GBEP Working Group on Capacity Building for Sustainable Bioenergy

ACTIVITY GROUP 2

"Raising awareness and sharing of data and experiences from the implementation of the GBEP indicators"

Ghana's experience implementing the GBEP Sustainability Indicators

OVERVIEW

- Country: Ghana
- Scale at which the GBEP indicators were measured: National
- Year(s) during which the GBEP indicators were measured: October 2011 to February 2013
- Organization(s) commissioning/overseeing the measurement of the GBEP indicators: Government of Ghana
- Organization(s) carrying out the measurement of the GBEP indicators: The Council for Scientific and Industrial Research as well as Ghana Energy Commission coordinated the project while three Ghanaian research institutes (CSIR-FORIG, CSIR-IIR and UG-ISSER) studied and carried out the measurement of the indicators. The Dutch biomass and bioenergy sustainability expert, Partners for Innovation, provided technical assistance.
- Source(s) of funding: Dutch government
- Funding size: ☑ < 500k USD; ☐ 500k - 1,000k USD; ☐ > 1,000k USD
- Existing bioenergy pathways (e.g. feedstocks, processing technologies, fuels and end-uses) in the country:
- Bioenergy feedstocks assessed through the GBEP indicators: wood resources, jatrohpa, sunflowers and agricultural residues
- Liquid, solid and gaseous fuels assessed through the GBEP indicators and respective end-uses (e.g. heating and cooking, power generation and transport) and end-use sectors (e.g. residential, commercial, industry): This study looked at liquid biofuels for transport, solid for heating and power generation in the residential sector and gaseous in the commercial sector.
- GBEP indicators measured (disaggregated by bioenergy feedstock, fuel, end-use and end-use sector considered, as necessary): The project assessed 11 out of 24 indicators and focused on existing data, meaning actual measurements, tests and surveys were not part of the study.

  As time and resources for the work were limited, the three institutes made choices regarding the scope of their work. Based on a selection and prioritization of the indicators by stakeholders, the following 11 indicators were measured:

Environmental	Social	Economic
1) Lifecycle greenhouse gas emissions	10) Price and supply of national food basket	17) Productivity
2) Soil quality	12) Jobs in the bioenergy sector	18) Net energy balance

Environmental	Social	Economic
3) Harvest levels of wood resources	14) Bioenergy used to expand access to modern energy services	20) Change in consumption of fossil fuels and traditional use of biomass
4) Land use and land-use change related to bioenergy feedstock production		23) Infrastructure and logistics for distribution of bioenergy

In their analysis of these indicators, the three research institutes monitored the following feedstocks and end-uses for each one.

The data collected for the environmental indicators, included:

- GHG emissions for wood fuel and biodiesel from jatropha
- Hectares of land used for jatropha and sunflower plantations and wood fuel
- Carbon stock per hectare for different land-use systems
- Annual harvested wood and amount used for bioenergy (traditional and modern)
- Total area of land used for bioenergy feedstock production, types of land used and annual conversion rates of land types.

The data collected for the social indicators, included:

- Food prices for maize and sorghum and changes in import, export and agricultural production
- Number of jobs in wood fuel, charcoal and jatropha sectors
- Number of households using traditional biomass

The data collected for the economic indicators, included:

- Productivity, processing efficiencies and production costs for firewood, charcoal, jatropha biodiesel, sunflower biofuel and biogas from waste
- Net energy balance for charcoal feedstock production and processing
- Change in consumption of fossil fuels and annual savings due to sunflower oil, jatropha biodiesel, biogas and cogeneration with wood
- Number and capacity of critical distribution routes for biogas, charcoal and biodiesel

- Approach/methodology used for attribution of impacts to bioenergy:

- Year when the next measurement of the GBEP indicators is planned: Unknown

KEY LESSONS LEARNT AND RECOMMENDATIONS ON THE RELEVANCE, PRACTICALITY AND SCIENTIFIC BASIS OF THE INDICATORS

- Overview / cross-cutting, e.g. stakeholder engagement:

The applicability of the GBEP indicators in Ghana is related both to the complexity and the requirements of the indicators as they have been developed, and to the situation in Ghana regarding the availability of data and the existence of data collection infrastructures. In the Ghanaian pilot situation, the data requirements as specified in GBEP methodology are partly met. The work done by the research institutes reveals that 10 percent of the collected data meets the majority of the GBEP data requirements, 54 percent meets part of the requirements for the data that could be collected, and the remaining 36 percent does not meet the requirements due to non-existence of data.

