentially valuable resources are often wasted. Importantly, much of the existing fuel infrastructure (engines, motors, cookstoves, generators, and so on) can use these non-oil-based fuels with no adaptations whatsoever, or with only small modifications.

Changing Modes of Production: It is essential to recognize that models based on large-scale, mega-sized approaches to fuel production will not work to speed up development and reduce poverty in sub-Saharan Africa.¹² Rather, more effective solutions can be found in small and medium-sized production facilities that are designed to supply fuel on a localized basis. This applies to fuels that can be produced both from oil by-products and from locally available biomass resources. Emphasis on small-scale local fuel production for domestic consumption is one of the missing links in a comprehensive and cost-effective approach to fuel production in sub-Saharan Africa.

The advantages of small-scale production are multiple. Construction of these production facilities requires relatively small investments. Because the quantity of fuel that can be produced is too limited to have large-scale international commercial value, these fuels are more likely to remain in the local area. The huge cost savings on transportation mean they will be more price competitive and affordable in the local marketplace. And a smaller scale approach to fuel production better enables context-specific solutions to the fuel deficit. That is, each region or locale may opt for the most suitable approach to fuel production, depending on local needs and locally available inputs.

ELIMINATE WASTE AND MAXIMIZE USE OF FOSSIL FUEL BY-PRODUCTS

It is necessary to better utilize and maximize resources related to oil extraction in those countries that have such resources. In particular, it is feasible to make greater use of oil industry by-products, like flared natural gas and natural gas liquids. In oil producing countries, these by-products are generally not brought to the

¹⁰ The key approaches advocated here are based on three basic concerns: 1) to expand and build on existing trends, moving them in a more positive direction that better accounts for technological advances; 2) to propose solutions that can appeal to private entrepreneurs; and 3) to identify interventions with a transformational potential in excess of initial investments, but that are also sustainable and balanced.

¹¹ In ECOWAS alone, there are more than 10 separate government or inter-governmental initiatives. For example, see : <http://www.iisd.ca/energy/renewable/hlfreee/html/crsvol187num13e.html>

¹² Large-scale fuel production will be competitive in the global marketplace, thus resulting in the export of these products. Consequently, they will be too expensive for local consumers. Nonetheless, there is scope for large-scale biofuel production.

local market, but instead are completely wasted by being flared off; this is usually a decision of the international oil corporations. At the same time, sub-Saharan African governments have been unable or unwilling to negotiate provisions for the adaptation of oil by-products for domestic use.

It is therefore necessary to augment the bargaining capacities of these governments when dealing with international oil corporations to ensure that local fuel needs are met to a greater extent than at present.¹³ In addition to their more typical social, economic and environmental clauses, for example, local content agreements should also focus on addressing fuel access issues in the domestic economy. This would contribute to creating positive feedback loops that can impact the pace of development: it is simpler and quicker in terms of sustainable results to expand and diversify existing practices of fossil fuel consumption by more effectively utilizing oil industry by-products for domestic benefit. Eliminating flaring also reduces the carbon burden of oil extraction.

For example, flared natural gas and natural gas liquids can be used to generate liquid fuels in small-scale, local facilities. Among others, these fuels include ethanol and methanol, and liquid petroleum gas that can be used for cooking. Flared natural gas can also be used to produce fertilizers in small-scale plants for local consumption (see Section 3 below).

BETTER DEVELOP CAPACITIES FOR BIOMASS FUEL PRODUCTION (BIOFUELS)

It is necessary to more extensively develop capacities for the production of fuels from multiple biomass sources that are locally available, particularly those that can be safely mixed with diesel and gasoline or can serve as substitutes. Biofuel processing technology has improved tremendously during the last decade and is now more widely available and at increasingly affordable prices. An added benefit of expanding production of fuel from fossil fuels to biomass sources is the manufacture of fertilizers, such as biochar. Biofuel production is also a business opportunity that can readily attract domestic private investors, big and small.

There are a range of biofuel alternatives that can be produced from biomass (some of which can also be produced from oil by-products or natural gas). For example, ethanol can be easily used in existing gasoline vehicles, as well as in many types of generators. It can also be used for cooking. Ethanol can be made from biomass and natural gas. Methanol is similar to ethanol and has many of the same uses. It can be used in vehicles and generators, including diesel engines, with additional adaptations. Like ethanol, it can be produced from biomass or natural gas, as well as other oil by-products. Butanol is produced from biomass and can be successfully mixed with many other fuels. Biodiesel is also produced from biomass, but requires the additional input of ethanol or methanol (whether sourced from biomass or fossil fuels).

