

GBEP Working Group on Capacity Building for Sustainable Bioenergy (WGCB)

ECOWAS/GBEP 5th Bioenergy Week - Summary

Accra, Ghana, 22-24 June 2017

The fifth Bioenergy Week of the Global Bioenergy Partnership (GBEP) was successfully held from 22 to 24 June 2017 in Accra, Ghana, as part of efforts of the GBEP Working Group on Capacity Building for Sustainable Bioenergy (WGCB) to facilitate cooperation and capacity building on the potential benefits of sustainable modern bioenergy.

The event was kindly organized by the ECOWAS Centre for Renewable Energy & Energy Efficiency (ECREEE), in collaboration with GBEP and the Food and Agriculture Organization (FAO), and supported by the Austrian Federal Ministry of Forestry, Agriculture, Environment and Water Management (BMWLWU). The event gathered around 90 participants from Africa, the Americas, Southeast Asia and Europe; the participants included scientists and government officials, as well as representatives from the private sector and civil society organizations.

The Ghana event represented a follow up to the first GBEP Bioenergy Week held in 2013 in Brazil, the second Bioenergy Week held in 2014 in Mozambique, the third Bioenergy Week held in 2015 in Indonesia and the fourth Bioenergy Week in 2016 held in Hungary. The Ghana event presented positive experiences and initiatives in the sustainable production and use of bioenergy that could guide the design and implementation of bioenergy policies in the interested region (Africa). Furthermore, it provided the opportunity to continue a dialogue with the private sector and stakeholders on ways to improve mutual cooperation towards a more sustainable production and use of bioenergy.

Opening session

The fifth Bioenergy Week was opened by welcome speeches by *Mr. John Yeboah*, ECREEE, *Dr. Maria Michela Morese*, GBEP Executive Secretary, *Amb. Laudemar Gonçalves de Aguiar Neto*, AG3 Leader (Brazil) and *Mr. John Nuworklu*, Director of Generation and Transmission at the Ministry of Energy, Ghana.

The welcome speeches highlighted the benefit of the Bioenergy Weeks for collaboration and sharing of experiences and demonstrated how GBEP, in collaboration with ECREEE, acts as a vital facilitator of cooperation between actors. Given the actual and potential importance of bioenergy in the region, it was noted that it was significant that the fifth year of the Bioenergy Weeks was being held for a second time in Africa. It was also noted that it is especially important that ECOWAS should host the event, as the ECOWAS Bioenergy Policy has just taken force in June 2017 and incorporation of this strategy into national policy now needs to take place. It was stated that it was the hope of the event to bring together positive experiences from the GBEP community in the ECOWAS region and beyond, in the sustainable production and use of bioenergy. These experiences will highlight bioenergy technologies and value chains in the specific African context, which in turn may guide the design and implementation of bioenergy policies in the interested countries.

The importance of access to energy for guaranteeing the wellbeing and development of rural populations was stressed. It was emphasised that, where possible, creative solutions in bioenergy can be used to increase access to sustainable energy services in line with the Sustainable Development Goals.

Participants were shown a [video](#), produced by ECREEE, on sustainable forest management and clean cooking. This video described the actual and potential situation if natural resources continue to be exploited for traditional bioenergy production and expressed the need for an alternative in the form of

modern energy. The positive impacts of a transition to more efficient cookstoves in the coming years were also demonstrated: reduced deforestation; new jobs in the forest sector and in stove production; increases in biodiversity; more time for other productive activities; improvements in health; and consequent benefits for local populations.

Session 1: Bioenergy policy and regulatory development

Speakers in this session, moderated by *Dr. Alfred Ahenkorah* (Executive Secretary, Energy Commission, Ghana), gave an overview on the policy environment for bioenergy in Africa and the ECOWAS region.

Mr. Gilbert Nzobadila (African Energy Commission, AFREC) outlined why bioenergy deserves specific attention in Africa. Currently 80 percent of energy used is produced from biomass but most of this consumption is in the form of traditional bioenergy, which has significant negative consequences, including indoor air pollution and deforestation. However, modern bioenergy can have many beneficial impacts, by increasing food security, improving energy access, and creating jobs. Mr. Nzobadila described the main points to take into consideration when developing policy and regulation for bioenergy in Africa, namely: economic, social, environmental, political and cultural dynamics; coordination with civil society; global and regional cooperation in trade and investment; financing for development; and stakeholder participation. He then outlined the main activities of AFREC in order to coordinate and harmonize the development of bioenergy in Africa by providing principles for national bioenergy policy and regulations for the promotion of sustainable bioenergy. The main challenges in the implementation of these policies are: the financial weakness at African Union Commission (AUC) and state level; lack of expertise in project design and presentation; limited private sector involvement; and lack of awareness of the importance of modern bioenergy. He expressed the necessity for national policy to incorporate the frameworks of the regional policy of ECOWAS.

