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"

Template for the Compilation of GBEP Indicators Experiences

OVERVIEW

- Country: **Indonesia**
- Scale at which the GBEP indicators were measured: ***NATIONAL***
- Year(s) during which the GBEP indicators were measured: **from 2011 to 2014**
- Organization(s) commissioning/overseeing the measurement of the GBEP indicators: **Food and Agriculture Organization of the United Nations (FAO)**
- Organization(s) carrying out the measurement of the GBEP indicators: **Bogor Agricultural University, Indonesian Soil Research Institute, Indonesian Geospatial Information Agency, Re-mark Asia;**
- Source(s) of funding: **International Climate Initiative of the Federal Ministry of the Environment, Natural Resource, and Nuclear Safety of Germany.**
- Funding size: ☐ < 500k USD; **X** 500k - 1,000k USD; ☐ > 1,000k USD
- Existing bioenergy pathways (e.g. feedstocks, processing technologies, fuels and end-uses) in the country: **Palm oil-biodiesel; traditional biomass; manure biogas**
- Bioenergy feedstocks assessed through the GBEP indicators: **Crude Palm Oil (CPO)**
- 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): **Biodiesel**
- GBEP indicators measured (disaggregated by bioenergy feedstock, fuel, end-use and end-use sector considered, as necessary): **All 24 GBEP Indicators**
- Approach/methodology used for attribution of impacts to bioenergy: **mass balance; for selected economic indicators economic value allocation was chosen.**
- Year when the next measurement of the GBEP indicators is planned: **unknown**

KEY RESULTS

- Overview (max. 1 page): In Indonesia, the growing demand for palm oil, including as biofuel feedstock, has triggered a supply response, in the form of an expansion in the harvested area of oil palm. Thanks to this increase in production, there was no diversion of palm oil from the food market to the biofuel market. The palm oil sector employes some 3.5 million people in the Southeast Asian archipelago and was responsible for gross revenues of about USD 30 billion in 2012. Indonesia is the world largest palm oil producer with 26.5 million tons of CPO in 2012 and world first exporter with 18 million tons. The main markets for the Indonesian palm oil are India, China, and the EU-27. Commercial biodiesel production in Indonesia started in 2007 and picked up

significance only in 2008. As of 2012, roughly 2 million tonnes of CPO produced in Indonesia were transformed to biodiesel domestically, or 8 percent of total. The country has responded to the increasing demand mainly through agricultural expansion which has brought a number of environmental challenges as well as some benefits, particularly linked to income, employment, food security and energy access and diversity.

- Environmental pillar (max. 1 page): Starting from the 1990s, in Indonesia a relevant growth of the palm oil sector was recorded. The land-use changes associated with the oil palm expansion have given rise to a range of environmental, social and economic impacts. In 2010, around 8.4 million hectares were planted with oil palm in Indonesia, of which 91.6 percent in the islands of Sumatra, Kalimantan and Papua. Between 1990 and 2010, about 6.35 million ha of land were converted to oil palm in these three islands. According to the Life Cycle Analysis (LCA) of GHG emissions that was performed under indicator 1, this expansion led to the conversion of high carbon stock areas (e.g. forests, timber plantations, etc.), causing significant emissions of carbon dioxide. In addition, about 1.25 million ha of peatland were drained and converted to oil palm cultivation, resulting in high, continuous GHG emissions from peat decomposition. Overall, the results of the LCA confirmed that land-use change, especially from forests, is the most important contributor to total GHG emissions from the Indonesian palm oil industry. Other important consequences of land use change associated with oil palm expansion are habitat loss and impacts on biodiversity. As of 2010, 17 percent of Indonesian oil palm plantations were found in High Conservation Value areas. Another important source of GHG emissions along the palm oil supply chain is the methane released by the anaerobic fermentation of palm oil mill effluent (POME). As of 2012, only around 5 percent of the over 600 Indonesian palm oil mills were equipped with methane capture systems. An analysis of the economic viability of these methane capture systems should be conducted and, if necessary, measures to promote their wider adoption might be considered. In addition to land-use change and the associated effects in terms of GHG emissions and biodiversity, a number of other environmental issues were assessed and analyzed. With regard to soil quality, in East Kalimantan, soil erosion affects oil palm production areas. Concerning soil organic carbon, data is scarce due to the lack of periodic monitoring. Regarding water quality, it was found that large quantities of pollutants, mainly nitrate and phosphate, are discharged into the bodies of water near the oil palm plantations. As a result, in several areas pollutant concentrations in rivers often exceed the thresholds set by law, particularly around smallholders plantations on peat soils. Further and more refined investigations of pollutant loadings in the internal waters in Indonesia due to biodiesel feedstock production are needed, including mathematical modelling of material transport. With regard to non-GHG airborne pollutants, the low level of mechanization in oil palm cultivation results in relatively low emissions of such pollutants. Concerning tailpipe emissions, tests have demonstrated that biodiesel can significantly reduce the emission of most non-GHG pollutants when compared to fossil-based diesel, showing the potential environmental and health benefits of a shift from traditional fuels to biofuels, especially in densely populated urban areas.

- Social pillar (max. 1 page): In Indonesia, the growing demand for palm oil, including as biofuel feedstock, has triggered a supply response, in the form of an expansion in the harvested area of oil palm. Thanks to this increase in production, there was no diversion of palm oil from the food market to the biofuel market, as confirmed also by the data available in national and international statistics. According to FAOSTAT, between 2008 and 2012, the supply of palm oil for food increased in Indonesia. This has resulted in a considerable increase in the number of people employed in palm oil production.

