



Renewable Energy Technology for Increased Agricultural Productivity and Sustainable Development in Africa

Report of a Regional Dialogue



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Forum for Agricultural Research in Africa

12 Anmeda Street, Roman Ridge,

PMB CT 173, Accra, Ghana

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Executive summary

There is a definite resurgence of policy interest in bio-energy resources in Africa as also in other parts of the world. This reflects a growing concern about some factors such as:

- i. The long-term sustainability of fossil fuels as sources of power to drive economic growth and development on the continent.
- ii. The perennial underutilisation of the vast agricultural products and wastes available as additional sources of energy.
- iii. The environmental impact of fossil fuels in terms of pollution and other negative effects.

In addressing these concerns, Africa it is obvious, is relatively slow in seizing the opportunity offered by renewable energy sources from sunlight, rain, wind, geothermal heat, animal, human and plant waste, which abound in large measures. The most popular source of renewable energy on the continent is biomass, derived from plant material or waste. This popularity suggests that bio-energy resources represent a natural alternative to fossil fuels for Africa to revitalise its agricultural sector and to fight poverty.

Without access to energy and energy services, millions of African people are denied the opportunity to improve their livelihood, stay well fed, healthy, earn higher incomes and acquire education. Creating sustainable energy solutions will directly transform the lives of these people by providing them with simple lighting, heating, cooling as well as mechanical and communication-related technologies. It will give poor communities the much needed power to confront poverty and get out of it. Nonetheless, many issues loom large in Africa regarding efforts which are aimed at exploring its vast bio-energy sources, particularly in relation to agricultural production as the mainstay of the economy, coupled with the political visibility of food security. It is therefore vital that African countries seriously consider the opportunities presented in 2012 as the International Year of Sustainable Energy for All, to come together as a continent to deliberate, advocate, institutionalise and implement novel and proven approaches for generating energy for agricultural productivity.

To address the above mentioned needs for sustainable energy alternatives, the **Regional Dialogue on Renewable Energy Technology for Increased Agricultural Productivity and Sustainable Development in Africa** was organized at Abuja between 17th and 18th October 2012. The theme of the Dialogue was ***Utilizing Bio-energy Resources for Agricultural Productivity, Food Security and Poverty Reduction***. The presentations and discussions were organized under four sub-themes namely: Renewable energy and agricultural productivity; Renewable energy technology and rural development; Regional development in bio-energy; and Country experiences in bio-energy production and utilisation.

The specific objectives of the Dialogue were to:

- i. Discuss new trends in renewable energy production and use and determine which ones are relevant for agricultural and social transformation in Africa.

- ii. Share lessons and experiences gained from successful renewable energy initiatives and identify options for up- and out-scaling such practices.
- iii. Discuss and agree on strategic policy options for development, dissemination, adoption and use of renewable energy technologies for agricultural and social transformation in Africa.
- iv. Advocate for increased public and private sector investments in renewable energy initiatives.
- v. Promote partnerships and collaboration between government, agri-business dealers and renewable energy companies.

The policy situation analysis suggests that solutions to the problem of food imports require agricultural public actions to reduce food imports. The target should incorporate intensified farming systems and extensive renewable energy sourcing from available diversified sources namely: rivers, sunlight, wind, geothermal, sea waves, natural biomass like wood products and natural gasses (from humid lands) etc., crops (biomasses and crop residues), agricultural wastes (animal and processing wastes), and city and industrial wastes (sieved wastes, raw wastes). Accordingly, the policy varieties identified during the Dialogue include the following categories:

- i. Policies that directly promote renewable energy production – price and quantity mandate policies, investment cost reductions like subsidies, rebates, etc.
- ii. Policies that promote bio-fuels for transport – e.g. bio-fuels tax reliefs, mandated proportions of bio-fuels for transport, etc.
- iii. Policies that target reduction in emission – monetary credit for emission reduction, greenhouse gas mitigation, percentage of emission reduction to be met by renewable energy, etc.
- iv. Policies that restructure the power sector – e.g. encouraging completion, privatisation/commercialisation etc.
- v. Policies that support distributed generation – e.g. rules, regulations, norms and standards for interconnection.
- vi. Policies that promote rural electrification – e.g. support to private investors to provide renewable energy products and services to end users, and or renewable energy as part of rural electrification policy and planning.

The general situation in the case of Africa is characterised by increased dependence on biomass in terms of fuel wood, though some countries are already towing a pathway to clean energy. Results of a study report indicated the following:

- i. A high proportion of rural households in Uganda still depend on biomass.
- ii. As the economic conditions of rural households improved in Uganda, people moved to a higher level on the energy ladder.
- iii. The type of energy used by rural and urban households is contingent on household size, economic status and other factors.

Another study in Kenya established that willingness to pay exists at both urban and rural levels, but is different for different types of energy sources (fuel wood, charcoal and modern methods).

It also differs based on income category (high income, middle income, low income), depending on the status of the household in the energy ladder, as well as age structure of households among other factors. In general, urban people were willing to pay more for electricity while the rural people were willing to pay more for charcoal. The willingness to pay was high for firewood for all income categories and people high up on the energy ladder.

Furthermore, it was established that countries represented at the Dialogue were not only at different stages in the development of renewable energy technology but also had varied experiences in policymaking and implementing bio-energy programmes. For instance, in Kenya the use of solar energy is associated with high capital cost and a lack of awareness despite the exemption of its equipment from value added tax; in Malawi the bio-energy policies especially with regard to jatropha bio-fuels appear to be incoherent and inconsistent and the challenge lies in integrating renewable energy output into the national grid; in Ghana, improved cooking stoves were associated with health hazards and other concerns, following the introduction of palm kernel wastes as fuel; and in Nigeria the food-versus-fuel debate is quite intense and follows the introduction of E10 (10% Ethanol) and other policies implemented for promoting bio-energy sourcing from agricultural products.

Participants at the Dialogue saw a role for bio-energy technologies not only as an essential requirement for farm productivity growth (through increased supply of farm power) and household use, but also as an instrument for increasing the access of farmers and other rural poor – focusing on women and youth in particular – to the so called “good things of life” that their urban counterparts have more and easy access to. These things include access to cleaner energy for cooking and other household uses, power to pump water for irrigation and human consumption, as well as rural infrastructure like information, education and communication facilities. Such information and other facilities would be internalised to build knowledge and other capacities in rural areas that will ultimately translate into productivity of agriculture in African countries. Thus, the development of innovative energy supply and consumption is needed from renewable energy sources. In addition, energy use holds the key to agricultural intensification in Africa, as agriculture needs fuels for machines in field, postharvest machines, transport of goods and people and water pumping.

Two major technologies were introduced at the Dialogue namely, the Green Energy Machine (GEM) and the Modular Distributed Green Energy (MDGE). The lesser ones also mentioned in passing include: the cooking stove enhanced with a chimney which directs the smoke away from users. This is popular in Ghana where the fuel source is waste produced from the extraction of palm kernel processing; solar lanterns sold at affordable prices to rural women; and bio-diesel from the jatropha plant which is currently gaining popularity in Nigeria for powering masts in the telecom industry.

GEM is a product of MSW POWER Inc. / IST-Energy which was introduced as a “Landfill Diverter” that transforms useless waste into valuable clean energy. It handles mixed waste streams such as paper, plastic, wood, food, and agricultural waste and has the capacity to process up to 3 tons/day. It helps diverting unrecyclable waste from landfills while complementing existing recycling programmes, and safely eliminating confidential waste. Thus the GEM, with an investment outlay of about \$1.1 million, is suitable for installation in rural areas to supply renewable

energy with minimum damage to the environment. The MDGE is a product of Bestech Company which is known for the supply of cost-effective and energy-efficient electrical appliances. The company offers a solution to rural electricity supply, by reducing power consumption through on-site generation, and the use of solar or wind power for lighting, heating or cooling and also for pumping water in submersible irrigation pumps. MDGE deploys energy-efficient appliances including short-neck bulbs designed to reduce energy consumption to the tune of 65-75% in most homes as a solution to rural electricity supply problems, and as an alternative to the use of biomass.

The situation analysis in Africa about bio-energy production and utilisation brings to the surface a number of issues. These issues border on the public policy process for promoting renewable energy products in Africa and also on factors facilitating the emergence of a thriving renewable energy market in the continent. On the supply side, key issues include the dilemma of energy security versus food security as a topical issue in African development, and the global concerns for environmental sustainability as it presently affects African countries. On the demand side key issues relate to availability, acceptability and affordability of bio-energy products.

In resolving these and other issues associated with bio-energy use in Africa, the Forum for Agricultural Research in Africa (FARA) was called upon to support a series of next steps as agreed on by participants. These steps were designed with a view to bringing renewable energy policy to the top of the African agenda at the country level, and integrating bio-energy issues into national and regional development strategy documents. FARA would support meetings and other activities geared towards articulating a policy framework for individual countries and the production of a regional plan with time-bound targets for the proper monitoring and evaluation of such efforts. It is also meant to raise funds for the purpose of implementation. At the instance of FARA, there is a need for a concrete plan of action anchored on this Dialogue as the nucleus of “Abuja Movement for Renewable Energy Development” or “Abuja Declaration for the establishment of a Pan-African Network for Bio-energy Technology”.

Based on the foregoing situation analysis and highlight of issues, the way forward after the Dialogue was specified in terms of a wish or shop list of actions required from policy authorities, on an outcome by outcome basis as follows:

Outcome 1: Awareness among African policy makers created on available alternative renewable energy sources, their contribution to agricultural productivity and the need to integrate them in agricultural and social development initiatives:

- Identify the various renewable energy sources e.g. hydro power, biomass bio-diesel, among others.
- African Union (AU), *Economic Community Of West African States (ECOWAS)*, Heads of State and FARA to initiate the awareness dissemination through study tours for policy makers.
- Study tours should be organized for policy makers to visit countries where successes have been recorded.
- The need for the creation of an inter-parliamentary group for renewable energy should be considered.

- After the creation of an inter-parliamentary forum for renewable energy, FARA to sustain the dialogue forum through an effectively functional inter-parliamentary forum.
- The different Management Development Institutes(MDIs) to create awareness of the concept of Renewable Energy (RE) e.g. Administrative College of Nigeria; the Ministries, Departments and Agencies (MDA).
- The different MDIs should be utilised with a view to building capacity of policy makers and in incorporating renewable energy in the training modules of these institutes.
- The respective countries to establish agencies for driving awareness must follow this up with policy makers beyond awareness.
- The platform of the AU, African Governance Forum, Heads of State and Government should utilise these platforms to initiate awareness (presentations at this level of meetings would be effective).
- The Dialogue should be maintained as a form of continuous collaboration between FARA and other stakeholders.
- A situation and institutional analysis of renewable energy production and use in different countries should be conducted with a view to knowing what has been done and what needs to be done; exploring the concept of renewable energy; and media exposure of the concept.
- Incorporating the concept of renewable energy in the academic modules of institutions of higher learning.