Mr. John Yeboah (ECREEE) presented the ECOWAS Bioenergy Policy (EBP), which was adopted in June 2017. Policy at the regional level is important as bioenergy production, transformation, trade, utilization and policy implications typically transcend national borders. The objective of the EBP is to harness programs that will increase access to sustainable energy services through the deployment of sustainability criteria in the production, transformation and utilization of biomass resources, without compromising food security. It will focus on: provision of energy services to the poor; promotion of agro-industrial development and job creation; reducing health risks and addressing gender imbalance; attracting investment in sustainable agriculture and land use; improving food security; impacts on biodiversity, natural resource management and climate change; and improving balance of payment and energy security. The EBP will assist the ECOWAS member states to transition away from the traditional use of biomass to a modern and sustainable production, transformation and utilization of biomass resources for electricity generation, cooking and heating. Mr. Yeboah presented the Bioenergy Policy targets for 2030 and the expected impacts of the policy on energy access and use across the region; in the ECOWAS region it is expected that 26 percent of energy should be produced from renewable sources by 2030. He also outlined the activities planned by ECREEE for the implementation of the policy, to include dissemination workshops, support to Member States for national policy development, organization of Public Private Partnerships, technical assistance, establishment of appropriate financial mechanisms and continuous evaluation and monitoring of funded projects. The roles of national governments, private sector and civil society were also outlined under the principles of good governance.

The ensuing discussion included a comment on the importance of considering bioenergy policy outside of ECOWAS and the African region, in order to ensure that the regional policy reflects trends in other regional policy frameworks to make it competitive in the international export market.

Mr. Birame Faye demonstrated the legal and regulatory experience in Senegal. He introduced the context to the development of bioenergy policy in the country. Currently 85 percent of rural energy for cooking is supplied by woodfuel and charcoal. This leads to consequent deforestation and scarcity of

this fuel source, high costs, long time spent collecting fuel sources, and health issues. Mr. Faye presented the National Household Biogas Programme (PNB-SN), which has the objective to develop and disseminate biodigesters as an alternative solution to traditional biomass use, in order to introduce modern renewable energy in the rural context and to ensure the viability and sustainability of the biogas market. In the context of this project, 1300 biodigesters were constructed in 2016, and training has been provided for: supervisors and trainers in biogas technology; facilitators on the impact of biogas at the household level; masons and companies on construction techniques; and artisans on the manufacturing of accessories. He went on to describe the main strengths and weaknesses of the project. The strengths included: ownership by Senegalese authorities; the participatory approach that involves many ministries; high demand for biodigesters and the organic fertilizer produced as a by-product (digestate); availability of funds for help with stalling and buying animals; mastery of technology through increase in local expertise. However, there were also a number of weaknesses, including: high cost of biodigesters; unfavourable credit conditions; unsuitable sizes of biodigesters for large households; unsuitable animal husbandry conditions for collection of feedstock; access to water; lack of producer organisations to allow pooling of investments; lack of attractiveness of agricultural sector to financial institutions; and the slow development of the private sector. Through a multi-stakeholder process, the project hopes to increase the resilience of rural populations through the use of biogas in order to augment and diversify rural incomes, and strengthen rural value chains for biogas. The project also hopes to contribute to national emission targets in relation to the Nationally Appropriate Mitigation Action (NAMA).

Mr. Moumouni Habi presented the fiscal incentives for wood energy in Niger. In Niger, deforestation has many complex drivers, among which the collection of woodfuel for the urban population is a principle factor. He outlined both the fiscal forest plan and the tax regime for the substitution of wood energy. The four pillars of the fiscal forest regime – *Stratégie Energie Domestique (SED)* – were outlined: reform of the taxation of wood by transferring the management of the forests to rural communities and to modify the roles of actors in the wood value chain; creation of rural markets for wood energy; guidance on management methods for the exploitation of wood energy for supply to cities by the Directorates of Procurement – *Schémas Directeur d'Approvisionnement (SDA)*; and reinforcement of forestry control. By transferring the responsibility of collecting taxes to the rural producers, the reform of the fiscal forest regime aims to empower rural communities to manage their forest resources in order to reverse the trend of deforestation, guarantee long-term supply of wood energy, reduce poverty of rural communities and create a basis for economic and social development at the local level. There were a number of challenges, such as weaknesses in monitoring, consultation and control over procedures at a decentralized level. Mr. Moumouni also presented the fiscal regime for the substitution of wood energy under *Le Programme de Référence d'Accès aux Services Énergétiques (PRASE)*, which aims to increase access to modern energy services in order to reduce poverty. He made specific reference to *Projet PASE SAFO*, which implements the PRASE approach in the Safo region, Niger. Through financial and institutional arrangements, the project provides the population with equipment essential to satisfy their needs (e.g. lamps, pumps, cookstoves, etc.) and the final energy production (e.g. solar). It was recommended that this subsidy of equipment, accompanying the policy of wood energy management, should be supported and promoted in other ECOWAS Member States.