Regarding the quality of the jobs created in this sector, compared to the average agricultural worker oil palm workers seem to benefit from a higher level of formalization of employment, better wages and benefits, and better protection against occupational risks. The increase in the demand for palm oil for biodiesel production has also provided additional income-generating opportunities for agricultural producers, including smallholders, who accounted for around 35 percent of total palm oil production in Indonesia in 2012. With regard to land tenure, a few cases of land conflicts were reported in literature, including in the context of oil palm plantations, with lack of adequate legal recognition of customary rights to land identified as one of the main causes.

- Economic pillar (max. 1 page): With regard to the economic sustainability aspects, the Indonesian biofuel sector appears to be cost-competitive. However, yields have been stagnant for many years, whereas higher yields have been obtained in experimental trials thanks to the research and development of improved varieties and management regimes. While the gross value added generated by the biofuel industry in Indonesia is relatively small compared to the GDP (e.g. 0.026 percent in 2012), the demand for goods and services associated with this industry has been reported to trigger multiple indirect and induced effects on the economy, including in terms of employment. From an energy balance perspective, the Indonesian palm oil-based biodiesel supply chain is rather efficient compared to the production of other first-generation liquid biofuels. However, there appears to be room for further improvement in the feedstock production phase of the supply chain (particularly in the case of independent smallholders), as well as for the refinery component of the processing phase. Furthermore, even though in 2012 biodiesel accounted for only 0.19 percent of the total primary energy supply (TPES) in Indonesia, this modern bioenergy led to around 282 million USD of estimated savings from avoided oil imports and generated 657 million USD of export revenues. With regard to the logistics of the biodiesel supply chain, distribution to the easternmost provinces of the archipelago, namely Papua and Maluku, may be difficult due to the lack of efficient infrastructures and this is considered the main cause that has prevented the country from fulfilling the B10 mandate in 2012. Distribution hurdles are also found in the two main producing islands, i.e. Sumatra and Kalimantan. The latter, in particular, suffers from limited processing facilities and poor internal distribution routes (e.g. dirt roads and shallow ports). For this reason, large quantities of feedstock need to be transported in relatively small batches from Kalimantan to Sumatra. In order to meet higher biofuel mandates, it is suggested that these logistical issues are thoroughly assessed and managed.

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

- Overview / cross-cutting, e.g. stakeholder engagement (max. 1 page): The GBEP indicators are rather data and skills intensive. For the testing, it was not possible to get hold of a number of data related to various indicators, especially within the Social basket. Part of this data was not available (an issue that might be in common with other developing countries as well) while in other cases it was not possible to get access to them due to a number of reasons, including the commercial sensitiveness of some of the information. This shows the importance of involving all relevant stakeholders in the process, ranging from relevant government departments/ministries (e.g. those dealing with agriculture, energy, environment, rural development, food security, infrastructure, etc.) to producer associations, universities and NGOs. Stakeholder engagement and

ownership of the process is key in order to get access to the necessary data and information, receive inputs and feedback, discuss and interpret the results, and ultimately inform policy discussions and decisions. A multidisciplinary team of experts with an in-depth knowledge of the national context and of the domestic bioenergy sector is needed in order to measure these indicators. As realized during the testing in Indonesia, in order to enhance the practicality of the GBEP indicators, more clarity and guidance would be needed regarding both methodological and practical issues related to the implementation of certain indicator methodologies. An implementation guide would be needed in order to complement the GBEP report on the sustainability indicators.

With regard to the overall and cross-cutting issues of the sector, as bioenergy continues to expand and higher biofuel mandates are considered, it is essential to monitor the land-use changes associated with bioenergy feedstock expansion, given the important implications that land-use changes can have for a range of environmental, social and economic sustainability issues. Remote sensing, field visits and stakeholder consultation are complementary tools that have proven valid for the assessment of the sustainability of bioenergy at the national level and that could be used in the future to analyze the land-use changes associated with bioenergy feedstock expansion. In order to ensure that the increase in the demand for biodiesel associated with the aforementioned targets is met sustainably, it is recommended to implement measures aimed at increasing the productivity of palm oil production, for instance through the introduction of improved varieties and management practices.

- Environmental pillar (max. 1 page): With regard to oil palm expansion, it is recommended to prioritize low carbon stock areas such as degraded lands, shrublands and grasslands, where oil palm cultivation could contribute to sequester more carbon than it would naturally occur. On the other hand, further conversion of forests, both disturbed and undisturbed, and of wetlands and peatlands should be avoided, given the negative impacts that their conversion would have both in terms of biodiversity loss and GHG emissions. The avoidance of new oil palm development on peat soils and, where possible, the conservation and re-wetting of these areas are also suggested as priorities for the sustainable development of Indonesia, as this would prevent the emission of large amount of GHG for an extended period of time.

- Social pillar (max. 1 page): The social implications of the future oil palm expansion should be considered as well, for instance in terms of allocation and tenure of land for bioenergy feedstock production. Concerning food security, according to the results of the AGLINK-COSIMO model described in indicator 10, the increase in biodiesel blending mandates to 25 percent proposed in the new National Energy Policy would result in a decrease in the availability - and an increase in the price - of palm oil on both domestic and international markets. It is recommended to carefully consider these effects in order to inform possible adjustments to the policy framework and the design of potential corrective or mitigation measures.

- Economic pillar (max. 1 page): Most information was available on public datasets. However, often cross-checking of information from datasets belonging to different national entities did not result in a complete match. Great relevance and valuable insights were offered by indicator 17, 18, 19, 22 and 23. The methodological approach of indicator 24 was felt misleading if applied to the case of forms of solid biomass, but overall the economic indicators describe well the Indonesian biodiesel sector.