Outcome 2: Information on best practice initiatives and investment opportunities, as well as policy options for up- and out-scaling such RE initiatives must be shared among participants. Thus, there is a need to:

- Identify available technology and capitalise on them, e.g. creating a website on the available RE technology will help to create electronic awareness about the technology.
- Conduct comparative advantage analysis of bio-energy technologies.
- Communicate with members about conflicts and trade-offs associated with specific bio-energy sources; engage professionals to bring up the results of their ideas for policy drafting.
- Create regional development pathways for bio-energy production and utilisation through production of a data base of existing country documents, value chain analysis incorporating social aspects, and alternative fund-raising strategies to be explored by FARA.
- Identify and list all the stakeholders and their roles for FARA.
- Produce a list of available technologies in renewable energy and agriculture.
- Incorporate bio-energy in the commodity value chains in agriculture rather than treat them as a choice between food security and energy security.
- Engage with policy professionals to help them incorporate the result of their work into effective policy formulation and implementation processes.
- Work on the vision in terms of regional or local development pathways.
- Produce a database of existing country policy frameworks or documents or other documents that can help.

- Conduct a value chain analysis of products or projects (integrating social aspects, wastes, shared value, environment and not finance).

Outcome 3: Opportunities for partnerships between government, agri-business dealers and renewable energy technology companies created, and strategies to promote collaboration identified:

- Government and companies that have simple technologies should be encouraged, the knowledge should be very simple.
- Partnerships between public and private sector for production and use of renewable energy should be established; the private sector should lead with government support; educators to be involved in the popularization of technologies; the need to identify sources of seed fund; FARA to work with all tiers of the government and to create a one-stop shop for products; the government to encourage multinational companies to participate in the partnerships.
- Government and commercial companies should encourage and provide simple technology at reasonable and affordable cost to the end-users.
- The technology should be unambiguous and adaptable so as to allow consumers to partner with the technology.
- Partnership between the consumers and agricultural producers (farmers) should be facilitated.
- The private sector should handle production, while government should subsidise the price in order for rural people to be able to afford the technology.
- Business educators should not be left out of the partnership process as the renewable energy technology details need to spread to the youth and others end-users.
- FARA should identify institutions that can provide seed grants such as government institutions, banking institutions and donors.
- Governments at all levels should be involved in the partnership process.
- Microfinance institutions and NGOs should help in the transfer of the products from the point of creation to end-use.
- Products should be tested to ensure that they are cost-effective, and of standard quality to enhance the support of the government.
- Government should encourage multinational companies to help with the development of renewable energy technology.
- Government should create the regulatory framework on which the partnerships will grow.

1. Introduction

The resurgence of policy interest in bio-energy resources in Africa reflects a growing concern about the long-term sustainability of fossil fuels as sources of power to drive the engine of economic growth and development on the continent. It also reflects the concern for perennial underutilisation of vast agricultural products and wastes available as additional sources of energy. Moreover, the use of fossil fuels is

widely implicated as a major source of pollution and other environmental problems which will have negative effects on future generations of Africans. Hence the present world view that increased exploration and exploitation of bio-energy resources, holds the key to accelerated growth of African economies now and for the future.



The neglect of renewable energy by African countries presents a situation of double jeopardy for agriculture as the backbone of the region's economy. Firstly, the pronounced energy deficit has posed a major constraint to productivity growth in agriculture, as power was not adequate to drive farm operations and agro-industrial production; and Secondly, the resultant sluggish growth of agriculture has put a low limit on the capacity to explore the sector's potential for sources of renewable energy and the modern bio-energy technology space. Thus the nexus of agricultural production and sustainable development in Africa culminates in a cycle of poverty triggered from pronounced energy deficit leading in low agricultural productivity, then proceeding to food insecurity and back to perpetual energy poverty of the region. Virtually all countries of Africa are trapped in this vicious cycle which, unless they are able to break loose at some point and escape, the policy efforts to increase agricultural productivity and to attain sustainable development of the continent will amount to mere platitudes.

Against this background, the **Regional Dialogue on Renewable Energy Technology for Increased Agricultural Productivity and Sustainable Development in Africa** was organized by FARA in collaboration with the Office of Special Adviser to the President of the Federal Republic of Nigeria on Special Duties and Social Development Matters, at Abuja between 17th and 18th October 2012. The theme of the Dialogue was ***Utilizing Bio-energy Resources for Agricultural Productivity, Food Security and Poverty Reduction***. The initiative for this event was derived from the role of FARA as the apex organization for coordinating agricultural research and development in Africa under the mandate of African Union Commission (AUC) and New Partnership for Africa's Development (NEPAD) Planning and Coordinating Agency (NPCA).

The opening session of the Dialogue was chaired by the Honourable Mrs. Sarah Pane, the Special Adviser to the President of Nigeria on Special Duties and Social Development Matters.

Mrs. Pane also delivered the welcome address of the programme. The Dialogue was declared open by Honourable Mr. Bukar Tijani, Nigeria Minister of State for Agriculture, followed by the delivering of opening remarks by other dignitaries or their representatives, namely: Nigeria Honourable Minister of State for Power, Arc. Darius Ishaku FNIA; Chief Executive Officer NEPAD, H. E. Dr. Ibrahim Mayaki; Nigeria Honourable Minister of Environment, Honourable Mrs. Hadiza Ibrahim Mailafia; and Director-General of Nigeria Energy Commission, Prof. A. S. Sambo. The keynote address was delivered by the Executive Director of FARA, Professor Monty Jones, which set the tone for the Dialogue. The technical sessions featured paper presentations by experts drawn from academia, policy institutions, the private sector and other stakeholders, as well as panel discussions at different stages. These discussions were organized under four sub-themes - Renewable energy and agricultural productivity; Renewable energy technology and rural development; Regional development in bio-energy; and, Country experiences in bio-energy production and utilisation. The expected outcomes of the Dialogue were three-fold as follows:

- Awareness among African policy makers on available alternative renewable energy sources, their contribution to agricultural productivity and the need to integrate them in agricultural and social development initiatives.
- Information on best practice initiatives and investment opportunities in renewable energy shared among participants, and policy options for up- and out-scaling such initiatives by participants.
- Opportunities for partnerships between governments, agri-business dealers and renewable energy technology companies were created and strategies to promote collaboration have been identified.

The report is structured into four main sections after the introduction. First is the Conceptual Framework as articulated ahead of the Dialogue by FARA; second is Situation Analysis conducted along the thematic lines and based on the papers presented; third is the Highlight of Issues based on comments by participants and content of discussions held at different stages of the Dialogue; fourth is Conclusions, Recommendations and The Way Forward which was based on the final thematic working groups and closing remarks.

Opening speeches

In her welcome address, Mrs Sarah Pane broached the topic of renewable energy in terms of the relationship between man and the changing environment. The consequences of the fast technological advancement of the past one hundred years are visible today. She said, “a cost to material and environment and distortions we witnessed today are direct consequences of this exploitative interface between man and nature”. The recent flood disaster in Nigeria was a case in point which has negated the giant strides recorded by the country towards food security in the past years by dealing with low agricultural productivity, and reducing the magnitude of poverty. Thus a paradigm shift is required to forestall the negative environmental consequences of heavy reliance on fossil fuels which also is not sustainable well into the far future. This creates the need to promote the production and use of bio-energy resources in Africa, which are “readily available, cheap, clean and with capacity to restore the soil and the environment”.

Delivering its opening remarks, NPCA indicated that the regional body is presently working in the area of energy and food security through bio-energy projects of the Comprehensive Africa Agricultural Development Programme (CAADP) and other different activities. The situation of poor access to energy, and low energy use in Africa was decried as was the fact that 50% of earnings of Africa go to oil import bills. The need to shift from traditional biomass to modern energy becomes paramount in the face of intense desertification as well as gender and nutritional imbalance. This would trigger different economic activities and generate employment in rural areas, as it would also reduce wastes and increase the use of crop residues for bio-energy production instead of food crops. Reducing fossil fuel consumption and increasing bio-energy use at the same time is desirable and consistent with the clean energy initiative of the United Nations (UN) that has set time and quantity targets for universal access to modern energy services. Nonetheless there are challenges such as the inadequate land tenure and land grabbing that is not only related to bio-energy but also threatens food security on the continent. Thus the efforts to tackle it require a holistic approach which includes capacity-building, regulatory policies, innovative farming systems and institutional arrangements among other aspects.

In his opening address, Honourable Mr. Bukar Tijani stressed the importance of renewable energy in the quest for growth and development of African countries given the vast resources available for this purpose on the continent. He stated that the whole world is looking up to Africa so they can also tap into these available resources. In this regard, Nigeria presently implements an economic transformation programme focusing on power, food security and human resource development, as well as opening up to private sector investment in the economy. Towards this end, the Federal Ministry of Agriculture and Rural Development collaborates with other government and private sector agencies to promote renewable energy production and use through crop value chains. The cassava value chain specifically, involves the production of ethanol for use in machines and power generators. This combines with the commitment of the government to reform the hydro-energy sector and explore other renewable energy resources such as wind and solar power as well as the production of jatropha.

Keynote address

The keynote address was delivered by Professor Monty Jones, the Executive Director of FARA, setting the tone for the Dialogue. He stressed that the heightened interest in bio-energy predicated on a number of reasons, which include: Energy scarcity – that is, energy from non-renewable sources is becoming scarcer and more costly to extract; Energy security – that is, reducing dependence on supply from politically fragile States is important; Mitigating climate change – fossil fuels are associated with high GHG emissions and that needs to be monitored; Idle resources – the bio-energy resource base is under-exploited as a potential driver for rural development and more attention needs to be diverted towards tapping into it; and Diversification – that is, bio-energy presents as an alternative to the production of illegal cash crops such as coca and these alternatives need to be explored. Even though for Africa the bio-energy resource base is predominant in the energy mix, the production trends are driven by policies of actors outside the continent notably the European Union (EU), USA and

China. While these countries look to Africa as the source of a large share of the increased production needed to meet their targets, Africa itself has not moved fast enough to respond to the associated opportunities and risks to meet this expectation.

Thus, according to Professor Jones, the link between energy and human development is strong and poses many challenges to Africa. Energy is a very important factor in the economic growth of a region as illustrated by the industrial revolution in Europe. An economy grows as its energy consumption increases and so sluggish economic growth can be due to low energy consumption. The evidence of this permeates all aspects of our life as energy production leads to extended working time and an increase in the number of hours that children can study. It also improves labour productivity among yielding other benefits.

