# GHG BALANCE TOOL

Determining the net GHG emissions from
PPO, Biomass Gasification and Anaerobic Digestion projects.

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# BACKGROUND

- FACT Foundation commissioned the development of a simple tool to assess the GHG balance of bioenergy projects, where possible based on existing CDM methodologies and parameters

- The tool discounts leakages in the carbon chain due to land use conversion, fertilizer use, mechanized planting / harvesting, transportation of feed stocks, feedstock processing and autoconsumption of the conversion equipment

- Three types of biomass to energy projects are included:
  - Jatropha PPO to electricity, including sequestration by growing jatropha
  - Biomass Gasification (rice husk, corn cob, woodchips), including sequestration by short rotation coppice (Leucaena)
  - Anaerobic Digestion of biomass (dung, weeds, and grasses) for electricity production, including avoided methane emissions from used animal dung

- The baseline is diesel powered electricity generation

# GENERAL SETUP OF THE TOOL

- The tool contains 7 sheets
- The first three sheets are labeled 'Biodigester Tool', 'PPO Tool', and 'Gasification Tool'; in these sheets the specific input variables per project can be inserted
- Parameters and constants are listed in the 'Inputs' Sheet. Default values are inserted for all parameters and constants, but user should review these values for their applicability
- The reductions and leakages are calculated in three 'Calculation' Sheets. These sheets are hidden
- Explanations of variables and parameters are shown when hovering the mouse pointer over the concerned cell

# GENERAL SETUP OF THE TOOL (CONT'D)

- The tool uses a simple formula:

  *Reduction of GHG - Leakage of GHG = GHG Balance*

- One of the main calculations used in the tool is based on the 'Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site' (Version 04)

- This tool is an approved Methodological Tool by the Clean Development Mechanism Executive Board and can be either used to calculate a reduction when the waste material is used, or as a leakage when the waste material is dumped

- In order to understand the calculations in the tool, and the correct parameters and variables, user is advised to read this tool

- All References to Parameters and Constants used in the calculations can be seen in the 'Inputs' Sheet

# BIODIGESTER TOOL

- Guiding documents that were used are:
  - 'GEEA Biomass 5 MW Power Plant Project' PDD
  - 'Jatropha curcas Cultivation in the Democratic Republic of Congo' PDD
- Before using the tool the following needs to be known:
  - Type of feedstock (i.e applicability to the 'Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site')
  - Average distance between the source of the feedstock to the project site and number of feedstock transports per year
  - Feedstock preprocessing
  - Methane leakage from biodigester
  - The gross generator output in MWh per year, and diesel usage in case of dual fuel engine sets

# BIODIGESTER TOOL (CONT'D)

- For the feedstock cow dung: renewable energy generation replacing diesel as the baseline is counted towards the GHG reduction plus the avoided methane reduction from using the cow dung

- For the feedstocks grass and weeds:

  - Only renewable energy generation replacing diesel as the baseline is counted towards the GHG reduction

  - Sequestration of $CO_2$ is not calculated due to the fact that these values are unknown. According to the Methodological Tool under CDM "Estimation of changes in the carbon stocks of existing trees and shrubs within the boundary of an A/R CDM project activity" (version 01), $CO_2$ sequestration can only be calculated if the biomass in question is considered a tree or a shrub.

# BIODIGESTER TOOL (CONT'D)

- Byproducts
  - Digestate can be dumped in ponds, if this occurs there will be leakage and the variables relating the digestate need to be inserted (OX, MCF, DOCj, kj). Please note that DOCj relates to the feedstock used in the biodigester.
  - Digestate can also be used as a fertilizer, if this occurs there will be a positive contribution to the GHG balance. Please fill in which types and amounts of chemical fertilizer are replaced.

# PPO TOOL

- Guiding documents that were used are:
    - 'GEEA Biomass 5 MW Power Plant Project' PDD
    - 'Jatropha curcas Cultivation in the Democratic Republic of Congo' PDD
- Before using the tool the following needs to be known:
    - Type and area of land cleared
    - Type and area of Jatropha plantation (traditional or hedge)
    - Average distance travelled from the source of the feedstock to the project site and from the project site to the end user, and number of trips per year
    - Type and amount of fertilizer used per year
    - Type of equipment used for oil production
    - The gross generator output in MWh per year

# PPO TOOL (CONT'D)

- Fertilizer use: the emissions from production and usage are accounted for in leakage

- For mechanized planting only in the first year, average the hectares which make use of mechanized planting for the project lifetime

- For land clearing, please indicate the total area of land cleared under the project

# PPO TOOL (CONT'D)

- Byproducts
  - Husk can be used in a Gasifer to produce energy. If this occurs please use the 'Gasification Tool' to calculate the GHG balance. Husk can also be dumped, if this is the case please insert the amount of tons of husk being dumped at Wjhusk and fill in the variables (OX, MCF, DOCj, kj). Please note that DOCj relates to the biomass at hand, which is Jatropha
  - Seedcake can be used in a Biodigester to produce energy. If this occurs please use the 'Biodigester Tool' to calculate the GHG balance. If used as fertilizer, please fill in the type and amount of fertlizer being replaced.
  - Seedcake can be used for the production of char, replacing traditional charcoal as household fuel. In this case, please enter the amount of char produced
  - Seedcake can also be dumped, if this is the case please insert the amount of tons of seedcake being dumped at Wjcake and fill in the variables (OX, MCF, DOCj, kj). Please note that DOCj relates to the biomass at hand, which is Jatropha

# GASIFICATION TOOL

- 'GEEA Biomass 5 MW Power Plant Project' PDD was used as a guiding document

- Before using the tool the following needs to be known:

  - Type of feedstock (i.e. applicability to the 'Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site')

  - Average distance between the source of the feedstock to the project site and the number of trips per year

  - Feedstock preprocessing (sizing)

  - The gross generator output in MWh per year, and diesel usage in case of dual fuel engine sets

# GASIFICATION TOOL (CONT'D)

- Leucaena (short rotation coppice):
  - Use the bottom section of the tool
  - The calculation follows the same steps as the PPO tool
  - No avoided methane is calculated when using Leucaena as a feedstock
  - For mechanized planting only in the first year, average the hectares which make use of mechanized planting for the project lifetime

# GASIFICATION TOOL (CONT'D)

- Byproducts
  - Char can replace normal household use of charcoal, this is a positive contribution to the GHG balance. Please fill in the amount being replaced per year.
  - Terra preta: this is produced by mixing the char with soil. This option sequestrates 3.66 tC02e per t of char used. Please fill in the amount of char used for terra preta production per year.
  - Tar Water: produced in small quantities and is not taken into GHG balance consideration

# CONTACT

- For any further information regarding the tool, please contact:
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- Your feedback is much appreciated!