As with the more efficient use of oil by-products, primary attention should be given to small-scale production oriented to enhancing local access and raising levels of consumption. Localized production of biofuel can be cost effective and, of key importance, derives from locally available vegetation that is insulated from the dynamics of global fuel markets, particularly crude oil-related fuels. Although these inputs are widely available and/or can be easily grown in sub-Saharan Africa, at present many of these potentially valuable resources are wasted or not used to their fullest extent.

This does not mean that the potential for large-scale commercial production capacities should be ignored. Commercial production is already underway and there is scope for both greater investment and expansion

¹³ It is crucial that improved bargaining capacities are underpinned by strong political will at the national leadership level. This political will must be oriented to productively invest in the domestic economies of these oil-rich countries and to work against corrupt practices.

in this sub-sector.¹⁴ In contrast to localized production, large-scale commercial production (particularly ethanol and biodiesel) does compete on the international fuel market, where much of what is currently produced leaves sub-Saharan Africa. In parallel with shifting the focus of local content agreements in the oil sector to fuel access issues and maximizing the potentials of oil industry by-products for domestic benefit, commercial biofuel production can also be adapted to more effectively serve the development of domestic economies in similar ways; i.e., through local content agreements that focus on domestic fuel needs and increasing consumption.

3. TAPPING AFRICA'S AGRICULTURAL POTENTIAL

Given that the production of biofuel (whether on a small or large scale) requires organic material, this raises the question of agricultural practices in sub-Saharan Africa. Today agriculture is a key policy element in the development debate and a primary focus of economic investment.¹⁵ Food security and improved livelihoods will not be achieved without a significant increase in levels of agricultural productivity.

Traditional agriculture is the main economic activity for many in sub-Saharan Africa, with an estimated two thirds of the population making their livelihoods this way, most of whom practice subsistence farming and live in extreme poverty.¹⁶ Agricultural productivity is very low. In fact, Africa is the only continent in the world where food production per capita has declined over the last fifty years. However, farming in sub-Saharan Africa has enormous potential, with the availability of large swathes of arable land and (despite climate change) an abundance of both surface and groundwater.¹⁷

Despite this potential, it is estimated that only around 20% of arable land is used at present. With 60% of the world's unused arable land, African farmers produce barely 10% of global agricultural output.¹⁸ In order to multiply output over the next 10 years, the mode of production must be radically improved. This includes addressing a full range of issues: the increased use of fertilizers, better seed quality, improved crop protection techniques and pest control, development of resource-smart irrigation systems, better storage facilities and enhanced access to markets. Land reform and land rights are equally critical factors for overhauling agricultural practices.

THE MISSING LINKS

While a wide range of agricultural initiatives are underway, they continue to face serious shortcomings when it comes to implementation. Moreover, these efforts overlook at least two fundamental opportunities when it comes to comprehensively transforming the agricultural sector.

¹⁴ So far, large-scale biofuel production in Africa has been limited, but the trend is for its rapid expansion, particularly in the production of ethanol as a by-product from sugar industries. The most compelling example in this instance is Zimbabwe, but Kenya and Malawi are moving in the same direction. Palm oil and cassava-based ethanol is being produced in West Africa. Jatropha-based biodiesel is also attracting the attention of commercial agriculture investors in different parts of Africa.

¹⁵ In 2003, African leaders approved a Comprehensive Africa Agriculture Development Programme (CAADP), which is often referred to as Africa's Green Revolution Plan. It is built around four pillars: 1) extending the area under sustainable land management; 2) improving rural infrastructure and trade-related capacities for market access; 3) increasing food supply and reducing hunger; and 4) agricultural research, technology dissemination and implementation.

¹⁶ World Bank (2012). *World Development Indicators*. Source: <http://data.worldbank.org/data-catalog/world-development-indicators>

¹⁷ This is not to discount the problem of water scarcity, particularly in the dry lands of the Sudano-Sahelian region. Rather, it is to recognize that the large underground water reserves in this region can be tapped and more effectively utilized through smart irrigation schemes that minimize water usage even in large commercial agricultural fields.

¹⁸ These are FAO estimates. However land registry practices in sub-Saharan Africa make it difficult to assess land use and potential land use with accuracy. Source: http://www.aig.com/Africa-Agriculture-Potential_2590_421198.html

First, although a significant increase in the use of fertilizers is recognized as necessary for improving agricultural productivity,¹⁹ almost no attention is given either to the potentials of small-scale, local fertilizer production or the use of alternative fuel sources for fertilizer production. This is particularly relevant for improving subsistence farming practices. Second, these initiatives make no link with biomass production for fuel diversification, nor do they encourage better utilization of biomass resources that are already available. It is therefore necessary to build on existing agricultural initiatives in a way that enlarges discussion to highlight affordable access to fuel as a critical component of agricultural reform.