Mr. Otu-Danquah Kwabena (Energy Commission, Ghana) introduced the bioenergy sector in Ghana. He outlined the various policies for the promotion of sustainable bioenergy production, such as woodlot cultivation, the generation of heat and electricity from waste (from the oil palm and saw mill industry), and the promotion of efficient conversion technologies for woodfuels (such as briquettes and pellets). He also discussed the promotion of efficient end-use devices (e.g. efficient cookstoves that operate on biogas or briquettes). In Ghana, the regulations call for promotion of standards for efficient woodfuel stoves, including standards on GHG emissions, and there are currently two test facilities for the testing of cookstoves in order to improve design. Ghana's policy for the export of charcoal was also discussed and the stringent national sustainability requirements for export were presented. Mr. Otu-Danquah also stressed the importance of capacity building and R&D across the whole sector. He highlighted Ghana's commitment to the rapid development of the bioenergy sector and to investigating potential revolutions in the sector to improve its sustainability. Mr. Otu-Danquah concluded by stating the interest of Ghana

in advanced biofuels, looking at all possible feedstocks in light of food security considerations, and on efficient use of wastes for electricity and heat, in particular he mentioned biogas systems installed in public buildings like hospitals, prisons, etc.

Session 2: Sustainable value chains for food and energy security

This session, moderated by *Mr. Olivier Dubois* (Senior Natural Resources Officer, FAO), presented private sector points of view, and aimed to foster exchange of experiences and demonstrate effective systems, challenges and opportunities in Africa.

Mr. John Idan (Biogas Africa, Accra, Ghana) presented his experiences on biogas produced from animal and human sewage sludge, and agro-industrial and municipal solid waste. He discussed the potential benefits of sustainable biodegradable organic waste recycling for Africa and its ability to contribute to a circular economy. He then presented some specific examples from his experience. One example was from Chicualacuala village in Mepunza, Mozambique, and involved the treatment of the manure of 600 cattle to produce electricity and the digestate (used as fertilizer for fruit and vegetables then sold in South Africa). One of the challenges of producing biogas from animal waste is the present situation in animal husbandry in the ECOWAS sub-region, as it means that it is difficult to collect waste. Further examples included: treatment of organic waste from a soya processing factory, Tema, Ghana; a bio-latrine at Keta in the Volta region, Ghana; and a biogas plant at Central University (Miotso), Prampram, Ghana. It was demonstrated that biogas is a very flexible option that works at both small and large scales, using a variety of feedstocks, and producing biogas that can be used for both heating, cooking and electricity. However, the importance of capacity building, in terms of institutional training and artisanal skills upgrading, was highlighted.

Mrs. Veronica Agodoa Kitti (ASA Initiative, Ghana) introduced her experiences in producing pellets and briquettes from agricultural residues, building improved cookstoves, and spreading knowledge of benefits derived from the adoption of gasification and biochar systems. She started by introducing the independent and interrelated parts of the biochar system, and continued by explaining the components of both small-scale biochar systems for cooking and heating purposes at household level, and large-scale biochar systems in industrial pyro-gasifiers. The benefits of the use of biochar as a soil amendment were outlined, including: reducing the toxic elements absorbed by crops, thus helping to produce healthy food; improving soil capability for retaining water and nutrients; and increasing soil organic carbon content thus ameliorating the soil structure and improving soil fertility. Biochar ensures the recycle of soil nutrients thus reducing the need for chemical fertilizer. She gave an example of a large-scale plant pyro-gasifier in Zimbabwe where the biochar produced and applied to soil in ginger farms increased yields by 100 percent. Mrs. Kitti also explained that biochar that is not used as soil amendment could instead be processed to produce briquettes that can be used as feedstock in clean cookstoves; this reduces pressure on forest resources as it eliminates the need to harvest wood for charcoal. Briquettes have a comparatively lower cost of energy for cooking (compared with charcoal, wood fuel and LPG) and therefore improve energy access opportunities. The technology is also flexible to meet several household and industrial cooking needs. Given that it cooks faster than other alternative cookstoves, it saves time for other household and economic activities, and improves health by reducing indoor pollution. Mrs. Kitti concluded by stating that biochar systems provide energy access for green economy that will improve food security, well-being and the environment. However, she notes that *perfect finishing* is now needed to ensure uptake of the technology by higher-income users and thus lower costs for all users through economies of scale.

Mr. Pragnesh Mishra (Abellon, Ghana) discussed large-scale pellet manufacturing and renewable heat application in cooking. Abellon manufacture pellets as part of a *Triple Bottom Line Approach* – integrating energy security, energy equity and environmental sustainability. They employ agro-forestry techniques for bioenergy crops, and examples of food and energy intercropping were given, as well as the integration of a solar agro-electric model where there is the dual use of both water and land. Mr.