Bioenergy is a new and developing topic in Ghana and as a result, the existing data collection structures are not focused on bioenergy, which made data collection a delicate exercise. As a result, for this pilot, about half of the indicator values could be filled in. For the others, data was

not available, and about half of the data was taken from one-off studies and information from individual experts/stakeholders, which means that data is not gathered in a structural manner.

There is a general consensus among Ghanaian stakeholders of the relevance of the GBEP Sustainability Indicators as fast economic development in the country increases the need for policymaking based on concise and up-to-date data and indicators. For bioenergy development, this information is currently not available. These are an important tool for bioenergy policy development.

It was concluded that the descriptions of the indicators in the methodology reports were of sufficient detail and appropriate. The complexity and detail of the methodology, however, can lead to practical problems when implementing the sustainability indicators. The amount and detail of information needed for the individual indicators is high and can also impede practical implementation. The Ghana pilot revealed that the GBEP indicators can be an important instrument to improve the sustainability of bioenergy in Ghana. A simplified step-by-step implementation of the indicators seems very practical. The structured approach of GBEP is very valuable for Ghana but full fledged implementation is not yet feasible nor desirable.

The GBEP methodology facilitated the use of a structured approach for the data collection by the three research institutes as well as the selection of indicators for the pilot. At the same time, however, it was concluded that a lot of the data is currently not available in Ghana in the form required by GBEP. Moreover, a number of indicators need to be measured which is currently not done and which would take considerable resources. Additionally, for some indicators, only a selection of the many sub-indicators are relevant in the Ghanaian context. The complexity of the GBEP methodology and the level of detail of the indicators make full-fledged implementation of the GBEP indicators very difficult. Looking at what is needed in Ghana at the moment full-fledged implementation is also not desirable. For Ghana a more selective and less detailed approach makes more sense.

The follow-up project for Ghana should use the GBEP methodology, however with (i) a limited number of sub-indicators, (ii) a selective scope and (iii) sometimes simplified data collection methodologies. This 'light version' of the GBEP methodology can be extended in the long-run. The main other recommendations for the follow-up project would be that it should: cover preferably all 24 indicators and select the most relevant sub-indicators; seek support from all key stakeholders; seek synergies with other Ghanaian data collection, monitoring and reporting initiatives; use the four objectives formulated during the pilot project for follow-up; and foresee difficult human and financial resources.

- Environmental pillar:

Indicator 1	
Relevance	Biomass constitutes a major source of energy (firewood and charcoal), particularly for the rural population and for low-income urban groups. These bioenergy feedstocks play a major role in determining the contributions to greenhouse gas emissions. Also, they are directly linked to major sustainability impacts in general.
Practicality	The data available from the national communications is useful as it provides insight in the importance of the contribution of bioenergy towards the overall greenhouse gas emissions in Ghana and it provides a first estimate for indicator 1.1. For indicator 1.2, no data has been found. The suggested GBEP LCA approach can be implemented in Ghana but additional research and LCA are needed, especially taking land-use change issues into consideration will require major investments in time and resources.
Indicator 2	