SMALL-SCALE FERTILIZER PRODUCTION²⁰

At present, farmers in sub-Saharan Africa consume on average only 10 kilograms of industrial fertilizer per hectare (kg/ha) compared to 176 kg/ha in South Asia, while the world average stands at 122 kg/ha.²¹ Although enhanced agricultural productivity depends on a radical increase in the use of fertilizers, the price of fertilizers is prohibitively high, which explains why farmers use so little. Sub-Saharan African farmers pay anywhere from two to six times the average world price and it costs more to move a kilogram of fertilizer from an African port to a farm 100 kilometers inland than it costs to move it from a factory in the US to the port.²²

These price distortions stem from transportation costs, which are highly dependent on the price of oil. Bad roads, along with old and poorly maintained vehicles only exacerbate this problem. Transportation of both fertilizers and other farm inputs, as well as getting produce and other farm products to markets, represents the major part of farm-level costs in remote areas of the region—compared to less than 5% in the United States.²³ As a result, farmers earn less for their produce, which is made worse by low productivity rates. Reduced public spending because of rising oil prices further aggravates the problem. This means fewer agricultural extension services and less applied research to increase agricultural productivity.²⁴

In parallel to the potentials of small and medium-sized fuel production facilities aimed at increasing local consumption, it is necessary to more fully explore the localized production of fertilizers. This approach is in contrast to the focus on large-scale, capital-intensive fertilizer manufacturing that is a key pillar of current agricultural initiatives in sub-Saharan Africa. In particular, biochar can be produced from locally available biomass, much of which is often wasted, to improve small-scale farming techniques and increase agricultural yields.²⁵ Fertilizers can also be produced from oil by-products (flared natural gas) on a small scale for local consumption where these resources are available.

Although production costs may be higher than those of large mega plants, manufacturing fertilizers closer to the point of use enhances their overall economic viability. As with locally produced biofuels, the small-

¹⁹ The CAADP puts strong emphasis on increased use of fertilizers; e.g., the Abuja Ministers of Agriculture meeting of 2006, which approved a Declaration on Fertilizer for an African Green Revolution. The New Partnership for Africa's Development (NEPAD) has also launched a fertilizer support program that aims to facilitate the production, distribution, procurement and increased use of fertilizer.

²⁰ In keeping with the focus on fuel, here fertilizer is also understood in terms of fuel.

²¹ World Bank (2012). *World Development Indicators*. Source: <http://data.worldbank.org/data-catalog/world-development-indicators>

²² Fleshman, Michael (July 2006). "Boosting African farm yields: More fertilizer, irrigation and other inputs are vital, says NEPAD" in *Africa Renewal Online*. New York: United Nations, page 10. Source: <http://www.un.org/africarenewal/magazine/july-2006/boosting-african-farm-yields>

²³ Ibid.

²⁴ A number of governments have also implemented subsidy policies aimed at reducing fertilizer costs. As with fuel subsidies, these policies have led to mixed results and have proved impossible to sustain in the long run because of the costs involved for public budgets.

²⁵ Biochar production has added benefits: as it is made, bio-oil and gas are also produced, which can be used for fueling vehicles, generating electricity and cooking.

scale production of fertilizers means these limited quantities will not be internationally competitive, but will remain in the local marketplace. More importantly, the lower transportation costs associated with local production mean these fertilizers will be more affordable for local farmers. These benefits indicate that small-scale fertilizer production has value added in terms of expanding current approaches to increasing agricultural productivity, especially for small farmers.

Without reliable and affordable access to more diverse sources of fuel and significant increases in necessary agricultural inputs (especially fertilizers), sub-Saharan Africa's long awaited agricultural transformation remains a distant promise. But if Asia can now feed more than 3 billion people in a Green Revolution that also spurred rapid economic growth,²⁶ why can't Africa?

4. STRATEGIC CONCERNS: GOVERNANCE AND REGULATORY POLICIES

At the level of national policies, rules and regulations, and public budgets, priority must be given to enhancing and strengthening the linkages between access to affordable fuels and increased agricultural productivity. This includes greater emphasis on the small and medium-sized production potentials of both fuels and fertilizers from locally available resources that are better utilized and maximized to benefit local populations.