Mishra then gave details of the 100 000 tonnes capacity pellet manufacturing facility in Ghana and the benefits provided (e.g. 500 jobs have already been created in waste collection). It gives the ability to add value to waste that is currently disposed of in an inefficient manner and has unused potential (such as residues from sawmills). The pellets produced can then be used in stoves to produce heat and cooking in industrial, commercial and household contexts. The use of pellet boilers and stoves can save up to 30 percent on fuel costs, and have further benefits of being environmental clean, smokeless, and safer than gas stoves. Although there are challenges to be overcome and further learning opportunities, Mr. Mishra concluded by stating that the benefits of the pellets are already evident.

[Mr. Alex Bulnes](#) (GOPDC Ghana – SIAT Group) presented integrated organic matter management for a sustainable agro-industrial sector through his experiences on biogas production in the palm oil value chain in Ghana and Nigeria. The anaerobic treatment of effluents in lagoons has environmental benefits (e.g. reduction of pollutants in wastewater and, consequently, reduced soil contamination; capture of methane emissions from effluents); agricultural benefits (e.g. recycling of nutrients through the distribution of digestate to soil) and economic benefits (e.g. power generation: in GOPDC Ghana in 2016 they used 85 percent green energy).

[Mr. Olivier Dubois](#) concluded the session by summarizing the main points of the presentations and subsequent discussion. He stated that for successful, sustainable projects in Africa, we need guaranteed provision of feedstock, but that the competitive usage of all types of feedstock also needs to be carefully taken into account in developing local Action Plans and policies. Therefore, the importance of a well-considered business plan, including feasibility assessment, funding and training, was stressed. The ‘buy-in’ from local communities is also key; collaboration and sharing of benefits is important to enhance this. Awareness raising is also crucial for improving social acceptance.

ECOWAS Special Session: Report on developing standards for biofuels in the ECOWAS region

[Ms. Meghan Sapp](#) (National Renewable Energy Laboratory, NREL, USA) introduced a recently published report on developing standards for biofuels in the ECOWAS region. Ms. Sapp introduced the concept of a regional fuel market for ECOWAS: it would represent a single market for fossil fuel and biofuel, achieved through common fuel standards. It would create economies of scale and would increase significantly the fuel demand, reducing fuel costs, and would facilitate cross-border trade, improving fuel availability. Furthermore, it would reduce the cost of doing business, stimulating investment, SME development and job creation. It would also reduce FOREX expenditure and inflation. On top of the economic benefits, standards in fuels would lower noxious emissions and air pollutants, which would lead to reduced greenhouse gas emissions and fewer deaths and illnesses from respiratory-related diseases. Fuel standards include three components – sustainability standards, operational standards and fuel quality standards. These standards are currently very low, or lacking, in ECOWAS, for example, max Sulphur limits in gasoline for 2016 in ECOWAS varied between 151 and 2 500 ppm, compared with Europe, where they were between 0 and 10 ppm. Ms Sapp concluded by suggesting that the next steps would be the engagement of ECOWAS stakeholders to develop standards and then to develop the necessary systems (such as legislation, regulation, auditing and compliance) for their implementation.

Session 2 (con’t): The biogas option in Africa – SWOT Analysis

This session, moderated by *Mr. John Yeboah* (ECREEE) and *Mrs. Veronica Agodoa Kitti* (ASA initiative, Ghana) aimed to investigate the Strengths, Weaknesses, Opportunities and Threats for both large- and small-scale biogas value chains in Africa.

[Dr. Maria Michela Morese](#) set the scene for the session by expressing her hope that the SWOT Analysis of biogas value chains in Africa carried out in the session, along with follow up activities, will help to better understand the potential of biogas technology in the African context in advance of the opening of the new GBEP Activity Group on Biogas later in 2017.

[Mrs. Veronica Agodoa Kitti](#) introduced the rationale behind the SWOT Analysis. She explained the difference between internal factors that are inherent to the business model (i.e. Strengths and Weaknesses) and external factors that exist in the industry environment (e.g. Opportunities and Threats).

The results of a preliminary online survey on large-scale biogas value chains, conducted prior to the event, were presented by [Mr. John Yeboah](#). The methods were shown and the key strengths, weaknesses, opportunities and threats (as identified by a few key stakeholders that completed the online survey) were presented graphically.