In the last 30–40 years, energy consumption has doubled the share of renewable energy, including hydro, bio-energy, wind and bio-thermal energy. Altogether they constitute 13%, with bio-energy accounting for 10% out of this. Fossil fuels, that is, coal, oil and natural gas account for 81% which is not renewable and so will soon disappear unlike renewable fuels that are sustainable with assured perpetual supply. In Africa, charcoal and firewood dominate the bio-energy mix which attracts the interest of policy authorities for many reasons. Therefore, Africa must embrace bio-energy at all costs and move away from traditional sources like charcoal and biomass. This will also create an opportunity for the continent to reduce importation of energy, thereby substantially saving the energy bill of countries.

Undoubtedly the balance between food security and energy security poses a challenge, which is due to lack of knowledge and experience, as most countries have no policy in place to maintain this balance, and the high production and transaction costs as a result of fragmented markets for energy products. In this regard it is left for African countries to strike a balance in their different circumstances, whether 50-50, 80-20 or other ratios of food production and energy production from renewable sources, without necessarily sacrificing one for the other.

It was also observed by Professor Jones, that in Africa most policy documents fail to even mention energy let alone recognise bio-energy as an instrument of growth and development, leave alone setting realistic targets for its use over time. This implies that there is potential for bio-energy production and use in Africa but no policy framework to harness it. However, in harnessing the potential the need to move cautiously arises. The starting point is the articulation of the policy framework followed by capacity development; not just to plant jatropha in marginal areas but to first identify the experts such as breeders and others to do the job which is where the role of FARA is recognised, for coordinating research and development in Africa. In this regard the mission of FARA involves development of broad-based approach through its networking support functions and through capacity-building. In the case of bio-energy development in particular, the entry points for FARA are based on its proposition to provide strategic platforms and to ensure that such platforms function optimally to promote collective action on the matter, while bringing everybody in the value chain together on the same page. Therefore FARA is well disposed to promoting the establishment of such a platform on bio-energy in Africa and to support the current efforts of the AU in that direction. For this purpose external resources could be leveraged in a coordinated manner. An example is the current initiative of China to support five countries in this area, towards increased agricultural productivity and poverty reduction.

2. Conceptual framework

Background

Agricultural productivity in Africa has been in regression in the last two decades. Farm yields of strategic crops have either stagnated or declined resulting in supply shortages, high food prices and rising number of chronically hungry and malnourished people, currently estimated at about 200 million. This increase in the number of chronically hungry people presents a security challenge to African governments



especially countries emerging from conflict. With its rich endowment of abundant natural, mineral and human resources, Africa should be able to produce enough food to feed itself and generate foreign exchange earnings from the export/sale of surpluses. Unfortunately this is deterred by a wide range of constraints including inter alia, inappropriate policies and irrational use of natural resources.

African policy makers recognise that agriculture has the potential to stimulate growth, improve food security and reduce poverty by virtue of its contribution to household income, employment, foreign exchange earnings and GDP. It was therefore a step in the right direction when in 2003 African Heads of State and Government adopted the CAADP in the Maputo Declaration. CAADP is an Africa-led and owned framework for the revitaliation of Africa's agriculture through leveraging of investments that will stimulate growth and productivity in the sector through four mutually reinforcing "pillars" namely: Extending the area under sustainable land and water management (Pillar I); Improving rural infrastructure and trade-related capacities for market access (Pillar II); Increasing food supply and reducing hunger (Pillar III); and Agricultural research, technology dissemination and adoption.

The CAADP vision cannot however be achieved without consideration for the energy resources required to oil the technologies that will move Africa from subsistence farming to mechanised agriculture. Energy is vital to escaping poverty, essential to food production and it is a necessity for achieving the Millennium Development Goals (MDGs), especially of halving hunger and poverty by 2015. Prior to the industrial revolution, the primary energy input needed for agriculture was the sun. However, with industrialisation came the advancement of technology, and ever since, agriculture and food production has become increasingly dependent on energy derived from fossil fuels. Today, the agricultural demand for fuel includes: fertiliser production, irrigation and water generation and control, farm machinery and equipment, processing, packaging and transportation.

Renewable energy which is derived from natural processes that replenish constantly, from sunlight, rain, wind, geothermal heat, animal, human and plant waste presents an opportunity for Africa to revitalise its agricultural sector and fight poverty. About 16% of global energy consumption is derived from renewable sources with 10% coming from traditional biomass, which is mainly used for cooking and heating, and 3.4% from hydroelectricity. New renewable sources such as biomass, solar, bio-fuels, geothermal and wind account for 3% of global energy consumption and are growing rapidly. Some countries rely on renewable sources for most of their energy consumption, including Iceland and Paraguay (100%), Norway (98%), Brazil (86%), Austria (62%), New Zealand (65%), and Sweden (54%).

While many renewable energy projects across the globe are large scale for urban areas, renewable energy technologies are also suited to rural and remote areas where energy is crucial to human development. As of 2011, small solar PV systems provide electricity to a few million households, and micro-hydro configured into mini-grids serves many more. Over 44 million households use biogas made in household-scale digesters, for cooking, lighting and heating, and more than 166 million households rely on a new generation of more efficient biomass cooking stoves.

In Africa, the most popular form of renewable energy source is biomass which is derived from plant material or waste. Through the process of photosynthesis, plants capture the sun's energy (serving as a sort of natural battery for storing solar energy) and when burnt, they release this energy. As long as biomass is produced sustainably, this energy source will last. That is, plants can be grown specifically for energy use or the residues from plants can be used to produce bio-fuels. Bio-fuels include a wide-range of fuels derived from biomass and could be in solid, liquid or biogas forms. Liquid bio-fuels include bio alcohols, bioethanol and biodiesel. Gaseous bio-fuels include biogas, landfill gas and synthetic gas. Biodiesel is derived from animal fats or vegetable oils and in its purest form, it can be used to fuel vehicles. Bioethanol derived from fermenting the sugar components of plant materials can be used to fuel vehicles or as gasoline additive to increase octane levels and improve vehicle emissions. It is widely used in the USA and Brazil.

Given the rapid growth of Africa's population and the accompanying increase in food requirements and the world's finite supply of fossil fuels, the existing relationship between agriculture and energy must be altered. Farms (especially large ones) must be encouraged to generate their own clean energy and governments should create the enabling policy environment for these changes to be effective. The government must also invest in renewable energy technology demonstration centers. Given the challenges posed by the energy-intensive nature of agriculture, effective use of energy resources and improved modern technologies will significantly improve the long term-sustainability of food production.

Justification

Rising global oil and food prices, food crises in the horn of Africa, concerns over energy security and the urgent need to address the devastating effects of climate change have all put energy at the center of public policy discourse and international development debates. Energy poverty

threatens the lives of millions of people in Africa and it has the potential to further exacerbate the incidence of chronic hunger and food insecurity if a sustainable solution is not reached.

Energy poverty which is a lack of access to modern energy for basic domestic needs such as generating clean water, cooking, cooling, heating, lighting and essential services required for education, healthcare and transportation to function properly; condemns millions of women, men and children in Africa to absolute poverty and hunger. Over 1.6 billion people world-wide do not have access to electricity, more than 3 billion people depend on harmful solid fuels to meet their basic energy needs, 2.5 billion people cook with biomass (wood, animal dung and agricultural residues) and over half a billion cook with coal. A quarter of the 2.5 billion people cooking with biomass live in Africa where only 15% of the population has electricity, with 4 out of 5 families lacking access to electricity. Majority of the people still cook on open-fires, the fumes of which kill up to 1.4 million people each year. Most of those affected are women, children and the elderly. The international community recognises a number of basic rights: the right to water, food, shelter, healthcare, education, gainful employment and the right to take part in cultural life. What is often omitted is the right to energy, yet everyone needs energy to generate clean water, to increase food production, for transportation, processing food, storing food, cooking, cooling, heating, and delivering quality education, and healthcare.

When the U N outlined the eight MDGs and world leaders committed to it in 2000, energy did not feature. Yet, access to energy is vital to the achievement of the MDGs. So far, accelerating the achievements of the MDGs has been impeded by energy poverty especially in Africa where the lack of access to efficient modern energy and energy technologies has a significant impact on small and medium scale enterprises, educational opportunities, infant mortality, and drudgery for women and the general quality of life and socio-economic development. With three years left to the 2015 target date of achieving these goals, access to energy is now a burning issue in global discourse. It is now a prerequisite for human development on a personal, community, national, sub-regional, continental and global scale, without which the MDGs cannot be achieved. According to the UN Secretary-General Ban Ki-moon, “Universal energy access is a key priority on the global development agenda. It is a foundation for all MDGs”.

In December 2010, the UN General Assembly declared 2012 the **International Year of Sustainable Energy for All**, in recognition that access to affordable modern energy is essential for sustainable development and for the achievement of the MDGs. In view of this, the UN Secretary-General Ban Ki-moon is currently leading a global initiative on Sustainable Energy for All (SE4ALL) to mobilise action from all sectors of society in support of three inter-linked objectives to be achieved by 2030: Providing universal access to modern energy services; Doubling the global rate of improvements in energy efficiency; and Doubling the share of renewable energy in the global energy mix.

The UN Development Programme (UNDP), World Bank and European Commission (EC) also recognise the intrinsic importance of energy in achieving the MDGs. The 9th Session of the Commission for sustainable development concluded that “to implement the goal accepted by the international community to halve the proportion of people living on less than \$1 USD per day by 2015, access to affordable energy services is a prerequisite”. In addition, the Rio+20

Earth Summit called for a greener economy in the context of sustainable development focusing on seven priority areas: job creation, energy, sustainable cities, food security, sustainable agriculture, water, and disaster readiness without which the MDGs cannot be fully achieved.

Without access to energy and energy services, millions of African people are denied the opportunity to improve their livelihood, stay fed, healthy, earn higher incomes and obtain education. Creating sustainable energy solutions will directly transform the lives of these people by providing them with simple lighting, heating, cooling and mechanical and communication technologies. It will give poor communities the much needed power to confront poverty and get out of it. It is therefore vital that African countries take seriously the opportunities presented in 2012, the International Year of SE4ALL, to come together as a continent to deliberate, advocate, institutionalise and implement novel and proven approaches for generating energy for agricultural productivity. It must be borne in mind that the agricultural sector is the largest employer of labour on the continent, covering an estimated 70% of Africa's total labour force.

Purpose, objectives and expected outcomes

Organized under the auspices of FARA's Food and Agricultural Policy Platform (AFAPP), the purpose of the workshop is to provide a forum for key stakeholders involved in the renewable energy sector to dialogue on the theme: ***Utilizing bio-energy resources for agricultural productivity, food security and poverty reduction in Africa***. Specific objectives are to:

- i. Discuss new trends in renewable energy production and use and determine which ones are relevant for agricultural and social transformation in Africa;
- ii. Share lessons and experiences gained from successful best practice renewable energy initiatives and identify options for up- and out-scaling such best practices;
- iii. Discuss and agree on strategic policy options for development, dissemination, adoption and use of renewable energy technologies for agricultural and social transformation in Africa;
- iv. Advocate for increased public and private sector investments in renewable energy initiatives;
- v. Promote partnerships and collaboration between government, agri-business dealers and renewable energy companies.

