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:** EGYPT

- **Scale at which the GBEP indicators were measured:**
  local *(Dakahlia Governorate- Sidi Ben Salam village),* ***or project*** *(The Rice straw Gasification Unites in Dakahlia Governorate).*

- **Year(s) during which the GBEP indicators were measured:** 2012- 2013

- **Organization(s) commissioning/overseeing the measurement of the GBEP indicators:** The Egyptian Environmental Affaires Agency (EEAA)- Ministry of State for Environmental Affairs and Desert Research Center (DRC) – Ministry of Agriculture and Land Reclamation.
- **Organization(s) carrying out the measurement of the GBEP indicators:**
  DRC & EEAA

- **Source(s) of funding:** Governmental.

- **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:** Rice straw and maize stalks as feedstoks , the pyrolysis technology, Thermal Gas as fuel for cooking stoves at homes – The end users are local Citizens and farmers.

- **Bioenergy feedstocks assessed through the GBEP indicators:** Agricultural Wastes mainly rice straw and corn stalks.

- **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):** Thermal Gas, (heating and cooking) – the end- use sectors (residential).

- **GBEP indicators measured (disaggregated by bioenergy feedstock, fuel, end-use and end-use sector considered, as necessary):** The three main pillars of GBEP **Environmental** (Lifecycle GHG emissions, Soil Quality, Emissions of non-GHG air pollutants) – **Social** (Change in income, Jobs in the bioenergy sector, Change in mortality and burden of disease attributable to indoor smoke.) – **Economical** (Change in consumption of fossil fuels and traditional use of bioenergy, Training and re-qualification of the work force)

- **Approach/methodology used for attribution of impacts to bioenergy:**
  The following steps were followed:
  1. The preliminary data of the project was used to have an overview of the early stage.

2. Review of literatures related to the project was collected.
3. Data was classified according to the GBEP three pillars.
4. In each pillar certain indicators were chosen according to its:
   a. Data availability.
   b. Relevance to both pilot study and the country.
5. Data gaps were overcame through focus groups.
6. Metadata were converted to Numeric data using a specific scale per each indicator.
7. The proper statistical analysis was used to define the importance of each indicator. (not relative, less relative, relative, very relative)

- **Year when the next measurement of the GBEP indicators is planned:**
  It depends upon the availability of the needed financial resources, so not sure yet.

KEY RESULTS

- **Overview:**
  Egypt has one million Km^2 total land area, where 97 % of the total area is considered as a hyper arid desert that are totally exposed to drought and desertification disasters. Only 4% of the total area is occupied by 90 million people, representing more than 1.16% of the world total population.

  The related socioeconomic indicators of 2014 indicated that; rural population represented 57% of total population, GDP was 286,538,047,765.90 US$, GDP per Capita was 3,198.70 US$, Access to Electricity (% of population) was 100 %, Energy Imports Net (% of energy use) was-4.90 and Fossil Fuel Energy Consumption (% of total) 96.37.

  Egypt is a resource rich country. According to the US Energy Information Administration (EIA), it is the largest non-OPEC oil producer in Africa and the second largest dry natural gas producer on the continent. However, energy production in Egypt has been steadily declining since 2009 and in 2012 reached 82,046 ktoe (kilotonne of oil equivalent). This is due to shortages in natural gas supply and oil production being unable to keep up with the energy demand. The shortages have led to frequent electricity blackouts in the country as well as decreasing exports. Factoring in exports and bunkers, Egypt's primary energy supply was 78,214 ktoe in 2012. Final energy consumption in Egypt in 2012 added up to 55,879 ktoe. Egypt is a net exporter of crude oil and natural gas. In addition, it has a strategic position in oil transfer because of its operation of the Suez Canal and Sumed (Suez-Mediterranean) Pipeline, two major routes for the transfer of Persian Gulf oil. However, the combination of increasing consumption and declining production has led to a decline in natural gas exports since 2009. In order to satisfy domestic demand, the government has been diverting natural gas supplies from exports. In terms of coal and peat, Egypt is a net importer. Coal imports are expected to increase in the short- and medium term, since the Egyptian government has approved the industrial use of coal in April 2014 and in the same year signed a construction deal for the first coal-fired power in the country. In 2013, the Egyptian government spent 120 billion Egyptian pounds (about 13.8 billion EUR) on fuel subsidies, which equals 7% of the GDP. These costs in combination with economic stagnation have contributed to the increasing deficit, which reached about 12% of GDP in 2013. In order to alleviate this burden, the Egyptian government announced spending cuts on energy subsidies in June 2014.

