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: Japan
- Scale at which the GBEP indicators were measured: Municipal biodiesel oil processing plant in Kyoto which is operated by Kyoto city government.
- Year(s) during which the GBEP indicators were measured: 2010
- Organization(s) commissioning/overseeing the measurement of the GBEP indicators: The project was implemented as a research project of Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries (PRIMAFF) under the request from the headquarter of Ministry of Agriculture, Forestry and Fisheries (MAFF).
- Organization(s) carrying out the measurement of the GBEP indicators:
  The measurement of the indicator was implemented by researchers in PRIMAFF.
- Source(s) of funding: PRIMAFF
- 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: Waste cooking oil from food service sectors, food processing sectors and households, the feedstock was converted to BDF and used for municipal garbage trucks and local buses.
- Bioenergy feedstocks assessed through the GBEP indicators: Waste cooking oil
- 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): Only BDF from waste cooking oil was assessed.
- GBEP indicators measured (disaggregated by bioenergy feedstock, fuel, end-use and end-use sector considered, as necessary): As some indicators are not relevant to Kyoto case, 14 out of 24 indicators were measured; indicator 1(Lifecycle GHG emission), 4 (Emission of non-GHG air pollutants), and 5 (Water use and efficiency) from environmental pillar, indicator 11 (Change in income), 12 (Jobs in the bioenergy sector) and 16 (Incidence of occupational injury, illness and fatality) from social pillar, and all eight indicators in economic pillar.
- Approach/methodology used for attribution of impacts to bioenergy: All the impacts assessed here are attributed to bioenergy (BDF). For the measurement, 'bottom up approach' was applied: some plant data were collected and supplemental data were also collected from Kyoto city government. In addition, previous studies related to Kyoto case was also used for the measurement.

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

KEY RESULTS

- Overview (max. 1 page):

Kyoto city government launched BDF production in 1997. Its material is waste cooking oil, and the amount of waste oil collected was 1487KL in 2010, among which 207KL from household, and 1279KL from food service and food processing sectors. To collect the waste oil from household, the city government installed 1500 collecting points in all over the city. The amount of BDF produced was 1405KL (50349GJ) in 2010. Produced BDF is used for 147 garbage trucks as B100 and 95 municipal buses as B20 (as of 2010). As the BDF plant is located next to a garbage disposal plant, garbage trucks are fuelled at pumps nearby the BDF plant on their way to the disposal plant. A bus depot is located 1.6km away from the BDF plant, and BDF is transported to the depot and buses are fuelled there.

The reasons why we choose Kyoto BDF plant as GBEP pilot study are following two: one is the plant has been operated for over 10 years and much data which are available for the measurement of the indicators is originally collected by the plant, and the other is the city government emphasizes on many effects of BDF production not only environmental ones such as waste reduction (saving cost to treat waste oil), global warming mitigation, and avoiding water pollution but also social ones such as actual environmental education for school kids, and promoting community activities by installing local collecting points in communities. We thought these effects on social aspects might be reflected to results of measurement of the indicator in social pillar.

This pilot assessment is plant level which covers only one single BDF plant in Kyoto. In addition, one should note that we focus on only waste cooking oil as feedstock, other bioenergy from various feedstocks, for instance, biogas from food waste and livestock manure is not considered in the measurement. Such application of the indicator may differ from the original purpose of the indicators which fosters national or regional level application, and then we cannot understand whole pictures of either Kyoto or Japan from the assessment. For national level application in Japan, currently only the measurement of the indicators in environmental pillar has completed, and the indicator in social and economic pillar have not yet assessed.

- Environmental pillar (max. 1 page):

In environmental pillar, we measured indicator 1(lifecycle GHG emission) 4 (emission of on-GHG air pollutants) and 5 (water use and efficiency). For the indicator 1, we referred to a previous study which applied lifecycle assessment to BDF production in Kyoto and estimated the amount of GHG emission (Terakawa and Tohno, 2008). As a result, we found BDF could achieve significant GHG reduction compared to fossil fuel. In terms of the indicator 5, we compared the amount of water consumed in the plant with total annual water withdrawal in Kyoto municipality. However, the amount of water consumed in one single plant has very tiny share in total water withdrawal. In addition, in Japan, as water balance is not so tight, the relevance of the indicator related to water use might not be so high although it can be estimated from the view point of data availability.

- Social pillar (max. 1 page):

Indicators measured in social pillar are indicator 11 (change in income), 12 (jobs in the bioenergy sector) and 16 (incidence of occupational injury, illness and fatalities). In terms of indicator 11 and 12, there are 6 employees in the plant, of which four are working exclusively. Their total wage paid amounts to 9.3 million yen in 2010. For indicator 12, as this indicator is designated to indicate by person per GJ of bioenergy, the figures

became so small that they don't make sense. Regarding indicator 16, there have been no injuries or fatal accidents in the plant so far, so the result is null. This indicator also does not make sense in Kyoto case. Over all, we believe the indicators in the social pillar are not so relevant in our case.

