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"

Compilation of GBEP Indicator Experiences

OVERVIEW

- Country: **Germany**
- Scale at which the GBEP indicators were measured: **National**.
- Year(s) during which the GBEP indicators were measured: **from 2012 to 2014.**
- Organization(s) commissioning/overseeing the measurement of the GBEP indicators: **Federal Ministry for Economic Affairs and Energy (BMWi).**
- Organization(s) carrying out the measurement of the GBEP indicators: **ifeu – Institute for Energy and Environmental Research Heidelberg and IINAS – International Institute for Sustainability Analyses and Strategies, Darmstadt.**
- Source(s) of funding: **Federal Ministry for Economic Affairs and Energy (BMWi) (former Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety).**
- 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:
  biofuel for transport, such as Biodiesel made from rape seed, soybean, palm oil, used cooking oil; Bioethanol made from cereals sugar beet, sugar cane, palm(Biodiesel, liquid, gaseous);
  biogas upgraded for transport biofuel and biogas for electricity and heat made from maize and other grown crops as well as from agricultural and industrial residues, and
  woody biomass for electricity and heat
- Bioenergy feedstocks considered: **All feedstocks mentioned above for GHG and non-GHG emissions; all other indicators only applied for the domestically produced feedstocks**
- Liquid, solid and gaseous fuels considered and respective end-uses (e.g. heating and cooking, power generation and transport) and end-use sectors (e.g. residential, commercial, industry): **All fuels, end-uses and end-use sectors**.
- GBEP indicators measured (disaggregated by bioenergy feedstock, fuel, end-use and end-use sector considered, as necessary): **in principle all 24 GBEB indicators Five indicators were excluded justified by lack of relevance in German context (indicators 13, 14, 15, 21 and 23**
- Approach/methodology used for attribution of impacts to bioenergy: **mass balance at crop level;**

- Year when the next measurement of the GBEP indicators is planned: **undetermined (possibly in 2017/18)**

KEY RESULTS[1]

- Overview: (max. 1 page): In 2012 12.6 % of the final energy consumption was provided by renewable energies, out of which 66 % where produced from biomass (in total numbers: 737 PJ bioenergy). Rapeseed is the most important feedstock that is used for biodiesel production (62.8 % of biodiesel is made from rapeseed). Rapeseed also is a major feedstock for pure vegetable oils and is used for about 37% of the whole production (the rest is produced from palm oil). Most important crops in bioethanol production are maize (48%), wheat (24.47 %) and sugar beet (18%). 34% of the maize used is imported from the USA).
  The amount of agricultural land used for bioenergy feedstock production has been steadily increased over the past years. In 2012 about 2.1 million ha of bioenergy crops have covered German cropland (i.e. 12.3 % of the agricultural area and 18.3 % of the arable land).
  Some of the environmental problems arise from the fact that increased bioenergy production induced a shift in the combination of agricultural crops. Especially the production of corn for biogas production has strongly increased.
  An important amount of bioenergy (feedstocks) used on the German market are imported. Only 33% of the reported biofuels / bioliquids have been produced in Germany (based on the energy content) whereas 21 % / 27 % where imported from EU countries / third countries. Regarding gaseous bioenergy it can be assumed to be produced mainly from domestic biomass. The main feedstocks are maize and manure which usually are not transported over long distances. Only in border areas a significant share may stem from abroad. Solid bioenergy is currently mainly woody material which comes primarily from domestic sources (forests residues, sawmill residues, post-consumer wood etc.).
  Germany has several reporting commitments. Under the European Renewable Energy Directive (RED) Article 22 (EU 2009) it has to provide information on the use of renewable energies, including bioenergy. Furthermore, key data is provided annually by the Federal Statistical Office (DESTATIS), the Working Group on Renewable Energy Statistics (AGEE-Stat) and the Federal Agency for Renewable Resources (FNR) which all report under several national laws. These official key data sources were used to derive the quantitative base for all indicators.

- Environmental pillar (max. 1 page): Good data are available to report on the indicators 1 (GHG emissions), 4 (air pollutants) and most aspects related to indicator 8 (land use and land use change). These data are reported and used for monitoring purposes on an annual basis. Regarding GHG emissions and air pollutants, however, it is not possible to distinguish between imported and nationally produced biomass.
  In contrast, data are of medium to poor quality for indicator 2 (soil quality), 3 (harvest level of wood resources), 6 (water quality) and 7 (biological diversity). Regarding soil quality, there are neither data on the influence of bioenergy on the soil organic carbon nor on the application of soil improvement measures. However, there is an obligation

[1] The results summarized in this section and the related recommendations should be treated as preliminary and indicative, as during the testing of the GBEP indicators in Colombia only partial analyses could be conducted due to the limited data available.

for balanced humus content. Although water quality is measured on a regular basis, the contribution of bioenergy production cannot be identified. The same difficulty occurs with indicator 7 as there is no information on the exact geographical location of bioenergy feedstock production.
Indicator 5 (water resources) has been proved to be not relevant in the German context.