Relevance	This is a very relevant indicator for Ghana. The indicator is primarily related to the productive capacity of the land and ecosystems. Agriculture is one of Ghana's most important economic sector, employing more than half the population on a formal and informal basis. Soil degradation, caused by bioenergy production (or other factors) can have severe impacts. Covering about 23 percent of the total area, forests also play a crucial socio-economic role in Ghana. The forestry sector contributes about 6 percent to Ghana's GDP, employing 120 000 people directly. Both traditional and modern bioenergy are relevant for this indicator.
Practicality	Currently available data does not fit the requirements of this GBEP indicator. The suggested methodology will take a lot of efforts in: sampling of soil quality, processing of data, setting-up a data collection methodology and how supervision and enforcement need to be arranged. The suggested revised strategy is to: determine soil and agricultural practices that help to maintain or enhance soil quality; collect data on bioenergy land where these practices are being implemented; and collect data on total bioenergy land.
Indicator 3	
Relevance	This indicator is very relevant for Ghana for multiple reasons. Wood and wood related products are an important economic factor in Ghana. Firewood and charcoal are the major sources of energy in Ghana, particularly in rural areas and low-income urban groups. Currently an unsustainable level (exceeding the annual allowable cut of 1 million m^3 as was set in 1996) of wood resources are being used resulting in deforestation.
Practicality	The data is very useful (not considering data quality), showing unsustainable level of using wood resources. The indicator can be used instantly in Ghana.
Indicator 8	
Relevance	This indicator is very relevant for Ghana as it is closely related to important issues like food security, land grabbing, deforestation and destruction of natural habitats, sensitive ecosystems and biodiversity.
Practicality	The presented figures, although very comprehensive and detailed in themselves, provide a rough impression of the current situation. More elaborate data using actual measurements and observations are needed to make the data useful for the indicators on hand. The indicator methodology is practical in itself but implementation will require a lot of efforts and resources, especially in building up the institutional infrastructure and the local capacities with farmers and agricultural organizations. This is especially the case for on the ground data collection, storage and recording.

- Social pillar:

Indicator 10	
Relevance	This indicator is very relevant for Ghana as it is directly related to food security. Although currently no food crops are being used (at least not in substantial volumes) for bioenergy production, there is a risk this could be the case when the sector is going (as expected) to develop. Less clarity consists if bioenergy feedstock production causes land use changes effecting food production. As food prices currently are probably not induced by their demand for bioenergy this provides the opportunity to develop a baseline for food prices.
Practicality	The described methodology is one of the most complex of GBEP and requires a lot of many different data in combination with complex

	assessments. It will be very difficult to implement this indicator in the Ghana context fully in line with the GBEP methodology. A critical selection of the usefulness and practicality of the sub-indicators is needed. The most important sub-indicators at the moment seem to be 10.2 and 10.3 as they help determine the availability of food crops for bioenergy production.
Indicator 12	
Relevance	Without a doubt, the number of jobs in the bioenergy sector are part of the important determinants of the sector's sustainability. Currently, while the jobs in the bioenergy sector in Ghana are insignificant, it is expected that in the next 10 to 15 years more energy jobs will be created in the bioenergy sector. It is expected a lot of jobs in the bioenergy sector will be created in rural areas (agricultural activities and collection, handling and transportation of biomass resources) and will be unskilled or low skilled jobs. In these two areas more jobs are needed.
Practicality	Examining the newness and the low level of bioenergy development in Ghana, all the 13 sub-indicators are not feasible at the moment in the context of Ghana. In consequence, ISSER recommended that the following sub-indicators are used in the first instance: 12.11, 12.12 and 12.13. These sub-indicators are sufficient to bring understanding to the sector at the moment. Subsequently, when the sector develops, the rest of the other sub-indicators can also be studied.
Indicator 14	
Relevance	Indicator 14 is very relevant for Ghana in the context of sustainable bioenergy development. Ghana's quest to expand in the areas of renewable energy supply and consumption for sustainable development demand an up-to-date data on all sources of renewable energy supply, including bioenergy as well as data on consumption. Data on these subindicators will therefore paint a proper picture about the state of the bioenergy sector.
Practicality	Bearing in mind the low level of bioenergy development in Ghana, not all 40 subindicators are necessary at this moment in the context of Ghana. In consequence, it is recommended that in the first instance focus should be on subindicators 14.1 – 14.21 and 14.33 – 14.36. These subindicators are sufficient to bring understanding to the sector at the moment. Subsequently, when the sector develops, the rest of the other subindicators can also be studied.