There is a corresponding need to combine small-scale farming with commercial agricultural production, finding the right balance between the two.²⁷ Policy measures and economic incentives should be designed to link small holders and their communities to large estates through mutually beneficial business partnerships and sustainable land tenure practices. In particular, it would be risky to move too quickly into the large-scale production of biomass for biofuel processing without simultaneously making significant progress on fighting hunger and poverty.

Countries should adopt policy frameworks that encourage agricultural and energy production for domestic and neighboring markets, including biofuel processing and production of low cost fertilizers from locally available resources. This means it is necessary to determine the right mix between supplying domestic, regional and export markets, with a more equitable share of farming output being channeled to national food and fuel needs. This makes economic sense: local and regional markets remain a largely untapped potential that can be better exploited; they are easier and faster to access; and they tend to be more stable than international commodity markets once they are established.

The laws and regulatory frameworks of sub-Saharan African countries should be revised to promote and protect the interests of those engaged in the production and marketing of biofuels—whether this is on a large-scale commercial basis or for small-scale production oriented to local consumption. For large-scale commercial enterprises, it should be mandatory (i.e., included in local content agreements) that a percentage of the biofuels produced in any given country be made available for domestic consumption at affordable rates. This will protect the national economy against the wholesale export of biofuels from the region and mitigate the devastating impact of external price shocks. Similarly, for firms engaged in the oil sector (or any other extractive industries), their local content agreements could also be oriented to supporting fuel diversification; e.g., instead of flaring off natural gas or wasting natural liquid gas, these resources could be harnessed for domestic consumption.

²⁶ Asenso-Okyere, Kwadwo and Samson Jemaneh (March 2012). "Increasing Agricultural Productivity & Enhancing Food Security in Africa: New Challenges & Opportunities", Synopsis of an International Conference. Washington, DC: International Food Policy Research Institute. Source: <http://www.ifpri.org/sites/default/files/publications/oc71.pdf>

²⁷ In other words, the transformation of agricultural practices cannot be used as a mechanism to grab land from poor villagers in disregard of their rights, values and livelihoods. Protecting these rights will entail extensive land reform legislation, along with efforts to overcome the long-standing perception that sees large-scale farming as detrimental to local populations, especially their ancestral land rights.

The role of the private sector in fuel diversification should be clearly acknowledged, with special attention to the needs of small and medium-sized enterprises. Legislation should be enacted to protect investment and property rights. The approach advocated here is based on the assumption that private entrepreneurs will see fuel-related activities (including small-scale fertilizer production) as profitable: a business opportunity that offers the prospect of reasonable returns over time.

The modernization of practices that would enable increased fuel and agricultural productivity in sub-Saharan Africa, including the production of biofuels, must be consistent with adequate environmental policies. In order to achieve synergy between the biofuel sub-sector and environmental policies, efforts must be made to strengthen environmental governance.

FINAL CONSIDERATIONS AND NEXT STEPS

To leave behind two or more billion people in hopeless poverty is not an option in terms of the world's future. In part, international peace and stability depend on the capacity of sub-Saharan African governments and institutions²⁸ to resolve their enormous development challenges. They are optimistic that they can. Looking at these challenges from the perspective of fuel offers additional insights on how to do so.

Several decades of development policy have made an impact on health and education, as well as on some economic sectors. This has fostered greater resilience and change. Despite massive investments, however, development policies and programs have not yet produced a continent-wide transformation from endemic destitution to decent opportunities for all. The overall trends still point to widespread poverty and human despair.

This creates fertile ground for mass migrations, violence, widespread banditry and piracy, and extremist ideologies. Unless there is comprehensive and far-reaching progress, violent conflict, insecurity and civil strife are likely to continue to occur in some sub-Saharan African countries. In particular, the emergence of violent extremist groups in some parts of West Africa and in the Sahel region has the potential to be profoundly destabilizing.²⁹ This puts development at risk.

Beyond Africa, the future of sub-Saharan Africa will have a direct strategic impact on Europe, North Africa and the Middle East. It will also affect other global actors, especially the US and China. History and politics, recent migration patterns and geographical proximity should not be ignored in this context. These factors will continue to connect unresolved problems in sub-Saharan Africa with the rest of the world. This is all the more reason to speed up the pace of development and ensure a more equitable distribution of benefits to those who need them most.

