# 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"***

**OVERVIEW**

- Country: Netherlands.
- Scale at which the GBEP indicators were measured: National.
- Year(s) during which the GBEP indicators were measured: December 2011 to March 2012.
- Organization(s) commissioning/overseeing the measurement of the GBEP indicators: NL Agency and the Ministry of Infrastructure and the Environment
- Organization(s) carrying out the measurement of the GBEP indicators: NL Agency Ministry of Infrastructure and the Environment.
- Source(s) of funding:
- 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: traditional biomass for stoves; forestry resources (fresh wood, waste wood and processing residues) for stoves, co-firing and incineration; agricultural residues (including manure) for co-firing, incineration and biofuel production; wastes for incineration/biogas; rapeseed and used cooking oil (UCO) based biodiesel; maize based ethanol; short rotation coppice (SRC); and miscanthus.
- Bioenergy feedstocks assessed through the GBEP indicators: maize, rapeseed, SRC and miscanthus as well as traditional biomass.
- 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): The main fuels considered were: liquid biofuels for transport; biogas for commercial and industrial use; and solid biomass for residential use.
- GBEP indicators measured (disaggregated by bioenergy feedstock, fuel, end-use and end-use sector considered, as necessary): All indicators were considered relevant in the Netherlands except for indicators 9, 10, 13, 14, 15 and 21. Therefore, a total of 18 indicators were measured for each feedstock.
- Approach/methodology used for attribution of impacts to bioenergy:
- Year when the next measurement of the GBEP indicators is planned: Unknown.

## KEY RESULTS

Overview:

One of the key priorities of the Netherlands is the development of a bio-based economy, causing bioenergy production and use to expand. The Netherlands measured the sector's sustainability through a desk study of 18 of the 24 GBEP indicators. In this study, the environmental and economic indicators were found to be more relevant as all but one of them was measured. Overall, it was determined that the environmental impacts were limited while there were larger positive social and economic impacts.

The results also indicated that the Netherlands has the potential capacity available to extend its actual bioenergy production of municipal solid waste combustion, co-firing of biomass and biofuel use for road transport. Increased use of bioenergy from other smaller-scale bioenergy systems would require an increased production capacity.

Environmental pillar:

All eight of the environmental pillars were measured. The use of energy crops for bioenergy production in the Netherlands is limited and its impact on land-use related environmental impacts is therefore inherently minimal. The cultivated energy crops showed differences in water use, fertilizer needs and soil carbon stocks. Selecting a suitable energy crop for the local conditions in the Netherlands is key for further improving the sustainability performance of domestic biomass production. This will also be true for residues and waste for biomass production although specific information on these resources was too scattered to provide a precise conclusion.

It was determined that the maximum total area of land for bioenergy feedstock production in the Netherlands compared to the total national surface is 0.3 percent. This is 2 percent of the total agricultural area. The bioenergy feedstocks that are produced on this land have not directly contributed to yield increases. Residues contribute to 48 percent of the domestic bioenergy production, and waste contributes 50 percent.

Furthermore, the study found that a very small amount of fresh harvested wood and harvest residues are being used for energy purposes in the Netherlands. The net annual conversion rates between land-use types caused directly by bioenergy feedstock production have been minimal in the last years. Limited changes have taken place between crop types within the agricultural area. The production was found to lead to slight increases in carbon stocks in the soil. The exception to this finding is the production of rapeseed when it replaces wheat or when SRC replaces grassland. Therefore, the risk for lower soil quality due to lower soil carbon stocks is expected to be minimal.

The study found that the Netherlands has a moderate water stress level. Water use by the agricultural sector is minimal compared to other economic sectors. The estimated proportional contribution of energy crops to the total actual renewable water resources (TARWR) is very small. The contribution of energy crop cultivation to pollutant loadings in the water is very minimal as well.

The average greenhouse gas emissions that can be attributed to biofuel in the Netherlands is 29.7 g of $CO_{2eq}$/MJ. Compared with the standard fossil transport fuel emission according to ER-RED (2009), this constitutes a GHG emission savings of about 65 percent. Insufficient data was available for the GHG emissions from bioenergy for heat and electricity. The estimations on non-GHG gas emissions to air caused by bioenergy production have significant uncertainties. The outcomes suggest that on average per MJ bioenergy, the emission of pollutants like $NO_x$, $SO_2$, PM2.5 and PM10 are often higher than per MJ of conventional energy.

Social pillar:

Only indicators 11, 12 and 16 were measured. The average growth in employment in the total renewable energy sector in the Netherlands is 189 percent from 2007 to 2010. This was 200 percent for the bioenergy sector and 160 percent for the wind energy sector. Employment growth of the bioenergy sector has thus been positive. Income levels and risk of injuries of the bioenergy sector are comparable to other economic sectors with similar activities. Results indicate that the bioenergy

sector is increasingly contributing to the employment and income generation for people in the Netherlands. Contributions are, however, still limited in comparison to other traditional economic sectors.

Economic pillar:

Seven of the eight economic pillar indicators were measured in this study. Indicator 21 was deemed to be not as relevant. The results showed that bioenergy in the Netherlands contributes to the total primary energy supply and diversity to a limited extent (2.4 percent in 2010). Total annual savings of convertible foreign currencies are positive for most bioenergy systems but negative for biofuels. Underlying reasons are that biofuels are typically more expensive than fossil fuels for road transport and that most of the biofuels, or the crops they are made from, are imported. It should be noted that bioenergy production and use in the Netherlands is largely policy driven, and the costs are generally higher compared to fossil systems (excluding externalities and carbon credits).