  Regarding renewable energy, in 2012 electricity production from renewable energy sources reached 14,855 GWh, which is a share of 9.04% of the total electricity production. While 13,358 GWh (8.13%) were produced by hydropower installations, wind power contributed another 1,260 GWh (0.77%) and solar PV 237 GWh (0.14%). The current installed wind capacity accounts for 550 MW (2012[7]). Egypt is endowed with abundant wind energy resources. Particularly in the coastal regions, high and stable wind speeds are frequent (up to an average of 10.5 m/s in the Gulf of Suez). Furthermore, the country's large deserts and abundant thinly populated areas are well suited for the construction of large wind farms. Solar energy use is still in its infancy, with only 15 MW of solar PV installed capacity so far. Additionally, there is one solar thermal project, an integrated solar combined-cycle power plant. Here, the solar power partially replaces fossil fuel. The plant has an overall capacity of 140 MW, of which the solar input is 20 MW. More PV projects are in the pipeline, one in Hurghada (20 MW, expected start of operation 2016), and one in Kom Ombo (20 MW, expected start of operation 2016). The total installed capacity from hydropower accounted for 2,800 MW in 2012, most of it being produced by large dam projects on the Nile: the High Dam, Aswan I and Aswan II. As the country has very limited water resources never exceed than 58.3 million cubic meter annually. The water crisis leaves no chance for any additional hydropower electricity generation by any means possible.

The country has experienced the black clouds as an evidence for CO_2 emissions since 1999 and up till now. These black clouds caused serious health risks in the main cities of Nile Delta & valley as well as Cairo. It caused by burning the agricultural wastes particularly rice straw in the open air, mainly during the period from October to the end of November. Despite of the WHO had warned that; to achieve the level of 200 mg. NO_2 concentration in the air is a major health risk, yet records had reached 350 mg in Cairo, 482 mg in Giza and 700 mg in Qaha. Consequently, Cairo is considered as one of the highest pollutant cities, where the pollution indicators are getting high ten times more than the WHO indicators.

The target project of applying GBEP indicators helps in controlling the black clouds problem, release some economic pressure in the local fuel market by producing the thermal gas from rice straw to decrease the dependency on LPG, and improve the health and life conditions for farmers and elevate poverty.

- **Environmental pillar:**
  Beside what discussed before, burning rice straw in the open air was found to be the main source of black clouds, both GHG and non-GHG emissions in Egypt. Cairo seemed to be affected by the nearby rice agriculture governorates such as Dakahlia and El-sharkia. The air quality was deteriorated rapidly in the core area to affect the life quality and put another economic stress on the local farmers who are already burdened with multiple life stress. The negative environmental impacts exceeded its local influences in the core area to have very strong and deep effects on very important sectors like tourism activities in the main cities such as Cairo and Mansoura. During testing GBEP indicators we found that farmers gain a lot of benefits by giving up the open air burning of rice straw. These benefits included the switch from dependency on the LPG to the produced thermal GAS, improving the agricultural soil properties by restoring the organic carbon into the soil when they used the first byproduct of rice straw biochar as a soil amendment; it also helped in decrease the chemical fertilization consumption, hence decrease the expected pollution in soil and water as well. These of course have positive effects on the farmer's health and life conditions. Farmers also were able to use the second byproduct of biodegradable aqueous bitumen which was used to insulate roofs and floors of farmer's houses instead of using non-degradable and environmentally hazard chemical products for the same purpose. It was clear from the first moment of applying and testing the sensitivity of environmental pillar of

GBEP indicators on the project area, that there are only three very relevant indicators i.e **1) Lifecycle GHG emissions** as % of CO2 reduction after starting the project which showed that the reduction percentage was 30% at least. **2) Soil quality**; which was measured as percent of organic carbon restored in the soil resulted from using the biochar that produced as byproduct from the technology as soil amendment by farmers.**3) Emissions of non-GHG air pollutants,** including air toxics, which evaluated as degree of the air purity and visibility, farmers were very sensitive for this indicator particularly , they were able to feel the improvement that happened in the air purity and visibility even the smell of the air itself that was purified from the smoke smell resulted from burning rice straw in the open air.