Accordingly, the expected outcomes of the Dialogue were identified as follows:

- i. Awareness created among African policy makers on available alternative renewable energy sources, their contribution to agricultural productivity and the need to integrate them into agricultural and social development initiatives;
- ii. The process identified for information sharing on best practice initiatives and investment opportunities in renewable energy and policy options for up- and out-scaling such initiatives by participants;
- iii. Opportunities identified for partnerships between government, agri-business dealers and renewable energy technology companies and strategies to promote collaboration.

3. Situation analysis

The analysis of Africa's situation with bio-energy production and use was conducted along the thematic lines and with a view to raising key issues for discussion by participants. This is based on content analysis of the various presentations during the Dialogue, which helped in identifying the key issues.



Renewable energy and agricultural productivity

This sub-theme featured presentations by Dr. Emmanuel Tambi, Dr. Allain Ange and Dr. Vincent Motola. Dr. Tambi's presentation highlighted FARA's perspective on renewable energy policy within the context of agricultural transformation in Africa, which is driven by economic, social, environment and security concerns that also influence its production and use in driving agricultural productivity. Thus FARA's support to renewable energy development in Africa is in terms of: appropriate institutional arrangements; strategic options for policies, institutions and markets; access to knowledge and technologies; human and institutional capacity, and platforms establishment. Within this context, FARA provides networking support that covers the aspects of advocacy and policy, knowledge and technology, capacity strengthening as well as partnerships and strategic alliances on a number of cross-cutting issues such as gender, climate change, environmental sustainability, governance, monitoring and evaluation.

Africa's target of 6% annual growth in agriculture will depend on increased and efficient use of energy in the sector. The proportion of renewable energy use must increase significantly while effective renewable energy policies must be put in place. In this regard policy authorities will be required to:

- a. provide a stable, long-term commitment focused on specific and measurable outcomes;
- b. provide manufacturers, developers and agricultural producers with incentives that attract and sustain investment in renewable energy;
- c. provide consumers with incentives to use renewable energy.

The question was posed, why policy for renewable energy development in Africa? This was in order to address the salient issues affecting investment in renewable energy production and use which includes: cost issues (operating cost, maintenance cost, transaction costs, etc.); role of the public sector in subsidising investment on energy to make it cheaper; pricing and externalities; regulatory mechanisms for eliminating market sharp practices such as legal frameworks; restrictions in some countries in terms of rules not being in place, connection requirements and insurance-related issues; and market governance in terms of risk involved and access to finance required. In Africa, policy on Renewable Energy Technology (RET) is

driven within specific institutional contexts with particular reference to private and public sector institutions along with academia. It was established that effective renewable energy policy depends on the provision of stable, long-term commitment and measurable outcomes, as well as an incentive structure for both investment and consumption.

Six policy types were identified as having the capacity to significantly affect production and use of bio-energy in Africa:

- i. Policies that directly promote renewable energy production – price and quantity mandate policies, investment cost reduction like subsidies, rebates, etc.
- ii. Policies that promote bio-fuels for transport e.g. bio-fuels tax reliefs, mandated proportions of bio-fuels for transport, etc.
- iii. Policies that target reduction in emission – monetary credit for emission reduction; greenhouse gas mitigation; percentage of emission reduction to be met by renewable energy, etc.
- iv. Policies that restructure the power sector e.g. encouraging completion, privatisation/commercialisation, etc.
- v. Policies that support distributed generation e.g. rules, regulations, norms and standards for interconnection; and
- vi. Policies that promote rural electrification e.g. support to private investors to provide renewable energy products and services to end users, and/ or renewable energy as part of rural electrification policy and planning.

Dr. Ange's presentation explored the nexus of food security, energy supply and environment, which was hinged on four factors of agricultural productivity. First, the progress of food supply was not enough, but large scale food deficits were avoided in the face of an increasing population and shifting diets. In this regard, there are several scenarios as follows: Africa's increasing population growth versus decreasing growth rate of agricultural population; increasing agricultural production which did not raise food availability, while demand increased and agricultural exports per capita declined; soaring food imports, particularly the import of cereals and emergence of other food imports like sugar, animal products, edible oils, cigarettes, drinks, etc.; and FAO Food Security Risk index ranging from high to very high for most countries of Africa. In the past 30 years, national agricultural productions could not cope with the rising national demands for agricultural products. This is due to the lack of land use planning in support of farming expansion; the lack of investments towards improving farm equipment and labour productivity; and poor development of inputs supply, agricultural technology and credit.

Second, there are the environmental costs of agricultural expansion which led to high food imports and increasing food prices. This involves increased food production mostly through the encroachment of cropped areas into pastures and natural vegetation, and the huge amounts of land degradation up to 30% of agricultural area. Therefore food imports soared and international food prices sharply increased, putting sustainability at risk for most farmers, revealing the high susceptibility of African food systems.

Third, the prospects and scenarios for agricultural production in Africa are quite bright, notably from population growth and decreasing growth rate of agricultural population that will continue

to generate huge changes. Therefore, increasing agricultural production through intensification that may greatly contribute to increased food supply particularly in West Africa. In addition, significant intensification of farming and a possible sharp increase in cropped area particularly in West Africa could also be beneficial. Therefore food imports may at best be capped.

Last, innovative energy supply and consumption development is needed from renewable energy sources for sustainable economic progress, which is expected to have the desired effect on agricultural productivity and the food systems. The solutions to the problem of food imports require agricultural policies to reduce food imports. The target should incorporate intensified farming systems and extensive renewable energy sourcing from available diversified sources such as rivers; sunlight; wind; geothermal; sea waves; natural biomass like wood products, natural gasses (from humid lands), etc.; crops (biomasses and crop residues); agricultural wastes (animal and processing wastes); and city and industrial wastes (sieved wastes, raw wastes).

Thus innovative energy supply and consumption development is needed from renewable energy sources and also, energy use holds the key to agricultural intensification in Africa, as agriculture needs fuels for machines in the field, postharvest machines, transport of goods and people and water pumping. Therefore further encroachment of agriculture into natural vegetation would be necessary to feed the people of Africa so further land development can be available for bio-energy production.

Dr. Motola's presentation was focused on assessing raw resources for RET, through the mapping of renewable energy resources using GIS and remote sensing techniques. By these means data may be collected on infrastructure, demography and economy, against which the EU's Renewable Energy Directive (RED) has set compulsory targets for member States to implement the Directive toward 2020 and proposed certain criteria for bio-fuel sustainability. Towards this end and to ensure productivity, the main RED and Sustainable Criteria for "Forest and Agriculture" comprise the following:

- Exclude legally protected areas - national (e.g. nature reserves, national parks) and international [e.g. Biosphere reserves (UNESCO MAB), Ramsar sites; this involves identifying protected areas and excluding them from use. Additionally, differentiate management intensity based on IUCN categories, exclude all areas with category I (core zones), and adapt management on other areas (harvesting levels)].
- Adapt management in areas designated for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements, or included in lists drawn up by intergovernmental organizations or the IUCN - Identify areas with rare, threatened or endangered species and adapt management in those regions. Moreover, mind overlaps with protected areas.
- No drainage/ use of land that was wetland (including peat lands) in January 2008 - Identify wetlands and peat lands for exclusion from use.
- Buffer zones between cultivated land and areas of high biodiversity value (protected areas and wetlands) - Identify protected areas and wetlands; include appropriate buffer zones that are based on the size of the protected areas; exclude foliage and stumps from harvesting in the buffer zones.

- Maximum extraction rates for primary forestry residues - Extraction rates for primary forestry residues are adapted to local soil conditions based on slope, soil type, soil depth, soil compaction risk; no harvesting if slopes are greater than 35%; adapt harvesting to soil fertility determination based on a nitrogen deposition map.
- Ensure a sustainable use of renewable resources – Wood extraction rates should be lower than forest growth rates.

Thus the EU is committed to exploiting bio-energy subject to sustainable parameters of the general environment against which JRC issues geo data on forest, agriculture, soil, land cover as written in EU directive 28/2009/CE. Mandatory requirements on biomass sustainability are not only specified for EU member States, internal bio sources, but are also recommended on EU imported bio sources. The JRC data provided are geo referenced, while further geo processing and multi criteria analysis are feasible when additional local geo data are available.

Renewable energy technology and rural development

Under this sub-theme a range of renewable energy technologies were presented to demonstrate their applications in rural life, while introducing the role of the private sector in the whole process. This session included presentations by Mr. Cade Agbugba Adams, Mr. Tony Egba, and Prof. Dickson Ozokwelu. The session also featured a panel discussion by organizations engaged in renewable energy production and supply namely: Green Energy Foundation (GEF), an NGO implementing a solar energy distribution and financing project in Bangladesh represented by its Founder and Chairman, Mr. Dipal Barva; Solar Kiosk, the parent company of which is Solar23, the largest manufacturer of solar water heaters in Africa; and Solar Jooce, a charity organization implementing a project in social experiment, represented by Mr. Dave Agbakoba.

Two technologies were introduced; the first being the GEM, a product of MSW POWER Inc. / IST-Energy. It was introduced as a “Landfill Diverter” which transforms useless waste into valuable clean energy. It handles mixed waste streams such as paper, plastic, wood, food, agricultural waste, and has the capacity to process up to 3 tons/day. In essence, it diverts unrecyclable waste from the landfill while complementing the existing recycling programmes, and safely eliminating unnecessary waste. Thus GEM helps achieve sustainability goals by processing waste on-site, and eliminates landfill use by 95% (only 5% ash may be placed in landfills). Furthermore it saves money and eliminates 95% of waste hauling fees thereby reducing energy costs. The major components are the GEM (48’ ISO) container; Solid waste pre-processor (shredder, drier, pellet mill, pellet hopper); Gasifier; Non-ferrous and ferrous metal separation unit; Safety features (TUV certification); Fire suppression system; etc. Thus the GEM, with an investment outlay of about \$1.1 million, is suitable for installation in rural areas to supply renewable energy, doing minimum damage to the environment. The high return on the investment capacity of GEM, was emphasised along with the benefits of individualised payback modelling, completed for each client, and a payback period significantly shorter than the alternatives.