- Social pillar (max. 1 page): Good data basis was available for answering the indicators 9 (allocation and tenure of land), 10 (price and supply of national food basket) and 12 (jobs in the bioenergy sector). Indicators 9 and 10 proved not to be relevant in the German context in the sense that no risks regarding these aspects are expected.
  Indicators 13 to 15 are not applicable in Germany and thus were excluded from the assessment because collecting biomass is not performed by women and children, modern bioenergy is already established, and where in-door fireplaces where used this is more a life-style matter than an energy transition.
  Indicator 11 (change in income) could not be assessed due to a lack of data. Although there is data on wages in Germany these data do not differentiate between bioenergy and other activities (e.g. agricultural and forest workers).
  Also regarding indicator 16 (incidence of occupational injury, illness and fatalities) the data quality in Germany is low. German statistical data do not differentiate between bioenergy and other agricultural/forest activities.

- Economic pillar (max. 1 page): Good data are available for the indicators 17 (productivity), 18 (net energy balance), 19 (gross value added), 20 (change in consumption of fossil fuels and traditional use of biomass) and 22 (energy diversity). As regarding indicator 19, German national accounts do not allow to disaggregate GVA effects of bioenergy a proxy was used for GVA: investment and economic turnover.
  Indicator 21 (training and re-qualification of the workforce) and 23 (infrastructure and logistics for distribution of bioenergy) were not relevant for Germany and thus were not assessed.
  Indicator 24 (capacity and flexibility of use of bioenergy) could not be assess due to a lack of data. While data on capacity exists, for flexibility only few studies are currently being carried out.

KEY LESSONS LEARNT IN TERMS OF RELEVANCE, PRACTICALITY AND SCIENTIFIC BASIS OF THE INDICATORS

- Overview / cross-cutting (max. 1 page): In general, the GBEP indicators are mostly applicable and cover all relevant aspects of bioenergy sustainability in Germany.
  Many of the indicators (or at least part of them) are covered by the German 'National sustainability strategy' that was adopted in 2002. In most cases the database is of good quality to answer the indicators. Many indicators are already covered by monitoring systems and respective data are collected on an annual basis.
  Despite the overall good data availability, many indicators lack of an evidence-based approach to attribute effects of bioenergy against effects from biomass used for food, feed or other purposes (e.g. the contribution of bioenergy feedstock production to water pollution). It was beyond the assessment project to track back the origin of biomass for bioenergy in a way to attribute local/regional impacts. At represent, effects can only be allocated by a simple proportionality between bioenergy and other uses of the same feedstock (e.g. rapeseed, maize, wood). It should be made clear by GBEP on which unit this proportionality should be based (mass, energy…).

The authors of the study propose several additional sub-indicators: “Intensified use” of grasslands for bioenergy (biogas) and forests as a further sub-indicator for biological diversity impacts in the landscape (indicator 7). For Indicator 3: “Harvest level of wood resources” the suggested new sub-Indicator 3.4 "Bioenergy as share of annual increment" to reflect that (typically) the annual wood increment is more stable as a base for the percentage. Harvest levels might fluctuate due to non-energy demands, and natural disturbances such as droughts, storms etc.
Furthermore it is recommended to add two (sub-)indicators that allow reflecting changes in farm structures (sizes and ownership structures) and the influence on land rentals and prices.
For those indicators with low relevance for German bioenergy it has to be considered that German bioenergy policy induces relevant imports from abroad, especially for liquid biofuels. This mechanism transfers impacts to the exporting countries, where other indicators may be extremely relevant (e.g. food prices, water resources, traditional collection and use of biomass).
The only indicators where the scope has been extended from the national to the global level are GHG balances (due to the global scale of the impact) and non-GHG air emissions (due to the inherent transboundary character of the applied emission factors). As the indicators are to be assessed at a national level, in a strict sense those emissions and impacts that arise elsewhere should be omitted.
For some indicators, environmental impacts occur at a strongly regionalised level (soil and water quality, water quantity). Here, the identification of and focus on hot spots or high risk areas could be a good alternative if data availability at national level is insufficient.