The interactive SWOT analysis for small-scale biogas value chains was then conducted in groups. Each group was given an element of the SWOT to discuss and a spokesperson was then asked to share these with the rest of the participants. The table below shows the results of the group discussions:

Strengths	Weaknesses	Opportunities	Threats
Availability of feedstock (waste biomass, residues) Improve sanitation/health Reduce GHG emissions Save family time (e.g. in wood collection) Job creation Technology availability By-product as fertilizer Manpower availability Ease of transfer of technology know-how Poverty reduction Livelihood improvement	Availability of reliable feedstock Lack of technical knowledge and skills for operation and maintenance Lack of skills and knowledge in the construction of the biogas system (technical know-how) Cultural (un)acceptability High cost of construction Lack of financial resources Constant monitoring and evaluation	The by-product can be used for commercial purposes The methane gas obtained can be used for cooking and heating for households There is availability of pre-finance No cost for dislodging Small space requirement Access to modern, clean cooking energy Reduce expenses on electricity bills Simple technology, thus easy to adopt and manage Poverty reduction Job creation Save family time (e.g. in wood collection) Reduce indoor air pollution Climate change mitigation Reduce deforestation By-products (digestate) increase agricultural production	Comparative cost of other energy sources (e.g. LPG) Accessibility compared with other energy sources Social acceptability (due to culture/beliefs) Water requirements Lack of knowledge Availability of reliable feedstock Lack of skills/technological know-how (e.g. management of H ₂ S) High cost (initial capital requirements) Lack of knowledge on return on investment by investors and providers of capital Lack of bioenergy services Trade barriers on imports of biodigesters

It was concluded that biogas does not represent a *one-size-fits-all* approach and that appropriate feasibility studies and sustainability assessments are required prior to implementing any biogas project. The feasibility of each technology should be evaluated in each specific context, by considering: any possible bottlenecks (threats) e.g. long-term feedstock and water availability; plant costs compared to

household income; and cultural acceptance of the technology. Furthermore, the factors mentioned in the SWOT should be mapped and shared with the international community, with the aim of keeping all relevant stakeholders aware (financing institutions, entrepreneurs), to allow the most suitable technology to come to light, finally speeding up the sustainable development on the basis of tailor-made strategies for each country. To this end, a follow-up survey will be sent to all participants to carry out a detailed SWOT Analysis on small-scale, the results of which will be shared at the GBEP Meetings in Rome in November 2017, for the consideration of the Activity Group on Biogas under the Working Group on Capacity Building.

Session 3: Resources assessment, options and strategies

[Ms. Yasuko Inoue](#) (IRENA) moderated the session and gave the keynote address on resource assessment as a basis to evaluate the feasibility of value chains for food and energy security. She also presented a current publication under preparation by IRENA entitled *Biofuel Potential in Sub Sahara Africa – Raising Food Yield, Reducing Waste and Utilizing Residues*. This publication focuses on five countries across the Africa continent – Ghana, Mozambique, Nigeria, South Africa and Uganda. The potential of biofuels is divided into five categories, namely: sustainable land use; wood logging and processing residues; agriculture yield growth; farm and processing residues; and food loss and waste. The report also takes into consideration climate change, natural disasters, water and food security and competition over good land. When considering the analysis future potential, Ms. Inoue concluded that improvement of statistical information is needed to improve projections.

[Mr. Andreas Schleenbaecker](#) (GIZ, Togo) presented the ProREDD project in Togo that focuses on the rehabilitation of forests in the country. This project aims to improve the technical and institutional framework for the implementation of REDD+ in Togo, under four main areas of action, namely: the creation of institutional structures for the implementation of REDD+; the implementation of a national forest inventory; good practices for the protection and sustainable management of forests; and the clarification of land rights issues. Under ProREDD, the forest surface area, wood resources, degradation and biodiversity were all measured to give an accurate account of the forest situation in Togo. This data allowed for the development of sustainable management of 450 000 ha of forests and the establishment of rural timber markets. In the future, further projects will investigate support for decentralized energy supply and regulation in the renewable energy sector, and energy efficiency in the wood energy value chain.

[Mr. Lovans Owusu-Takyi](#) (Institute for Sustainable Energy and Environmental Solutions - ISEES, Ghana) presented ISEES experiences in small-scale, agro-industrial waste use. In Ghana, the average household uses 1065 kg of fuelwood and 434 kg of charcoal every year, primarily for cooking and small-scale processing. The use of fuelwood and charcoal has led to a 70 percent reduction in forest cover and causes indoor air pollution that leads to 13 400 deaths per year, 50 percent of which are children. However, there is a very low awareness of these impacts and minimal education on sectoral issues. ISEES, through its work on renewable energy and energy efficiency, has brought improved technology to many small-scale industrial processes, such as fish smoking, palm oil processing and gari roasting. Their experiences provided the following lessons for future projects: carry out research and set baselines; pilot new concepts; involve stakeholders and share knowledge; develop technology to be socially acceptable; and monitor periodically. Mr. Lovans stressed the benefit of a sustainability model that includes considerations of policies and regulations, demand side and supply side effects, and financial institutions.