The second technology is the MDGE, a product by Bestech, known for supplying cost-effective and energy-efficient electrical appliances. The company offers a solution to rural electricity

supply, by reducing power consumption through on-site generation and the use of solar or wind power for lighting, heating or cooling and also for pumping water in submersible irrigation pumps. Rural areas are characterised by poor infrastructure and low capacity for installation of capital-intensive turbines and power lines, to connect to the national grid, and distribute power in such areas. Also, Africa enjoys direct sunlight, which can be used for the benefit of the vast rural population engaged in small-scale enterprises and farming. The MDGE deploys energy-efficient appliances including short-necked bulbs designed to reduce energy consumption to the tune of 65-75% in most homes, as the solution to rural electricity supply problems, and as an alternative to the use of biomass. Generally, the company promotes rural livelihoods by providing high quality, affordable, renewable, green energy technologies and solutions to homes and businesses in both rural and urban areas, through the development, manufacturing and installation of ultra energy-efficient electrical appliances.

The paper by Mr. Egba raised the issue of appropriate technology in terms of sustainability, energy efficiency and friendliness to the environment. An appropriate technology was defined as the use of tools, materials and processes that are accessible, affordable, and easy-to-use and maintain. Accordingly, if the youth must be encouraged to taking up agriculture, new ways of farming and food production is necessary, which must be “appropriate, technologically driven and sustainable and energy efficient”.

In this regard, according to Egba, “one of the most serious problems facing our world in this century is a growing scarcity of cooking fuel”. Ninety per cent of women in the rural areas of Sub-Sahara Africa and over 50% in urban areas still cook over smoky, wood-burning stoves or open fires. It is estimated that nearly 2.5 billion people -- roughly over one-third of humanity -- cook by burning traditional biomass fuels. Excessive use of these traditional fuels has created environmental problems such as deforestation, soil erosion, water pollution and greenhouse gas emissions, all of which contribute to global warming. Burning biomass also deprives the soil of compost, leading to less productive agriculture. Thus, for sustainable and increased productivity in the agricultural sector in Africa, much work is required in developing appropriate renewable technology in terms of hydroelectric power, biomass, wood waste, ethanol, biodiesel, geothermal, solar and wind.

The role of non-State actors in the whole process of bio-fuel production and use was illustrated by the works of Solar Jooce which is a charity organization, and Solar Kiosk a subsidiary of Solar23, which is a company with 25 such subsidiaries operating in Africa. Solar Kiosk was instrumental in the provision of financial services to small-scale renewable energy production enterprises in several countries. Solar Jooce is implementing a pilot activity that targets 20 beneficiaries who are either illiterate or semi-illiterate, from four communities in Oyo State of Nigeria. These beneficiaries are trained on the use of solar lanterns with in-built solar batteries. This enables the women beneficiaries to save money which they would use on other economic ventures. The planned scaling-up has recorded some successes but is constrained by the limited capacity in terms of technologies and resources. Therefore the organization is open to collaborations as done in other countries like Kenya, where schools and universities are normal allies for technical knowledge, while the special focus on people at the community level is not compromised.

Regional development in bio-energy

This sub-theme featured presentations by Mr. Francis Mwaura and Mrs. Helen Hoka Osiolo, describing the situations in Uganda and Kenya respectively, as typical of the general situation of Africa as a whole. Uganda is energy-poor and characterised by biomass as the dominant energy source, constituting 92%, while fossil fuels and hydroelectricity constitute a paltry 7% and 1% respectively. The conversion of firewood to charcoal is low at 10% which indicates the burning out of the forest, since many sectors use fuel wood for energy including agroindustry and hotels. Thus, according to Mwaura, limited access and use of energy has been identified as one of the factors contributing to the slowing down of economic and social transformation in Uganda. This constitutes a major hindrance for the country in effectively addressing the threat of climate change, by reducing emissions from deforestation and forest degradation. It was established that: there is a high level of household dependency on wood fuel, which has negative effects on environment, health and economic growth. The high degree of dependency on biomass represents constraints on the country when it comes to achieving all the eight MDGs. Therefore, the need arises for policies that will ensure a shift in the energy utilisation status, and the type of energy used in cooking by households, since these are primarily determined by their location (rural/urban), education level, household size and economic status.

The country is towing a pathway to clean energy. A study was conducted to test the probability of adopting a modern energy source as alternative to fuel wood or charcoal and to identify factors affecting energy choice in different situations of rural households in Uganda. Results indicate as follows:

- i. as the economic conditions of rural households improved in Uganda, people moved to a higher level on the energy ladder;
- ii. a high proportion of rural households depend on biomass; and
- iii. the type of energy used by rural and urban households is a function of household size, economic status and other factors.

This leads to two recommendations as follows:

- Institutions dealing in the protection and management of forest estates need to be equipped in terms of knowledge, resources and legal backing to be able to achieve their mandates.
- The government needs to target a net increment in forest resources through controls in the use of available resources and achievable strategies to increase and expand cover.

The situation in Kenya presents various energy sources available namely small hydro, wind, cogeneration, and electricity, in different proportions. However there are many challenges which include: lack of appropriate regulatory infrastructure; lack of competition in the energy sector; limited and diminishing natural resources base for biomass and electricity power generation; low quality of power; low electricity access rate; high power system losses, and high IPP bulk tariffs. Furthermore, RET has a limited number of bankable projects to attract while the upfront costs and low technologies required to access renewable energy impedes its accessibility. This is coupled with the lack of up-to-date energy data to inform energy policy.

The major energy consumption sectors in Kenya are manufacturing and transport. The high electricity price reflects a rising fuel cost which forestalls the efforts to industrialise. Kenya is facing limited energy conservation, and severe inefficiencies as the country is stuck with out-dated technologies, thereby reducing the chances of a gradual rise in prices, which was contrary to expectation. Nevertheless the government is currently aiming to develop and secure low-cost clean energy, underpinned by diversification to renewable affordable sources and improved efficiency in transmission.

The Energy Act in Kenya is confronted by certain challenges that are being addressed. These challenges consist of the lack of appropriate regulatory infrastructure, lack of competition in the energy sector, low quality of power, low electricity access rates, high power system losses, and high IPP bulk tariffs. The other challenges confronting the country's Energy Act yet to be addressed are: limited and diminishing natural resources base for biomass and electricity power generation; upfront cost and technologies required to access renewable energy impeding its accessibility; and the lack of up to-date energy data in the form of an energy policy.

The policy must focus on expanding energy infrastructure, compared with Willingness to Pay (WTP) for improved energy service. Notwithstanding, the question remains whether consumers are willing to pay for improvement in energy services at all. In this regard, a study was conducted aimed at assessing the household willingness to pay for improved energy services. This formed part of a wider study conducted in 2009. The policy measures for improving services involves tariff and non-tariff measures, in which their outcomes depend on households' willingness to pay as an important requirement for enjoying utility change. The questions addressed pertained to whether or not households were willing to pay for improved energy services and what factors would influence the rural poor to do so or not. It was found that willingness to pay exists at both urban and rural levels, but is different for different types of energy sources (fuel, wood, charcoal and modern methods); income categories (high income, middle income, low income); status on the energy ladder; age structures of households. In general, urban people are willing to pay more for electricity while rural people are willing to pay more for charcoal. The willingness to pay was high for firewood through all income categories, and people high up on the energy ladder. In the light of these, the recommendations bordered on the need for improved quality, reliability and efficiency of energy products and services to reflect the true market value. The recommendations also included mass education on safety measures while using modern energy, as well as providing the needed information (especially for low income households) on credit facilities available for acquiring upfront appliances required for the use of modern energy in Kenya.

Country experiences in bio-energy production and utilisation

The last sub-theme featured a presentation by Dr. Segun Adaju and panel discussion by representatives from the following African countries: Kenya (Gareth M. Kituu), Malawi (Weston Mwase/ Patson Nalivata), Morocco (Youssef Mesfioui), Ghana (Gifty Baabah Asmah) and Nigeria (Tony Egba). In these and other African countries, according to Adaju, the solution lies in the smoke-free cooking stoves promoted by the Global Alliance for Cook stove (www.gacostove.org).

nigeriacookstove .org). In this context, some notable projects in bio-fuel production and use across Africa have attracted significant participation from financial institutions or funding agencies. They include: USD188m Addax Bio-energy project in Sierra Leone; Euro13.6m SITRADE Waste to Energy project in Abidjan; Funding for Global Bio-fuels Limited in Nigeria; 5MW bio-energy plant at Abakaliki, Nigeria to generate energy from rice husk, funded by the Bank of Industry (BOI) and UNIDO, etc.; USD 170,000 Toyola Efficient Cook Stoves in Ghana funded by E+Co.; USD 5m Takoradi Renewable Energy Limited; and USD100m Waste to Energy project by Buchanan Power, Liberia; and the BOI's funding for solar water irrigation by Jain Solar Systems Limited in Nigeria.

However, the role of banks is called to question with respect to the facilitation or uptake of the technologies in many respects such as: investors (providing finance either as debt or as equity); innovators (development of innovative financial products); valuers (estimation of project risks and project return on investment); stakeholders (equally having stakes in the power sector); enablers (promoting public-private partnership arrangements); influencers (initiating appropriate policy reforms).

Several products have been developed in Kenya. The Energy Act of 2006 was aimed at making Kenya globally competitive in the energy market and to expand access to electricity and water. The institutional arrangement involves the Energy Commission which oversees the transportation and distribution companies. Some emphasis is placed on renewable energy in Kenya, where the rural areas rely on biomass, which affects women and girls who carry out the household responsibilities. Nonetheless wind energy is being developed and a wind atlas is now available. The problem with the use of solar energy is its association with high capital cost and lack of awareness despite the exemption of its equipment from VAT.

In Malawi there is a high rate of biomass usage leading to high rate of deforestation. Load shedding is rampant owing to a dilapidated electricity distribution system. A project is underway now to connect the country to a major dam and renewable energy is being promoted, focusing on bio-fuel production through jatropha produced on marginal lands. Malawi produces ethanol to reduce the import of fossil fuels, and for blending with petrol. The major challenge now, is how to integrate the output from renewable energy into the national grid. There is active support to small-scale solar projects from the NGO sector. Bio-ethanol production from sugar commenced in the early 1970s, targeting vehicles that could run on ethanol 100%, while the sugar industry has continuously depended on steam energy. There is the need to move the country's bio-energy agenda forward. The bio-energy policies, especially with regards to jatropha bio-fuels, appear to be incoherent and inconsistent, as illustrated by the ban on farmers from jatropha production.

In Morocco ENR Afrique provides electricity to 95% of the homes. Farmers receive 100% subsidies on bio-energy production subject to the adoption of modern technology, while professional training schools have been established within the communities to enhance participation.

