The Global Bioenergy Partnership Common Methodological Framework for GHG Lifecycle Analysis of Bioenergy

Version One

1 October 2010

The following 10-step greenhouse gas (GHG) inventory framework is intended to guide policy makers and institutions when calculating GHG emissions from bioenergy and to enable life cycle assessments (LCA) of the GHG emissions of bioenergy to be compared on an equal basis. Not all 10 steps will apply to all biofuel or bioenergy systems, so in some applications it will be necessary to skip one or more steps of the Framework. At all stages, the user is invited to provide units of measurement and description of methodologies to add specificity to the report.

Information on LCA analysis performed using the methodology described

1. Note the number of bioenergy production pathways to which this methodology has been applied:

_____ One (1): LCA analysis has been performed for one specific biofuel, bio-electricity and/or bio-heat production pathway;

_____ A finite number (for instance, calculations for biodiesel from rapeseed, for bio-ethanol from corn, for ...). Please give the approximate number of production pathways for which the methodology has been applied:.....

.....

2. Are the results of the LCA analysis public? (Y or N) _____

If yes, please provide details (name of report, link to website, link to on-line report): .....

.....

Step 1: GHGs Covered

The user is asked to provide Global Warming Potential values and/or a clear reference for the GHGs included in the analysis. IPCC SAR values are assumed unless otherwise indicated. This is necessary to ensure consistency between reports and the repeatability of reported calculations.

CO_2 ___

CH_4 ___

N_2O ___

HFCs ___(List which HFCs)

PFCs ___(List which PFCs)

SF_6 ___

Other:……

Please report global warming potential used for each GHG covered, if different from IPCC SAR values:……

……..

Step 2: Source of biomass

The Framework distinguishes between waste and non-waste bioenergy. Use of "waste biomass" can cause emissions due to the loss of carbon stocks . The user is asked to specify the definition of "waste" biomass to ensure transparency at this critical point in the LCA.

Please provide list of feedstocks, differentiating between waste and non-waste below. If the methodology is pathway specific to a geographic origin of the feedstock, user may use space below to further describe these characteristics.
Select all that apply:

Non-waste __

Identify Biomass Feedstock: ……...

Residue __

Waste __

Identify Sources: ……..

* Please explain definition of waste:

Substance that the holder intended to discard ___

Substance that had zero or negative economic value ___

Substance for which the use was uncertain ___

Substance that was not deliberately produced and not ready for use without further processing ___

Substance that could have adversely affected the environment ___

Other:……

……

Step 3: Land use change

GBEP was asked to develop a checklist for Parties to indicate what sources of GHG emissions related to land-use change (Step 3) and the production agricultural and forests based biofuel feedstocks (Step 4) they include in their approach to lifecycle analysis.

In developing the content of Steps 3 and 4, GBEP followed two guiding principles. The first was to avoid even the appearance of promoting or endorsing one methodology or approach over another. It was recognized that differences regarding the approach to LCA analysis or the choice of LCA methodologies could arise due to differences in national circumstances or legitimate differences of opinion regarding what should be included in lifecycle analysis. The second principle was to promote transparency. Suggestions that made it possible for Parties to be clearer about what is included in their LCA GHG emissions estimate for biofuels or allowed additional parties to use the framework were generally incorporated.

The reporting framework presented below is intended to be flexible in order to clarify which of these multiple approaches is taken by the methodology being described.

___Direct land use changes are included explicitly in the assessment

___Indirect land use changes are included explicitly in the assessment

___Direct and indirect land use changes are assessed in combination

3a: Direct Land use Change

GBEP recognized that including land use changes as sources in frameworks to assess the full lifecycle GHG emissions associated with bioenergy products is very complicated. Any given approach must make choices regarding a number of technical considerations including (but not limited to) the type of baseline, the set of boundaries, and the timeframe over which emissions are allocated. For each of these considerations (and others) there are technically defendable alternatives available that can significantly affect the magnitude of the estimated GHG emissions associated with land use change.

This component enables the user to describe the methodological approach to several components that any method for estimating GHG emissions related to direct land use change may address. It then asks the user to provide related the information they feel are necessary to adequately clarify their approach and resulting estimates of emissions related to land use change.

Direct land use changes, when they occurred, are accounted for (Y or N)__

If yes:

1. Identify the reference period or scenario:

___ Historic (identify year or period):……

___ Business-as-Usual (BAU) scenario (identify time frame):……

___ Other (explain):……

2. Describe how the methodology attributes this type of land use change to biofuels: ……

……..

3. Explain key reference assumptions and characteristics relevant to estimating GHG emissions and sinks/removals from direct land use change. Examples include (but are not limited to) identifying or describing:

- System boundaries (such as sector, activity, carbon pool – i.e. above ground biomass, below ground biomass, litter, dead wood, soil carbon - and geographic coverage):…….

  …….
- For BAU scenarios, assumed trends in key variables and land uses:……

  …….
- Omitted emissions sources:…….
- Time period over which direct land use change emissions are allocated:……...