[Mr. Michael Akoto](#) (Embassy of Brazil, Accra) presented the results of the WAEMU study, a feasibility study on the production of biofuels in the WAEMU region (West African Economic and Monetary Union). The study evaluated agronomic, economic, social and legal aspects related to the biofuels industry. The key objective was to provide recommendations on viable business models, suitable public policies and on the plan that local and regional governments could put in practice to facilitate the adoption of biofuels in the region. The study also provides an implementation guide, with the potential

to speed up the creation of a biofuels market and industry. Mr. Akoto presented the three main conclusions from the study. First, given the low agricultural productivity and low rate of electrification acting as barriers to development in the region, biofuel production must be part of an agro-energetic plan that also ensures food security and generates electricity. Secondly, the study concludes that sugar cane is the crop with the most competitive cost position and therefore sugar cane-based ethanol production is suitable for the adoption of biofuels within the region. It could be cultivated with the use of Brazilian production technology, supported by irrigation and local labour. One plant in each country would be able to cater for three distinct markets given the priorities of local governments: sugar — enough to eliminate the need for imports; ethanol fuel — targeting the blend of 10 percent for the production of E10 gasoline; and electricity — for internal consumption in irrigation and mills, and for local distribution. The third main conclusion was that the mobilization of local governments and WAEMU is necessary to ensure the basic conditions for market development. The actions of governments should facilitate land access for new investors, establish a mandatory blending level, and give clear rules for market pricing. Mr. Akoto stressed the great potential for increased cooperation between Africa and Brazil in terms of agricultural-industrial technical, business, financing, institutional and legislative cooperation.

Mr. Eldad Ackom (Kwamoka Energy Ghana Ltd.) presented a Case Study from Ghana on the biomass assessment for a 6MW biomass power plant project near Kumasi. The project aims to address waste disposal problem and its associated hazards in Kumasi whilst creating a sustainable alternative to power generation and supply. The purpose of the biomass assessment was to identify the most suitable sources of biomass, establish reliable data related to supply, quality and cost of different types of biomass, and recommend logistical solutions for collecting, processing and transporting biomass from the sources to the power plant site. Data was collected through interviews with potential suppliers, collection and measurement trials, and laboratory tests. This information was then used to inform decisions on the most attractive biomass types, design of the power plant and the business plan, and identify potential fuel supply risks and how to mitigate them. Wood-processing residues were identified as the most suitable biomass due to low costs, significant quantities and lack of competition with alternative uses. However, seasonal fluctuation means that storage is necessary. Mr. Eldad concluded that the biomass assessment provided valuable insights into the availability and economics of different types of biomass as well as potential logistical solutions, but he noted that it is difficult to estimate costs of collecting, processing and transporting biomass/commodities that are not currently being collected and transported. Even a detailed, professional biomass assessment cannot answer all biomass-related questions and provide certainty about final costs.

Prof. Suani Coelho (University of San Paolo, Brazil) discussed water resources. She began by introducing Project 27 for the Research Centre for Gas Innovation (RCGI), which investigates biogas perspectives for São Paulo State. The project estimated that 46 percent of the natural gas consumption in São Paulo State could be covered by biomethane and that electric energy from waste-to-biogas could supply 5.8 percent of the electricity consumption. There is the opportunity to inject the biomethane into the natural gas grids and to replace 59.7 percent of diesel consumption for transport with biomethane, thus contributing to energy independence through reduced diesel imports. Prof. Coelho went on to discuss water resources in relation to the measurement of the GBEP Sustainability Indicators. In terms of sugar cane, there has been significant progress made on water consumption efficiency (from 5 m³/t sugar cane in 1997 to 0.85 m³/t in 2015). Water consumption in the agricultural phase is limited because much of the sugar cane produced does not need irrigation and where it is required there is the reuse of effluent (vinasse) for fertirrigation. There is also the potential to enhance water quality by using the vinasse for bioenergy production. Mechanical harvesting of green cane has also led to a reduction in the need for cleaning during the industrial phase. Prof. Coelho also presented a project that aimed to reduce water contamination with slurry from municipal solid waste in a lake in Minas Gerais State, Brazil, with a waste to energy plant. A project from Kenya was also discussed, which aimed to improve energy security and widen access to bioenergy services. Prof. Coelho also highlighted some of the general challenges for syngas (gasification and pyrolysis), biogas and biomethane projects, namely: lack of policies for demonstration plants; lack of capacity building of agro-industries and farmers; lack of

understanding of the synergies between syngas/biogas plants and reduction of environmental impacts; and lack of funds. On the last point she mentioned an innovative policy from Brazil, which is the legislation that came into force in 2000 that makes it mandatory for electric utility companies to use 0.5 percent of revenues for R&D projects and 0.5 percent in energy efficiency projects (Federal Law 9,991/2000); these funds have already been used to develop several projects.