- <u>Economic pillar</u> (max. 1 page):

Indicator 17	
Relevance	Bioenergy feedstocks in Ghana are numerous, but charcoal from fuel wood is the dominant bioenergy source for heating and cooking nationwide. Biogas and recently biodiesel are being promoted by the Government and selected civil society but are not yet implemented on a significant scale. Most promoted biogas feedstocks in Ghana have been human excreta from public and institutional places of convenience, and recently kitchen and slaughter house waste and agrowaste. The main fuel crops that were promoted were jatropha and sunflower while characterization of agro waste for biofuel production is in its infant stages still. As the sector is still immature it is important to learn the physical and cost efficiencies of the different pathways.

Practicality	The data collected for this indicator is very useful. For processing efficiencies it was proposed that the units be MJ end product / MJ feedstock.
Indicator 18	
Relevance	Production of bioenergy requires energy as an input at different steps of the value chain. Primary energy needs of bioenergy production may be met through consuming fossil and/or renewable energy. Indicator 18 is closely related to indicator 20. With the energy ratios, the cost effectiveness of different bioenergy technologies can drastically change due to lower net energy output. This might lead to different choices in stimulating specific bioenergy technologies.
Practicality	Not much data is available as the concept is new and only now being promoted and disseminated. Also the indicator has not yet been explicitly used in policy formulation in Ghana because it has not been nationally calculated, promoted and disseminated for application. If data can be found the GBEP methodology is not difficult to implement.
Indicator 20	
Relevance	Using modern biomass as a substitute for fossil fuels and/or traditional biomass can have many social, environmental and economic benefits (or take away negative aspects). As such this indicator is relevant for Ghana. However, currently in Ghana LPG for cooking is being stimulated, replacing traditional biomass (firewood and charcoal). Although a fossil fuel LPG has advantages over traditional biomass looking at safety, indoor air pollution, time used by women and children for collection of firewood, deforestation etc. it is unclear what will be the result of an assessment of the advantages and disadvantages of both LPG and clean cook stoves. Additionally, indicator 20 is strongly related to many other indicators like indicators 1, 3, 14, 15, 16, 18 and 22, and as such, it is unclear if the relevance of this indicator for Ghana is high enough to justify further actions towards implementing this indicator at this point in time. Maybe focus should be on specific pathways that are in line with national policies/programmes.
Practicality	Current available data is not very useful. The indicator itself is not difficult to use but data availability (and quality) will prevent easy implementation.
Indicator 23	
Relevance	As energy security is a major concern in Ghana, with many blackouts, this indicator is of importance. Transportation is of importance for charcoal but this is more related to efficiency, safety and clean transport, with many 'production' locations and (road) transportation routes. For biogas, infrastructure and logistics are of no importance as biogas usually is produced in a stand-alone system in the proximity of the place where it is also used. Biodiesel might have critical distribution systems, however currently very little biodiesel is actually produced. These small amount are transported by road. With a growing biodiesel market and production capacity, infrastructure and logistics can create risks that need to be looked at. In general, Ghana's bioenergy policy stipulates progressive increase in the biofuel component in Ghana's energy mix over the coming decade. Indicator 23 will therefore progressively become more relevant.
Practicality	The recommended methodology for data collection stipulates representative sampling at national and regional level. Systematic and continual generation and evaluation of data for the purpose of calculating

	security of biofuel delivery routes has not been done in Ghana. Some data had to be obtained on the allocation of carriage capacity in the ports and on rail for real charcoal carriage capacity of the critical routes to be determined. Charcoal exports have to be confirmed and actual carriage by rail needs to be obtained using prescribed methodology to validate percentage carriage estimated by the team. The proposed GBEP indicator methodology is practical and easy to apply but as very few confirmed figures were available, the team had to make a number of estimations. The Ministry of Roads and Transport regularly provides data on road mileage, rail mileage and lake mileage as well as total load carriage including traffic at the harbours and landing stages. A determination of the biofuel carriage component is what is required.