NEXT STEPS

A number of concrete steps for increasing fuel consumption and moving development forward at a more rapid pace require attention. The most critical of these are enumerated below:

1. **Mapping:** Existing statistics are generally based on rough estimates and poorly-based extrapolations of incomplete and inconsistent data. More reliable and comprehensive data focused at local levels is essential for policy formulation, program design and identifying the most effective lines of intervention. This includes assessments of the many fuel needs of end users (e.g., fuel for transport, fertilizer manufacture, cooking and electricity consumption) and inventories of available local resources (e.g., oil by-products and biomass). There is also a need to map existing approaches to resolving the fuel deficit and have a better understanding of the economic responses to current fuel costs and policies. It is necessary to systematically analyze both the successes and failures of existing initiatives—what is working effectively and what is not, and why.
2. **Advocacy:** It is necessary to promote the small and large-scale production of biofuels as one way to transform the economy alongside other initiatives oriented to addressing wider energy challenges, including electricity supply and broader energy sector reform. It is equally important to promote more efficient use of existing available fuel resources for local consumption, most of which are currently wasted. Alongside increased food security, expanding the biofuel sub-sector should be part of efforts to improve agricultural productivity, with attention to the production of appropriate biomass crops. Other

²⁸ The private sector and civil society also have an essential role to play in closing the development gap.

²⁹ For example, Harakat al-Shabaab al-Mujahideen in Somalia, Boko Haram in Nigeria and Al-Qaeda in the Islamic Maghreb.

critical needs of the local marketplace must also be taken into account when modernizing agricultural practices; e.g., fertilizer production, fuel for cookstoves, storage for agricultural products, access to markets and so on. It is crucial that these needs be identified by relevant local interests.

3. **Balancing potential risks and benefits:** It is critical to take into account frequently raised concerns about tensions between biofuel development (and necessary biomass inputs) and food security. This requires close attention to establishing a productive balance in land use. Environmental concerns must also be effectively addressed to ensure long term, sustainable land management practices; e.g., conservation of biodiversity, competition for land and water resources, desertification and deforestation, the use of genetically modified organisms where appropriate, soil erosion, etc. It is therefore important to support on-going efforts to develop and implement certification schemes for biofuel production and trade that are based on globally accepted sustainability standards.
4. **A comprehensive and integrated approach:** This approach to responding to Africa's fuel needs should be linked to existing initiatives, notably implementation of the African Union's Comprehensive Africa Agricultural Development Programme (CAADP), as well as the Fertilizer Support Programme and the sustainable land management initiatives under the TerrAfrica plan.³⁰
5. **Gender and fuel issues:** Easier access to locally produced fuels will have a significant impact on the livelihoods of women and girls, as well as on their safety and security. In many ways, the improved security of women and girls due to the more widespread availability of affordable fuels at the local level is in itself a very strong justification for intervention. The key role women play in social change is another strong reason for making fuels available to them. If women and girls can improve their productivity and income opportunities, as well as spend more time on education, they will be better empowered to be agents of change in their own societies. Investment in small-scale biofuel production can have a direct impact on the lives of women and girls. Hence, projects should be gender sensitive and have a clear focus on the impact of fuel diversification on women's lives.
6. **Leadership and regional cooperation:** It is necessary to emphasize that these complex issues are best addressed when they can benefit from cooperation among neighboring countries, even when emphasis is on a country-by-country or localized approach. Regional cooperation bodies, such as the East African Community (EAC), the Economic Commission of West African States (ECOWAS) and the Southern Africa Development Community (SADC) can be engaged to support this approach to responding to the fuel deficit. It is also critical to recognize the leading role of the African Union (AU) and cooperate with the New Partnership for Africa's Development (NEPAD) Secretariat, which has responsibility for spearheading innovation on these matters on behalf of the AU. UN agencies that focus on renewable energy in Africa should also be engaged.

³⁰ TerrAfrica is a regional African Union initiative to improve land management. Uganda, Ghana, Niger, Ethiopia and Mauritania have moved further along in designing their national programs. Mali, Senegal, Niger, Kenya and Nigeria are finalizing their investment frameworks.

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ABOUT FUEL FREEDOM FOUNDATION

Fuel Freedom Foundation is a non-partisan, non-profit organization dedicated to removing barriers to competition and promoting the development of cheaper, cleaner, American-made fuels.

Fuel Freedom Foundation is working to reduce the cost of driving your existing car or truck by opening the market to cheaper fuel choices at the pump. Our goal is to reduce the cost of transportation fuels in the US by \$300 billion annually within ten years. In personal terms it means \$2 a gallon at the pump, adding \$2,500 per year to the pockets of the average American family. In national terms it means accelerated economic growth, greater energy security, reduced air pollution, lower greenhouse gas emissions and improved health. Fuel Freedom provides a big break for the working poor without increasing government spending.

Americans have the right to drive for less.

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