[Dr. Edward Yeboah](#) (Head, Soil Microbiology Division, CSIR-SRI, Kumasi, Ghana) discussed soil and land resources. He first stressed the importance of soil as a basis for many critical ecosystem services and for food security and sustainable development. Soil is a non-renewable natural resource that is vital for sustainable agricultural production. He noted that, in Ghana, 57.1 percent of the total land area is suitable for agriculture but nutrient depletion occurs at an annual rate of 35 kg/ha for Nitrogen, 4 kg/ha for Phosphorus and 20 kg/ha for Potassium; this is due to crop and residues removal, nutrients leaching, Nitrogen volatilization, and soil erosion. The adoption of Integrated Soil Fertility Management (ISFM) practices can improve the fertility of the soil, thus increasing productivity and buffering against high input prices. Dr. Yeboah concluded by stressing the need to streamline the implementation of the ECOWAS Bioenergy Policy with the ECOWAS Fertilizer Policy in order to ensure sustainable agricultural production, increase farmers' income, reduce poverty and ensure food and nutrition security. His policy recommendations included assistance for resource-poor farmers to access quality seeds and fertilizers, development of nutrient-status maps (including micro-nutrient levels), and reassessment of the subsidy package to ensure quantity and type of fertilizers are based on soil tests and crop requirements.

Session 4: Successful Financial Mechanisms and Business Plans for Bioenergy Systems

This session, moderated by Prof. Joseph Adelegan (Division Chief, Environment and Sustainable Development, ECOWAS Bank for Investment and Development) and *Mr. Bah Saho* (ECREEE), focused on the financial mechanisms available for funding bioenergy projects, and the practical implications of accessing such funding opportunities.

[Mr. Alpha Oumar Kalogo](#) (Regional Adviser for Africa, GCF) gave a presentation outlining the framework of the Green Climate Fund (GCF). He introduced the GCF portfolio, which is split 50/50 between climate change adaptation and mitigation. However, there is a specific focus on the most vulnerable nations, with 50 percent of adaptation resources for Small Island Developing States (SIDS), Least Developed Countries (LDCs) and African States. Mr. Kalogo explained the steps in engaging with the GCF under the Readiness Support Program. The accreditation requirements of the Fund were also outlined and the idea of fit-for-purpose accreditation (whereby accreditation is based on the mandate, project size, environment and social risk category, and fiduciary functions) was introduced. The GCF is committed to financing projects that fall within their strategic results areas. Of the eight strategic results areas, *reduced emissions from energy generation and access* is one of the main areas under the mitigation pillar. So far, 2.2 billion USD has been financed (45 percent in Africa). Each proposal will be assessed against six high-level investment criteria: impact potential; paradigm shift potential; sustainable development potential; country ownership; efficiency and effectiveness; and responsiveness to needs of recipients. The project approval process typically takes approximately 11 weeks from the submission of funding proposal to final board decision. The GCF also has a Private Sector Facility to mainstream climate change mitigation and adaptation actions in the private sector by encouraging low-emission development and unlocking private sector investments in adaptation.

Prof. Joseph Adelegan (Division Chief, Environment and Sustainable Development, ECOWAS Bank for Investment and Development) gave an overview of other financial mechanisms and opportunities:

- ECOWAS Bank for Investment and Development (EBID)
- African Development Bank (AfDB)
- Brazilian Development Bank (BNDES)
- Climate Investment Fund

- United States Agency for International Development (USAID)
- World Bank Development Marketplace
- United Nations Development Programme (UNDP)
- Shell Foundation
- Gates Foundation
- Renewable Energy Cooperation Programme (RECP)
- German Society for International Cooperation *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ)

He stressed the importance of putting more emphasis on ‘bankable’ projects and readiness projects.

Field visits

Participants had the opportunity to visit two locations in the vicinity of Accra. The first visit was to a liquid waste treatment facility in James Town, Accra, managed by *Sewage Systems Ghana Ltd*. The main purpose of the plant is to serve as liquid waste disposal management and treatment for the city of Accra, under a Public-Private Partnership. The plant was constructed in 2012 and has capacity for approximately 300 trucks daily (with a maximum capacity of 2000m³ of sewage per day). According to the operating engineer, the treated water is reused in the plant to reduce water consumption costs; furthermore, the by-product (digestate) is dried and used in landscaping of the site. Once in operation, the system is equipped with a 2MW biogas facility, which could provide electricity to power the plant, thus reducing costs of electricity consumption.