- Economic pillar (max. 1 page):

  In economic pillar, all 8 indicators are measured. For indicator 18 (net energy balance), there are 4 sub-indicators. In the Kyoto case, as feedstock is waste cooking oil only, there is no energy input to produce feedstock, so sub-indicator 18.1 for energy balance in feedstock production does not make sense in our case. In addition, our data source for LCA: Terakawa and Tohno (2008) does not calculate GHG emission from transportation of BDF, we could not calculate net energy balance of bioenergy use. As a result, we only measured 18.2 (net energy balance of processing of feedstock into energy), which amount to 4.2. In terms of indicator 19 (gross value added), produced B20 is sold to transportation sector in the city government with 85 yen per litre in 2010. On the other hand, processing cost accounts to 134 yen per litre including gasoline purchasing cost which is blended to BDF. However, if waste oil is brought to a waste treatment plant, it costs 50 yen per litre of waste oil (53 yen per litre of BDF), and if waste cooking oil is used for BDF, this treatment cost would be reduced, according to the waste treatment plant. Therefore, we regard this cost reduction as income, and gross value added accented to 4.4 yen per litre of BDF.

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):

  In our pilot application of the indicators, only one single plant is used for the measurement. Actually, in Kyoto, there are two BDF plants; one is city-owned, and the other is privately owned. The GBEP indicators are aimed to apply at national/regional level. Japan has high diversity of biomass, and there are many types of feedstocks, technologies, and energy types. An aggregation to regional (Kyoto city) or much higher level is not an easy task. If the indicators are applied to national or regional level, we have to consider how to aggregate micro level evaluation to national/regional level.

  This also relates to the second challenge: data availability. Fortunately, thanks to kind cooperation of Kyoto city government, we could obtain much data to measure the indicators. However, a private company might not be able to provide us information and data needed to measure the indicators such as sales, production cost, wages etc. Unless the data need for measurement can be obtained, the indicators are not applicable to various cases.

  In addition, some of the data are highly technical, for instance, LCA data on GHG emission, and air pollutants. The GBEP indicator is designated for policy use, but some technical knowledge is needed for measurement, and these requirements might prevent policymakers from using the indicator. Therefore, it is necessary to organize statistics for biomass and bioenergy, especially data for LCA for GHG and other pollutants which require high technical knowledge for understanding. At the same time, we need a tool to systematically organize data required for estimation of the indicators. The system of environmental and economic accounting (SEEA) is one of the helpful tools to do this. The SEEA is originally developed by the United

Nations Statistical Division, and it is aimed to organize various environmental and economic data on a common framework.

The issues to be discussed are following two: first, how the indicators should be used for policy making. Although the indicators can be measured, we could not understand, after all, how the whole situation of sustainability of bioenergy in Kyoto (or Japan) is. To answer this question, we need a comprehensive indicator to aggregate all 24 indicators, and it is already made by some researchers (e.g. Hayashi et al., 2014). How to reflect country-specific situation on the measurement is the second issue. Country-specific or region-specific condition should be taken into account, but how to do this is not discussed fully yet. Particularly in Japan, imported bioenergy dominates certain share in domestic supply, so it is necessary to assess sustainability of imported bioenergy. On the other hand, too much emphasis on reflecting country-specific condition might result in a lack of comparability to other countries or regions. Therefore, one has to balance the comparability and the reflection of country specific condition.

- Environmental pillar (max. 1 page):

Data for indicators in environmental pillar has already accumulated and data availability was not a big problem in Kyoto's case. Additionally, most of data for the environment is based on academic and scientific basis, but on the other hand, these data is relatively difficult for people who have no expertise on environmental fields to understand. As the case is waste-based bioenergy, there are many indicators which has no relevance such as indicators 2 (soil quality), 3 (harvest level of wood resources) and 8 (land use and land use change related to bioenergy feedstock production). From the viewpoint of relevance, not all indicators can be measured even if data availability is not so tight.

- Social pillar (max. 1 page):

Most of the indicators in social pillar are not so relevant for Japan's case, as the indicators are mainly designated for developing countries. In addition, data availability for social indicators is not so high, and as all data on job in the bioenergy sector, change in income, and injury are obtained by an interview survey for a plant manager, these data are plant-specific and might not be based on solid scientific background.

- Economic pillar (max. 1 page):

Most of the indicators in economic pillars are relevant to the Kyoto case, such as indicators 17 (productivity), 18 (net energy balance) and 19 (gross value added). In our study, data availability is not so serious because Kyoto city government kindly cooperated to collect data. However, indicators related to energy security such as indicators 23 (infrastructure and logistics for distribution of bioenergy), 24 (capacity and flexibility of use of bioenergy) is not so relevant to the case, because distribution channel is completely fixed for use for either garbage collecting trucks or municipal buses.

- References:

Terakawa, T., and Tohno, S., (2008) "Lifecycle Assessment for Utilization System of BDF from Waste Food Oil in Kyoto City" Journal of Japan Society of Energy and Resources 29(6), pp.1-7, (Japanese with English abstract).

Hayashi, T., (2014) "A holistic sustainability assessment tool for bioenergy using the Global Bioenergy Partnership (GBEP) sustainability indicators" Biomass and Bioenergy 66, pp.70-80.