Accurate data about the suitability of the use of existing infrastructure for bioenergy was not available. It can, however, be concluded that major disruptions that endanger the energy supply in the Netherlands are unlikely.

Results on productivities of bioenergy in tonne and MJ per hectare are restricted to domestically cultivated crops. The results differ per crop, which can be attributed to the physical differences between the crops, their cultivation conditions and end-uses. Also, the processing efficiencies differ per bioenergy pathway, at least when expressed in MJ processed product per tonne feedback.

In monetary terms, bioenergy production costs are all in the same order of magnitude: 0.01 to 0.07 $US per MJ bioenergy. The gross value added per MJ has been calculated at 0.0083 US$. Bioenergy crosses various economic sectors; almost all sectors can have a relation to bioenergy, directly through bioenergy consumption or indirectly through services or goods supplied. In total, bioenergy adds 0.081 percent to the national GDP.

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

Overview / cross-cutting:

The practicality of the indicators was monitored during the data collection and assessment of the selected GBEP indicators. Three different variables were used to evaluate their practicality: data availability, methodological constraints and usefulness. Through this approach, it was determined that the GBEP indicators were a useful tool for informing policymakers about the environmental, social and economic sustainability aspects of the bioenergy sector in the Netherlands. However, the results were often subject to various uncertainties due to the lack of data availability and complications associated with adjusting and modifying the available data to the exact scope of GBEP.

The GBEP methodology asks countries to provide a complete and detailed overview of their bioenergy sectors. The data specificity and skill level necessary to complete such a task are therefore very high. These elements are further complicated by data gaps that can arise. For instance, in the case of the Netherlands, data was not available for the entire bioenergy lifecycle for all possible bioenergy pathways; very small processing units were not documented properly; and some data were considered too commercially sensitive to be shared with the public. One way to overcome possible gaps in the data is to link the monitoring period of the GBEP indicators with other existing monitoring initiatives. This would require coordination between relevant government organizations and institutes. To improve the usefulness of the indicators, another suggestion would be to include alternative approaches on how to measure indicators when complete data sets are unavailable and/or the methodology is too time intensive.

Data collection was complicated at times as the bioenergy sector in the Netherlands is not considered to be a separate economic sector in statistics or other monitoring activities. To enhance the practicality of the indicators it is recommended that methodological guidance is provided on how to

deal with the fact that the bioenergy sector does not exist as a separate economic sector, especially not in statistics. A related question to address is whether the sustainable use of bioenergy, as an objective of GBEP, should result in a separate bioenergy sector or a full integration of biobased activities in a country's economy (as desired by the European Commission or the International Energy Agency).

Another factor that made it more challenging to measure multiple indicators was the dynamism of the Dutch bioenergy sector, meaning the sustainability of its bioenergy production and use is inextricably linked with activities that take place outside of the country's borders. Some of the feedstocks and conversions are partially imported and partially produced in the country. For example, with rapeseed oil for biodiesel, the rapeseed can be imported or domestically produced, oil extraction can be done nationally or foreigners, conversion to biodiesel can either take place domestically or abroad and the end-use can be national or it can be exported. Outcomes of the GBEP indicators, and its interpretation in a national context, may therefore present a distorted picture when non-sustainable activities take place outside the country. It is therefore recommended to specify a country's footprint when presenting the results of the GBEP indicators, especially in relation to the land-use related indicators: water and fertilizer use, indirect land use change, field burning, harvest levels of wood resources, soil carbon stock changes and biodiversity.

GBEP may also consider providing more guidance on certain definitions as mentioned in the indicators. Examples are the interpretations of "critical ecosystems" or "conservation methods" under indicator 7 or the "flexibility of use" or "flexibility of production" under indicator 24. In other cases it would be helpful if GBEP specified how information/results should be presented. With some indicators it is recommended that the outcomes be displayed in the form of a graph and in other cases it would be best to display the results on a map.

Environmental pillar:

For several of the environmental indicators the geographical scope of the methodology was found to be unclear as they refer to using a "lifecycle" approach, which implies including the sustainability effects of bioenergy production and use occurring outside the country's borders. It is therefore recommended that better insight be provided on how the international trade of bioenergy feedstocks and intermediaries be dealt with. Furthermore, there were other indicators where the methodology was not very practical as it was either too labor or time intensive. The inclusion of alternative approaches would improve the indicators' usefulness. Lastly, the results of many indicators should be presented in the form of tables and figures, but for some indicators, it is more meaningful to display the outcomes spatially in the form of maps (e.g. soil quality). Remote sensing and geographic information systems (GIS) approaches would be useful in this regard. For more details on the findings for each indicator, please see the full report produced by the Netherlands.

Social pillar:

The main take away from the measurement of indicators 11, 12 and 16 was that in many cases the data needed to calculate the outcomes was not available. To get that information, samples or questionnaires would have had to have been carried out, but that was deemed to be too time consuming. Therefore, it is recommended that alternative approaches be provided. For more details, please see the full report produced by the Netherlands.

Economic pillar:

Aside from the previously mentioned uncertainties surrounding definitions of "flexibility of use," the main challenge encountered was determining bioenergy's economic contribution because bioenergy receives considerable subsidies in the Netherlands, which comes at a cost to the national economy. Guidance on how to incorporate subsidy information would enhance the practicality of the indicators as subsidy information would indicate something about the economic feasibility of bioenergy: the higher the subsidy, the less economically feasible. For additional lessons learnt and recommendations for the economic indicators, please see the full report produced by the Netherlands.