In Ghana, wood fuel consumption comprising firewood and charcoal, constitute the most important energy forms. This is largely used for cooking with traditional

technologies which are not only largely inefficient but also accelerate the rate of decline of Ghana's forest resources. In spite of its importance there is apparently no regulatory framework for the management of wood-fuel supply, particularly from the natural forest or woodlots, through effective policies aimed at achieving sustainable development and use of the resource. Ghana imports all of its petroleum products used in transportation and agriculture. The development of bio-fuel will enable Ghana achieve very important strategic objectives. First, it will lead to the attainment of energy security which is crucial to industrial development. Secondly, there will be a reduction in oil import, and subsequently, a huge saving of foreign exchange for use in other crucial sectors of the economy.

The goal of the government of Ghana with regard to bio-energy, is to modernise the supply and use and to maximise the benefits of bio-energy on a sustainable basis. The overall policy goal for the sub-sector is to develop and promote the sustainable supply and utilisation of bio-energy to ensure energy security for Ghana, whilst maintaining adequate food security. Ghana's bio-energy resources that currently provide for the majority of domestic energy use like cooking and heating, are restricted to wood-fuel, bio-fuel and biomass waste. The Energy policy of Ghana focuses on the sustainability of supply, subject to security, against a target of 10% import substitution and the attainment of sustainable energy for all by 2020. There is a ministry of energy and a lot of alliances such as the Ghana alliance of energy practitioners. Grassroots issues are taken seriously with the view of making energy accessible to rural dwellers with special focus on women and other vulnerable groups. In this regard, the cooking stove was improved with a chimney which directs the smoke away from users. This is made affordable and accessible to women as part of a project to provide micro credit. This scheme provides loans to women commercial bakers, caterers and households who need financial assistance. The fuel source is waste from the extraction of palm kernel processing done by women, which complements the promotion of solar lanterns and other products. The importance of effective communication of the policy efforts was stressed, emphasising the right methods to package the messages about renewable energy for proper delivery, to target audiences. In this regard, the need arises to adapt in terms of language used and the communication instruments deployed.

The strong efforts towards the attainment of the SE4ALL initiative involve the establishment of Sustainable Energy Departments in both the Ministry of Power and Ghana's Energy Commission. In this regard, the Daasgiff Quality Foundation works with the grassroots based on needs assessment. The departments strive to make energy products accessible and affordable by using technologies of high quality while having a strong reliance on local materials that are transferable. These products include the improved cooking stove, which, however, is associated with concerns about health hazards, despite the use of palm kernel wastes as fuel. Suitable microfinance is being provided to make the technology accessible. For instance, the provision of pre-financed Solar Lanterns as additional help for rural communities to access solar energy.

Nigeria loses 3% of forest annually. This deforestation represents an important source of greenhouse gas emissions for global warming. Thus the E10 policy initiative is about blending ethanol with petroleum at 10%, the aim of which, under the Agricultural Transformation

Agenda (ATA), is to generate limited amount of ethanol from cassava as a response to the “food versus fuel debate”. The campaign and policy attention is towards increased production of cassava and sugar cane, with a view to generating bio-fuels as a major component of the E10 policy initiative. Also there is in existence a robust Jatropha association for the development of bio-diesel in Nigeria, and bio-diesel stoves are already in place in Nigerian markets. Some evidence of this as provided by the representative of the All Farmers Association of Nigeria (AFAN), includes the present action of the giant telecommunication company MTN to use bio-fuel from Jatropha to power its masts in certain parts of the country. In addition to the role of the plant in the mitigation of deforestation of arid zones, farmers in the desert-prone areas have been sensitised and they are already buying into the new renewable energy technology programme for the purpose.

4. Highlights of key issues

The foregoing analysis of the situation with Africa about bio-energy production and utilisation gives rise to a number of issues, some of which emanate directly from the presentations and others, contextually through the discussions at different stages of the Dialogue. On the one hand, some of the issues to be highlighted or interrogated further, border on the public policy process for promoting renewable energy products in Africa, while on the other hand the remaining issues border on factors for facilitating the emergence of a thriving renewable energy



market on the continent. Pertaining to the latter (i.e. bio-energy market), the key issues raised during the Dialogue on the issue of supply include: i) the dilemma of energy security versus food security as a topical issue in African development; and ii) the global concerns for environmental sustainability as it presently affects African countries. Regarding demand, the main points include: the availability, acceptability and affordability of bio-energy products to the people, with particular reference to the vast rural population of Africans.

Policy process issues

The policy process issues involved were discussed in the keynote address by Professor Jones and the presentation by Dr. Tambi. Both of these illuminated them by nature and types while also identifying the role of FARA. Participants agreed that the policy environment for the promotion of renewable energy use was technology-driven, which makes the need for reform or restructuring of existing policy institutions, paramount. The policy should incorporate incentives for the participation of relevant sectors including promotion of research and development of relevant technologies, to incentivise academia in particular, and other actors in the energy value chain, in general. The policy framework for renewable energy in Africa should be commercial or business oriented from the outset, to avoid mistakes of the past, whereby a long period of public support to energy consumption had made people become mentally dependent on subsidy, thereby making its withdrawal difficult if not impossible to achieve in many countries. A case in point is fertiliser subsidy, whereby many African countries presently grapple with public opposition to its withdrawal following many years of operation. This is despite the heavy burden on public budget and widespread market malpractices affecting the quality of products, and the widespread accrual of policy benefits of the fertiliser subsidy, to unintended economic agents.

Also, the current situation where most countries' policies on renewable energy are ad hoc and experimental, was decried by participants. Rather, preference was shown for a policy framework to be properly articulated, beginning with problem definition and validation, appraisal, adoption, implementation including monitoring, evaluation and impact assessment. In this case, the role of policy analysis experts becomes crucial to ensure that the philosophy behind and guiding principles of the emerging policy directions or statements, are properly articulated, while the different components and instruments to be deployed are scientifically considered.

Supply side issues

Energy security versus food security

The concern of African countries about conflicts and tradeoffs implicit in the simultaneous pursuit of incremental food production and bio-energy production is real and quite understandable, as the same commodities may be involved for achieving both objectives in many of the countries. In this respect, the question was raised as to whether these technologies would still be desirable when all agricultural wastes were to be converted to biogas and very little or no plant residues were left to replenish the soil as organic fertilisers, especially given the fact that this would obviously negate the felt need for incremental food output on the continent. The most implicated crops are cassava and sugarcane both of which are food security crops that are also suitable for the production of ethanol as bio-fuel. This is why in the Nigeria, the E10 policy represents a cautious approach so as not to compromise the food value of these crops in favour of bio-fuels, beyond a normative low level (10%) of blending with petrol. This implies that only 10% of the present land area under cassava will be diverted to non-food purposes, which appears tolerable and can be recovered from current efforts to increase land area for the crops, under the transformation agenda.

In other cases, the introduction of the fuel-rich jatropha plant into the cropping system is an alternative approach to producing bio-fuel to avoid the controversy over food security versus energy security. The desirable properties of the plant for this purpose include its adaptive capacity to thrive in marginal areas like the dry savannah where it is also useful for combating desert encroachment. However, it still appears the substitution is not perfect as some of the resources deployed for the establishment and management of the jatropha plantations here and there have alternative uses on crop farms for food production, and the opportunity cost involved is quite considerable in terms of finance and policy attention to promote the crop for the purpose. Nonetheless, the power ministry in Nigeria finds the effort worthwhile to collaborate with other government agencies and the private sector, to explore jatropha and similar oil plants for bio-fuel production. Other plants in the pipeline for use in this category include castor and palm kernel, some of which also have by-products that serve as intermediate inputs for soap making or for use as fertiliser.

Further to this debate on tradeoffs, the argument for and against biomass use in energy production in Africa is valid. One view holds that the use of crop or factory residues as an alternative approach to producing bio-fuel does not necessarily compromise food production in any perceptible way. The examples cited include making bricks from rice husks for women

to fry “akara” balls (bean cake) on the roadside for sale in rural areas or elsewhere, which although itself is not value-free, creates an opportunity for the employment of graduates for the production of bricks. Thus, according to some participants, given that the threat of food insecurity looms large on Africa, the development of renewable energy should emphasise the use of biomass or non-edible oil seeds as the source of inputs. And also, given that biomass increases with population, Africa’s huge potentials for biomass production cannot be underestimated as its population is rapidly rising.

Another view holds that there truly is a conflict involved in the use of biomass from agricultural products and by-products, and everything that has to do with vegetation for generation of bio-energy. The kernel of this argument is that allowing these materials to be recycled as organic fertiliser for increased agricultural productivity will ensure food security. Nevertheless, the fact that using them for bio-energy generation for farm operations will also create more jobs and incomes as the resultant higher productivity of these farms will accelerate the attainment of food security, and encourage more people to go into agriculture. There is also an issue with the use of agricultural produce such as maize, cassava, sugar cane and sorghum to produce ethanol for the purpose of bio-diesel, which is in direct conflict with the need for increased food production towards food security. Therefore, it probably makes sense to avoid this conflict in Africa. By implication, the countries should concentrate on the use other sources of renewable energy such as wind, solar, hydro, geo-thermal, gas, and others that are available in abundance, thereby allowing agricultural products and by-products exclusively for production or use as organic fertiliser or human consumption, as the case may be. Indeed biomass is organic fertiliser which if removed, will leave the soil impoverished, which might lead to energy security without food security in the long run. Thus the need arises to look for areas of waste reduction like gas flaring, rather than biomass as sources of energy for African countries.

Environmental sustainability

An issue of environmental safety arose specifically in relation to the MDGE technology that deploys energy-efficient bulbs using solar batteries. The question was: what happens to these batteries in the long run and how to properly dispose of them without causing a second generation of health problems in urban or rural communities? However, many other environmental issues arise beyond health concerns pertaining to and affecting the productivity of agriculture, soil and land cover, against which standard practices have been established by the EU for observance by member States that African regional bodies can replicate in their respective domains.

Demand side issues

Availability, acceptability and affordability

A number of technologies are available in the market for use in rural and urban areas, including the major ones such as GEM and MDGE, and also the lesser ones such as clean stoves and lanterns. These are not necessarily or will not probably be adopted as desired in

Africa, where many such innovations in agriculture have been perfected at the initial stages, but rejected eventually. The major challenge is how to make the rural farmers in Africa adopt the new technologies on a permanent basis, given their reputation of strong resistance to change, despite the potential increase in agricultural production through the adoption of renewable energy technology. As indicated during the Dialogue, the eventual adoption of a given renewable energy technology in rural and urban areas depends on issues of availability, acceptability and affordability in specific circumstances.