The second field site visited by the workshop participants was in Ashaiman, near Tema. The plant is a 100kW waste to energy plant managed by *Safisana Ghana Ltd* and was established with a 2 Million USD investment. Approximately 30 Tonnes of waste is injected into the biodigester on site daily. The waste is a mixture of market waste (rotting fruit and vegetables), abattoir waste and sewage from public and private toilets; all wastes are transported to the site in trucks. The electricity produced from the biogas is then sold to the grid; this is the first of its kind in Ghana to be connected to the national grid, and only the second in West Africa, according to the operating Manager. As well as the income stream from the sale of electricity to the grid (at 17.5c USD per kwh), 2 Tonnes of by-product (digestate) is produced daily and is dried and sold as certified fertilizer, and a small amount of it is composted and used as substrate to grow tomato seedlings in an on-site greenhouse, which are subsequently sold. The wastewater from the biodigester is treated and used for irrigation.

Conclusions – Main messages of the Bioenergy Week

In the concluding session, [Mr. Bah Saho](#) gave an overview of the detailed conclusions of each session of the event, as summarised below:

Session 1: Bioenergy policy and regulatory development

- The work of AFREC was presented and it was noted that the major challenges related to implementation are: financial weakness at AUC and state level, lack of expertise in project development and presentation, limited private sector involvement, lack of awareness of the importance of modern bioenergy.
- The ECOWAS Bioenergy Policy (EBP) and the 2030 targets in terms of renewable energy were presented. It is now important to translate this into national policy.
- Country experiences in Senegal, Niger and Ghana were presented to show the diversity of experiences in the ECOWAS region.

Session 2: Sustainable value chains for food and energy security

- This session focused on private sector experiences.

- Different technologies were discussed, including: gasification; biogas from human and animal waste; and palm oil residues and wastewater.
- There were presentations on both large- and small-scale operations.
- The main conclusions were that:
 - We need guaranteed provision of raw material/feedstock
 - We need to be cautious of competitive usage of biomass feedstocks
 - Spread of knowledge and R&D is important
 - Buy-in and social acceptance from local population is key
 - Private financing is strong and public finance in projects should be reinforced
 - Business plans/funding and training are key

ECOWAS Special Session

- A report on regional standards for bioenergy for the ECOWAS region was presented.
- The three main elements of standards (sustainability standards, operational standards and fuel quality standards) could have many potential benefits when applied to the ECOWAS region.

Session 2 (con't): The biogas option in Africa – SWOT Analysis

- Results of SWOT Analysis on large-scale were presented as a result of a preliminary questionnaire circulated prior to the event, and SWOT analysis on small-scale biogas was conducted.
- The main conclusions were:
 - Need for a holistic approach
 - Biogas is not a ‘one-size-fits-all’ solution – need to take into consideration the local context through feasibility studies
- A follow-up survey will be sent to all participants to carry out a detailed SWOT Analysis on small-scale, the results of which will be shared at the GBEP Meetings in Rome in November 2017, for the consideration of the Activity Group on Biogas under the Working Group on Capacity Building.

Session 3: Resources assessment, options and strategies

- Presentations were given on project experiences in various countries to provide lessons learnt.
- The main lessons learnt:
 - The need for data in order to develop national/regional plans
 - The need for feasibility studies, both in terms of availability of feedstock and the demand for bioenergy
 - The need to assess competitive uses of feedstocks and the potential social and environmental impacts of use of feedstock for bioenergy
 - Public awareness raising and training are important

Session 4: Successful Financial Mechanisms and Business Plans for Bioenergy Systems

- An overview of the Green Climate Fund was given:
 - 2.2 billion USD, over 40 projects, has already been provided
 - There is a focus on Africa – 45% of the total has been provided to Africa
 - Country ownership and gender sensitivity are the key principles of the GCF
 - Energy is one of the four priorities under climate change mitigation
- An overview of other funding opportunities was given: ECOWAS Bank for Investment Development (min. 5 mil USD projects), AfDB, BNDES, Climate Investment Fund, USAID, World Bank Annual Competition Market Place, SID Award, UNDP, Shell Foundation, Gates Foundation and RECP, among others.

- The importance of well-developed, ‘bankable’ projects was stressed and the need for capacity building in this area was discussed.

Overall, the ECOWAS/GBEP Bioenergy Week demonstrated the diversity of bioenergy projects and the various considerations that need to be taken into account to make bioenergy development sustainable. The need for a holistic approach when assessing the impacts of bioenergy on the environment and food security was stressed, and the utility of carrying out feasibility assessments and sustainability studies in advance was demonstrated in many of the sessions. These assessments should take into account a number of factors, including feedstock availability (and competitive uses of feedstock), social acceptability and environmental impacts, among many others. Financing for projects is also a key concern and capacity building is necessary in order to propose well-developed, ‘bankable’ projects to financial institutions.

The Bioenergy Week was an opportunity to showcase the ECOWAS Bioenergy Policy and the implementation of this policy at the national level is now a priority. In order to properly develop and monitor impacts of these policies, better data is needed. The Bioenergy Week also served to demonstrate the importance of the private sector in advancing sustainable modern bioenergy, and the significance of policies to stimulate private sector investment.