- **Social pillar** :
  Regarding the social pillar, we found that only three indicators were found to be relevant to this case study (11, 12 & 15), while the rest of indictors seemed to be less relative, or data was not available. **11) Change in income:** were found to be relative as measured as percent of family income directed to energy consumption, we found that in most of the studied cases it minimized to reach zero. This because most of the surveyed families had switched their dependency on LPG to be on the produced thermal gas hence, it put another added value to the income when thrift the part of income-oriented for energy consumption. **12) Jobs in the bioenergy sector:** was also found to be relative. It was evaluated as percent of workers in the field of bioenergy in relation to labor force in the same age, when discuss with the labor force in the field of bioenergy they told that they like to work in this field compared to the agricultural field because permanent. **15) Change in mortality and burden of disease attributable to indoor smoke:** was found to be relative as well as evaluated as percent of change in cases per year, this indicator was estimated in cooperation with Ministry of Health that provided data to figure out number of cases before and after the project.

- **Economic pillar:**
  Only two indicators were found to be relevant to this case study (20 & 21), while the rest of economic pillar indictors were found to be less relative, or data is not available: **20) Change in consumption of fossil fuels and traditional use of bioenergy:** was found to be relative; families decreased their consumption form LPG significantly and switched into the produced thermal gas, so the local LPG consumption was decreased by 50% at least. **21) Training and re-qualification of the work force**: was found to be relative when evaluated as percent of workers in the field of bioenergy in relation to labor force in the same age (number of workers that took part in the survey). Results obtained indicated that compared to the labor force in the agricultural field, those who are lucky to work in the field of bioenergy had better access to training courses and requalification programs more than those who are belonged to the agricultural sector.

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

- **Overview / cross-cutting, e.g. stakeholder engagement:**
  At the beginning we had four main goals from applying GBEP indictors that are; testing the indicators sensitivity to evaluate the impacts of this technology on environmental, social and economic levels, testing the indicators implementation capability depending on the data reliability, testing the data gaps, and its impacts on the indicators results and evaluating the public awareness of the project and its importance. It was clear that applying the GBEP indicators was very interesting, yet it still needs more understanding and defining some other related indicators that are not

involved as illiteracy rate. It was also clear that people who are involved in the project are so happy of the results achieved, and they moved from attention to adoption level. It is a very clear symbol of dissemination the project idea in the community is the huge number of the new families that want to be involved in the second stage of the project. In addition, applying GBEP indicators gave us a golden chance to study and understand the negative aspects of the project, same time we were able to highlight the positive impacts of it. Despite that GBEP indicators were easy to apply yet in order to practically use it we had to design questionnaire form to cover all of the studied indicators, and of course this wasn't easy and took a long way to be accepted. Some collected data by nature was metadata so we had to convert it into numerical data with a specific scale and this was another challenge. Concerning applying GBEP indicators approach, there were certain steps were followed as previously described, some collected data has an overlap relation with other indicators that wasn't involved , but we had to use it to ensure the trust degree of the accuracy of the observations of GBEP indicators , such as the indicator number twenty " Change in consumption of fossil fuels and traditional use of bioenergy" we had to go to the ministry of petroleum in order to ensure the figure of LPG consumption in the village before and after the project then compare it with the data observed from GBEP indicator number 20. Another important issue is the importance of translating GBEP indicators into the other UN official languages particularly Arabic, this will help much in applying GBEP indicators more easily particularly in the Arab region because we had to translate it into Arabic to work in the field then re-translate the results into English to write the final results. It is important that we should declare that GBEP indicators was a real important step forward toward the sustainable use of bioenergy , and it will help much parties in putting the national priorities in the field of bioenergy in a perfect scientific , environmental and economic manner.