Much attention was paid to the issue of affordability, focusing on the cost of the technologies relative to average income of the people, which includes the acquisition and transaction costs. Thus to generate high social impact of the new technologies would require stimulation of agricultural extension services in African countries with a view to ensuring adoption by the end users, and ultimately systemic diffusion in a cost-effective manner. Towards this end, the need to ensure cost-effectiveness of the new energy technologies as well as availability of the technology products on a sustained basis, is paramount. The issue of affordability relates to two elements namely, income and price aspects, which gives rise to the need to crosstab the different technologies across these elements to have a better picture of the situation. With respect to cost, the point was made that this depends more on access to finance than the ruling price of technologies, noting that the notion of farmers being poor was not real but in the mind only. According to an AFAN representative, it is the urban mindset to say farmers are too poor to acquire a proven technology, and given that microcredit is made available, they would freely express their purchasing rights in the energy market much like their urban counterparts. In this connection, the example of GSM phones was referenced, which demonstrates the capability of farmers to buy into the technology en masse, in Nigeria and other African countries, when they were generally presumed to be so poor. Therefore, even though the new energy technologies appear expensive their adoption by the farm population increases. It is an assured deal if microfinance is made available in rural areas.

Another determinant of technology acceptance or adoption, is the labour intensity associated with its usage, whether it is labour saving or labour using or labour neutral in nature. Suffice it to say that in Africa, any attempt to introduce a labour-intensive technology wouldn't work since labour unavailability is a key socio-economic constraint of the farmers. Besides, "mistakes should not be made" to underrate the resilience of rural farmers in terms of their coping mechanisms to meet energy challenges posed by inadequate energy supply. For instance, the rural communities in Africa have the capacity to form themselves into groups or alliances in coping with such technological challenges, as in the case of a formidable Rural Women Power Initiative in Nigeria, formed for the conservation of non-renewable energy sources (i.e. fossil fuel sources) to curtail gas flaring in the Niger Delta region of Nigeria. Therefore, rural African farmers may be willing to devise similar modes of coping with energy shortages rather than accept the labour intensive technology option.

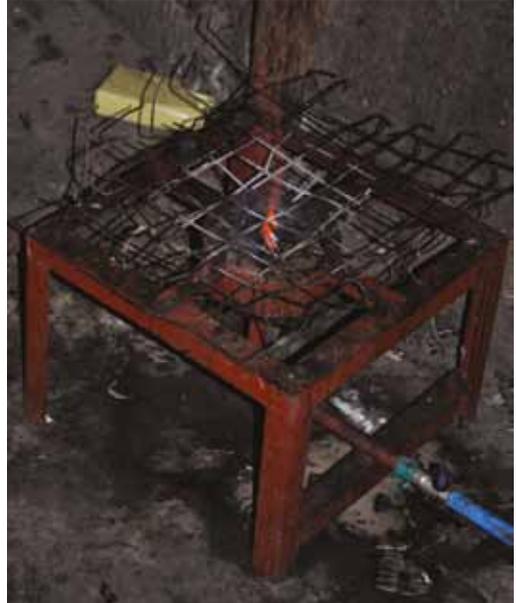
Further, the role of socio-economic factors in the adoption process is very important. The case of hydraulic palm oil press technology introduced to farming families in the old Western Region of Nigeria, is instructive in this regard. The technology was paired with credit facility and was initially accepted but later rejected, not on financial grounds but on the basis of social costs of women who were the original owners of the traditional palm oil processing enterprises

and who were displaced by the introduction of machines. Reports indicated that farmers who had previously adopted the technologies, soon rejected it when their wives became idle and busybodies, as a consequence of the technology. Another case in point was the shea butter processing equipment recently introduced in the Kwara State of Nigeria which was subsequently abandoned. This was also not based on financial grounds, but was because of the excessive noise of the equipment when in use. These cases lend credence to the need to revitalise the agricultural extension systems of countries in order to properly deliver bio-energy technologies in Africa without socio-economic perturbations.

Finally, consensus emerged about the need for the renewable energy technology process to carry a gender face. That is, consideration should be given to the different needs of women and men separately, in the discussion of renewable energy technology, through awareness creation about different energy needs of men and women; gender analysis to arrive at the energy needs of each gender; collection and use of sex-disaggregated data at each step of the process; and the constant mainstreaming of gender in the various strategies towards energy security. Also, the socio-economic behaviour of gender categories should be considered including different purchasing power capacities of men and women; access to resources by both; ranges of opportunities to both women and men; and the various social issues like religion, cultural factors, level of education, among others.

5. Conclusions, recommendations and the way forward

The speakers and participants at the Dialogue agreed that Africa should embrace new and improved technologies to increase food production. The value proposition was that increasing land area under cultivation is not a good way to go. Rather, intensification through increased energy production and use is the appropriate way to go. In doing so, however, a number of issues call for the attention of public authorities in Africa, bordering on policy process, as well as on the supply and demand sides of the technology market. Thus a new thinking emerged from the Dialogue, to give support to renewable energy technology and policy, with a view to increasing agricultural productivity and promote rural development in Africa.



In particular it was agreed that renewable energy technology can contribute to increasing agricultural productivity in the continent, towards meeting the target of 6% growth of agriculture -- according to Maputo declaration of Heads of State and Government in Africa -- from the present 1.5-2%. This will happen through greater access of farmers to bio-energy technologies for farm and household use as well as to provide what are considered the “good things of life” to other rural dwellers, with special focus on women and youth. This includes access to information, education and communication facilities and other facilities which would be internalised to build knowledge in rural areas and will ultimately translate into productivity of agriculture in African countries.

The countries represented at the Dialogue are not only at different stages in the development of renewable energy technology, but also have varied experiences in policymaking and implementing bio-energy programmes. In this regard, it was established during the Dialogue that, in Kenya, the problem with the use of solar energy is associated with high capital cost and a lack of awareness despite the exemption of its equipment from value added tax. In Malawi, the bio-energy policies especially with regards to jatropha bio-fuels, appear to be incoherent and inconsistent. In Ghana, improved cooking stoves was associated with health hazards and other concerns, following the introduction of palm kernel wastes as fuel. In Nigeria, the food-versus-fuel debate is quite intense and trails the introduction of E10 (10% Ethanol) and other policies, for promoting bio-energy sourcing from agricultural products.

Lastly, the participants expressed a desire that the dialogue be sustained with a view to resolving these and other emerging issues associated with bio-energy use in Africa. Therefore FARA was urged to give support in a series of next steps, in bringing renewable energy policy on top of the African agenda at the country level, and integrating bio-energy issues into national and regional development strategy documents. Specifically, FARA would support meetings and other activities geared towards articulating a policy framework for individual countries. FARA is also meant to support in the production of a regional plan with time-bound targets for the proper monitoring and evaluation of such efforts, and to raise funds for the purpose of implementation. Thus, at the instance of FARA, the need arises for a concrete plan of action to be anchored to the outcomes of the Dialogue and as the nucleus of an “Abuja Movement for Renewable Energy Development”.

Accordingly a motion was moved and unanimously carried for the adoption and implementation of these outcomes, as the “Abuja Declaration for the establishment of a Pan-African Network for Bio-energy Technology”. Therefore a motley of ideas and action points were identified by participants in line with the three expected outcomes of the Dialogue, which represents the specific recommendations, or constitutes the way forward as annotated in the menu of next steps below:

Outcome 1: Awareness among African policy makers created on available alternative renewable energy sources, their contribution to agricultural productivity and the need to integrate them in agricultural and social development initiatives -

- Identify the various renewable energy sources e.g. hydro power, biomass bio-diesel, among others.
- African Union (AU), *Economic Community Of West African States (ECOWAS)*, Heads of State and FARA to initiate the awareness dissemination through study tours for policy makers.
- Study tours should be organized for policy makers to visit countries where successes have been recorded.
- The need for the creation of an inter-parliamentary group for renewable energy should be considered.
- After the creation of an inter-parliamentary forum for renewable energy, FARA to sustain the dialogue forum through an effectively functional inter-parliamentary forum.
- The different Management Development Institutes(MDIs) to create awareness of the concept of Renewable Energy (RE) e.g. Administrative College of Nigeria; the Ministries, Departments and Agencies (MDA).
- The different MDIs should be utilised with a view to building capacity of policy makers and in incorporating renewable energy in the training modules of these institutes.
- The respective countries to establish agencies for driving awareness must follow this up with policy makers beyond awareness.
- The platform of the AU, African Governance Forum, Heads of State and Government should utilise these platforms to initiate awareness (presentations at this level of meetings would be effective).

- The Dialogue should be maintained as a form of continuous collaboration between FARA and other stakeholders.
- A situation and institutional analysis of renewable energy production and use in different countries should be conducted with a view to knowing what has been done and what needs to be done; exploring the concept of renewable energy; and media exposure of the concept.
- Incorporating the concept of renewable energy in the academic modules of institutions of higher learning.

Outcome 2: Information on best practice initiatives and investment opportunities in renewable energy, shared among participants and policy options for up- and out-scaling such initiatives by participants:

- Identify available technology and create a website.
- Conduct comparative advantage analysis of bio-energy technologies.
- Communicate with members about conflicts and trade-offs associated with specific bio-energy sources; engage professionals to bring up the results of their ideas for policy drafting.
- Create regional development pathways for bio-energy production and utilisation through the production of a database of existing country documents, value chain analysis incorporating social aspects, and fund raising strategies to help FARA find funds.
- Identify and list all the stakeholders and their roles for FARA.
- Produce a list of available technologies in renewable energy and agriculture.
- Incorporate bio-energy in the commodity value chains in agriculture rather than treat them as choice between food and energy.
- Engage with policy professionals to help them bring the result of their work into useful policies.
- Work on the vision in terms of regional or local development pathways.
- Produce a database of existing country policy frameworks or documents or other documents that can help.
- Conduct a value chain analysis of products or projects (integrating social aspects, wastes, shared value, environment and not finance).

Outcome 3: Opportunities for partnerships between government, agri-business dealers and renewable energy technology companies created, and strategies to promote collaboration identified:

- Government and companies that have simple technologies should be encouraged. The knowledge should be very simple.
- Partnerships between the public and private sector for the production and use of renewable energy should be established. The private sector should lead with government support; educators should be involved in the popularisation of technologies; the need to identify sources of seed fund arises; FARA to work with all tiers of the government

and to create a one-stop shop for products. government to encourage multinational companies.

- Government and commercial companies should provide and encourage simple technology at reasonable and affordable costs to the users.
- The technology should be unambiguous and adaptable so as to allow consumers to partner with the technology.
- Partnership between the consumers and agricultural producers (farmers) should be facilitated.
- The private sector should handle production, while the government should subsidise the price in order for rural people to be able to afford the technology.
- Business educators should not be left out in the partnership process, as the renewable energy technology details need to spread to the younger ones and others.
- FARA should identify institutions that can provide seed grants such as government institutions, banking institutions and donors.
- Governments at all levels should be involved in the partnership process.
- Microfinance institutions and NGOs should help in the transfer of the products from the point of creation to the end-users.
- Products should be tested to ensure that they are cost-effective, and of standard quality, to enhance the support of the government.
- Government should encourage multi-national companies to help with the development of renewable energy technology.
- Government should create the regulatory framework on which the partnerships will grow.

Appendix 1: Dialogue agenda



Federal Republic of Nigeria

REGIONAL DIALOGUE ON RENEWABLE ENERGY TECHNOLOGY FOR INCREASED AGRICULTURAL PRODUCTIVITY AND SUSTAINABLE DEVELOPMENT

“Utilizing bio-energy Resources for Agricultural Productivity, Food Security and Poverty Reduction”

Nicon Luxury Hotel, Abuja Nigeria

17 – 18 October 2012

AGENDA

Time	Activity/Topic	Resource Persons
DAY 1: WEDNESDAY 17TH OCTOBER 2012		
08:00 – 09:00	Registration	Participants
SESSION 1: OPENING SESSION Chair: Special Adviser to the President, Special Duties and Social Development Matters - Mrs. Sarah Pane		
09:00 – 10:30	Welcome Remarks: Office of the Special Adviser to the President on Special Duties and Social Development Matters	Special Adviser to the President, Special Duties and Social Development Matters – Hon. Mrs. Sarah Pane
	Welcome Remarks: FARA	Executive Director/Head of Mission, FARA – Prof. Monty Jones
	Opening Remarks: New Partnership for Africa’s Development (NEPAD) Planning and Coordinating Agency	Representative of CEO of NPCA – Madam Mariam Soumare
	Opening Remarks: Ministry of Power	Representative of the Hon. Minister - Eng. Abayomi Adebisi
	Opening Remarks: Energy Commission of Nigeria	Representative of the Director General – Mr. Alhassan Musa
	Opening Remarks: Private Sector	Prof. Ebene Omdiwe Dr. Jhelil Balewa
10:00 – 10:30	Opening Remarks: Minister of State for Agriculture and Rural Development	Hon. Minister Bukar Tijani
	Keynote Address: The role of bio-energy in Africa’s agricultural transformation agenda – CAADP	Prof. Monty Jones – FARA
10:40 – 11:00	COFFEE/TEA BREAK	

Time	Activity/Topic	Resource Persons
SESSION 2: RENEWABLE ENERGY AND AGRICULTURAL PRODUCTIVITY		
Chair: CSIR		
11:00 – 11:10	Objectives and expected outcomes of the Regional Dialogue	Ms. Idowu Ejere – FARA
11:10 – 11:30	Renewable energy policy in the context of FARA's policy support to agricultural transformation in Africa	Dr. Emmanuel Tambi – FARA
11:30 – 11:50	Food security, energy from / for agriculture and conservation of the environment in Sub Saharan Africa	Dr. Alain Ange – FARA
11:50 – 12:20	Progress on renewable energy production in Africa	Dr. Vincent Motola – European Commission
12:20 – 12:40	DISCUSSIONS	Facilitator/Participants
12:40 – 13:00	Group Photograph	
13:00 – 14:00	LUNCH	
SESSION 3: RENEWABLE ENERGY TECHNOLOGY AND RURAL DEVELOPMENT		
Chair: Agricultural Research Council of Nigeria (ARCN)		
14:00 – 14:20	Low Cost Renewable Power Systems for Rural Communities: <i>Making Energy Efficiency and Renewable Energy Most Affordable</i>	Prof. Dickson Ozokwelu, Bestech Energy Corporation, USA
14:20 – 14:40	The Green Energy Machine: Landfill Diversion & Clean Energy Generation	Mr. Cade Agbugba Adams, German-Netz GmbH, German
14:40 – 15:00	Appropriate Technology for Sustainable and Renewable Energy for Agricultural Transformation in Africa	Mr. Tony Egba, Agricultural Machinery Equipment Fabricators Association of Nigeria
15:00 – 15:20	DISCUSSION	Facilitator/Participants
15:20 – 16:00	PANEL DISCUSSION: Organizations engaged in renewable energy	Facilitator -Green Energy Foundation -Solar Kiosk - Solar Jooce -BestechEnergy Corporation
16:00 – 16:30	COFFEE/TEA BREAK	
16:30 – 16:45	RECAP OF PANEL DISCUSSION/ Summary of Day 1	Facilitator
16:45 – 17:30	Exhibition	Facilitator
17:30	End of Day One	
19:00 – 21:00	Cocktail reception	
DAY 2: THURSDAY 18TH OCTOBER 2012		
SESSION 4: REGIONAL DEVELOPMENT IN BIO-ENERGY		
Chair: Nigerian Investment Promotion Commission (NIPC)		
09:00 – 09:15	RECAP OF PREVIOUS DAY'S ACTIVITY	Facilitator
09:15 – 09:40	Household Biomass utilization for cooking in Uganda	Mr. Francis Mwaura, Economic Policy Research Centre, Kampala, Uganda

Time	Activity/Topic	Resource Persons
09:40 – 10:00	Household Willingness to pay for Improved Energy Services in Kenya	Mrs. Helen Hoka Osiolo, Kenya Institute for Public Policy Research and Analysis (KIPPRA), Nairobi, Kenya
10:00 – 10:30 DISCUSSION		Facilitator/Participants
10:30 – 11:00	COFFEE/TEA BREAK	
SESSION 5: COUNTRY EXPERIENCES IN BIO-ENERGY PRODUCTION AND UTILIZATION Chair: African Renewable Energy Alliance (AREA)		
11:00 – 12:00	PANEL DISCUSSION: Country Experiences in bio-energy production and utilization:	Ghana Kenya Malawi Nigeria Namibia Morocco
12:00 – 12:20	Developing Biomass Projects in Africa: The Role of Financial Institutions.	Dr. Segun Adaju – UNDP / Bank of Industry Access to Renewable Energy (AtRE) Project
12:20 – 13:00	DISCUSSIONS	Facilitator/Participants
11:00 – 11:30	COFFEE/TEA BREAK	
SESSION 6: CLOSING CEREMONY Chair: Prof. Monty Jones - FARA		
13:00 – 14:00	LUNCH	
14:00 – 15:30	Thematic working groups	Facilitator
15:30 – 16:00	Closing remarks by the Farmers' Association	All farmers Association of Nigeria
	Closing remarks by the Agricultural Research Council of Nigeria	Prof. Yusuf Abubakar – Executive Secretary ARCN
	Closing remarks by the European Commission	Dr. Vincent Motola European Commission
	Closing Remarks by CSIR	Director General CSIR Ghana- Dr. A B Salifou
	Closing Remarks by NPCA	Representative of CEO of NPCA – Madam Mariam Soumare
	Closing remarks by FARA	Executive Director/Head of Mission, FARA - Prof. Monty Jones
	Closing remarks by the Special Adviser to the President, Special Duties and Social Development Matters	Special Adviser to the President – Honourable Mrs. Sarah Pane
16:00 END OF REGIONAL RENEWABLE ENERGY DIALOGUE 2012		

Appendix 2: Presentations

1. **Professor Monty Jones** – Keynote address
2. **Ms. Idowu Ejere** – Objectives and expected outcomes of the Regional Dialogue
3. **Dr. Emmanuel Tambi** – Renewable energy policy in the context of FARA’s policy support to agricultural transformation in Africa
4. **Dr. Allain Ange** – Food security, energy from/for agriculture and conservation of the environment in Sub-Saharan Africa
5. **Dr. Vincent Motola** – Progress on renewable energy production in Africa
6. **Prof Dickson Ozokwelu** – Low-cost renewable energy systems for rural communities: Making energy efficiency and renewable energy most affordable
7. **Mr. Cade Agbugba Adams** – The green energy machine: Landfill diversion and clean energy generation
8. **Mr. Tony Egba** – Appropriate technology for sustainable and renewable energy for agricultural transformation in Africa
9. **Mr. Francis Mwaura** – Household biomass utilization for cooking in Uganda
10. **Mrs. Helen Hoka Osiolo** – Household willingness to pay for improved energy services in Kenya
11. **Dr. Segun Adaju** – Developing biomass project in Africa: The role of financial institutions

Appendix 3: List of participants

LIST OF PARTICIPANTS

Regional Dialogue on Renewable Energy Technology for Increased Agricultural Productivity and Sustainable Development 17th - 18th October, 2012

FARA SPONSORED PARTICIPANTS

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Acronyms and abbreviations

AFAN	All Farmers Association of Nigeria
AFAPP	African Food and Agricultural Policy Platform
ATA	Agricultural Transformation Agenda
AU	African Union
AUC	African Union Commission
BOI	Bank of Industry
CAADP	Comprehensive Africa Agriculture Development Programme
EC	European Commission
ECOWAS	Economic Community of West African States
EU	European Union
FARA	Forum for Agricultural Research in Africa
GEM	Green Energy Machine
MDA	Ministries, Departments and Agencies
MDGs	Millennium Development Goals
MDGE	Modular Distributed Green Energy
MDIs	Management Development Institutes
NEPAD	New Partnership for Africa's Development
NPCA	NEPAD Planning and Coordinating Agency
RE	Renewable Energy
RED	Renewable Energy Directive
RET	Renewable Energy Technology
SE4ALL	Sustainable Energy for All
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WTP	Willingness to Pay

About FARA

FARA is the Forum for Agricultural Research in Africa, the apex organization bringing together and forming coalitions of major stakeholders in agricultural research and development in Africa.

FARA is the technical arm of the African Union Commission (AUC) on rural economy and agricultural development and the lead agency of the AU's New Partnership for Africa's Development (NEPAD) to implement the fourth pillar of the Comprehensive African Agricultural Development Programme (CAADP), involving agricultural research, technology dissemination and uptake.

FARA's vision: reduced poverty in Africa as a result of sustainable broad-based agricultural growth and improved livelihoods, particularly of smallholder and pastoral enterprises.

FARA's mission: creation of broad-based improvements in agricultural productivity, competitiveness and markets by supporting Africa's sub-regional organizations (SROs) in strengthening capacity for agricultural innovation.

FARA's Value Proposition: to provide a strategic platform to foster continental and global networking that reinforces the capacities of Africa's national agricultural research systems and sub-regional organizations.

FARA will make this contribution by achieving its *Specific Objective* of sustainable improvements to broad-based agricultural productivity, competitiveness and markets.

Key to this is the delivery of five *Results*, which respond to the priorities expressed by FARA's clients. These are:

1. Establishment of appropriate institutional and organizational arrangements for regional agricultural research and development.
2. Broad-based stakeholders provided access to the knowledge and technology necessary for innovation.
3. Development of strategic decision-making options for policy, institutions and markets.
4. Development of human and institutional capacity for innovation.
5. Support provided for platforms for agricultural innovation.

FARA will deliver these results by supporting the SROs through these Networking Support Functions (NSFs):

NSF1/3. Advocacy and policy

NSF2. Access to knowledge and technologies

NSF4. Capacity strengthening

NSF5. Partnerships and strategic alliances

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