  …….
- Where possible, data sources and methods used to estimate emissions and removals (such as definition of land cover classes, source of default estimates of above and below ground carbon stocks and sequestration rates, foregone sequestration and other timed emissions or sequestration processes; source of inventory data, allometric equations, yield tables, growth models):……

  …….

4. Briefly describe the type of direct land-use changes accounted for. Examples include (but are not limited to) identifying or describing:

- Areas of land that change land use by type (such as forest, grassland, peat lands, pasture, to feedstock production):……

  ……
- Carbon stocks, before shift to bioenergy feedstock production, on lands that change land use by type (such as forests, grassland, peat lands, pasture, to feedstock production):……

  ……

5. The following impacts of direct land use change are accounted for:

   Accounted for net changes of carbon stocks in:[1]

[1] Depending on choice of methodology and temporal system boundary, the net changes in carbon stock in these carbon pools from land use conversion may be positive (increased carbon stock) or negative (decreased carbon stock). In responding to this question, please indicate the reason for including or

___ living above ground biomass;

___ living below ground biomass;

, ___ dead organic matter,

___ soils

6. The methodology and data used are publicly available:

   Methodology (Y or N) ___

   Data (Y or N) ___

7. Explain the methodological approach to timing of emissions allocation associated with direct land use change:……

   …….

3b: Indirect Land use Change

GBEP recognized that including land use changes as sources in frameworks to assess the full lifecycle GHG emissions associated with bioenergy products is complicated. For each of these considerations (and others) there are technically defendable alternatives available that can significantly affect the magnitude of the estimated GHG emissions associated with land use change. This component enables the user to describe the methodological approach to several components that any method for estimating GHG emissions related to indirect land use change may address. It then asks the user to provide the information they feel are necessary to adequately clarify their approach and results estimates of emissions related to indirect land use change.

Indirect land use changes, when they occurred, are accounted for: (Y or N)

___

---

disregarding changes in any of the carbon pools.

___ Domestic indirect land use change is taken into account **OR**

___ International indirect land use change is taken into account **OR**

___ Both are taken into account separately **OR**

___ Both are taken into account without making the distinction

Explain the choice:……

……..

Domestic indirect land use changes are accounted for (Y or N)___

If yes:

1. Identify the reference period or scenario:

   ___ Historic (identify year or period):……

   ___ Business-as-Usual scenario (BAU) (identify time frame):……..

   ___ Other (explain):……

2. Describe how the methodology attributes this type of land use change to bioenergy feedstock production:…….....

……..

3. Explain key reference assumptions and characteristics relevant to estimating GHG emissions from domestic indirect land use change. Examples include (but are not limited to) identifying or describing:

   - Baseline year
   - Change in biofuel volume
   - System boundaries (such as sector, activity, and geographic coverage):……

     ……

   - For BAU scenarios, assumed trend in key variables and land uses:…….

     …….

- Methods and assumptions used to assign indirect land use changes to bioenergy (Such as, whether emissions allocated to products using a marginal, average, or other approach):……

  …….
- Time period over which land use change emissions are allocated:……
- Land categories considered in the model, their definition, and associated estimates of above and below-ground carbon:……

  …….
- Data set that provides baseline land cover or land use for the model; categories of land cover that are assumed to be available for human use:……

  …….

4. Briefly describe the type of domestic indirect land-use changes accounted for. Examples include (but are not limited to) identifying or describing:

- Areas of land that change land use by type (such as forest, grassland, peat lands, pasture, to commodity production):…….

  …….
- Carbon stocks, before shift to bioenergy feedstock production, on lands that change land use by type (such as forests, grassland, peat lands, pasture, to commodity production):…….

  ……

5. The following impacts of indirect domestic land use change are accounted for:

   Accounted for net changes of carbon stocks in[2]:

   ___ living above ground biomass;

   ___ living below ground biomass;

   ,

   ___ dead organic matter,

[2] Depending on choice of methodology and temporal system boundary, the net changes in carbon stock in these carbon pools from land use conversion may be positive (increased carbon stock) or negative (decreased carbon stock). In responding to this question, please indicate the reason for including or disregarding changes in any of the carbon pools.

___ soils

6. The methodology and data used are publicly available:

   Methodology (Y or N) ___

   Data (Y or N) ___

6. Explain the methodological approach to timing of emissions allocation associated with domestic indirect land use change:…….

   ……..

International indirect land-use changes are accounted for (Y or N) ___.

If yes:

1. Identify the reference period or scenario:

   ___ Historic (identify year or period):……

   ___ Business-as-Usual (BAU) scenario (identify time frame):……

   ___ Other (explain):…….

2. Describe how the methodology attributes this type of land use change to bioenergy:……

……....

3. Explain key reference assumptions and characteristics relevant to estimating GHG emissions from international indirect land use change. Examples include (but are not limited to) identifying or describing:

- Baseline year
- Change in biofuel volume
- System boundaries (such as sector, activity, and geographic coverage):……

  …….
- For BAU scenarios, assumed trend in key variables and land uses:…….

……

- Methods and assumptions used to assign indirect land use changes to bioenergy (Such as, whether emissions allocated to products using a marginal, average, or other approach):……

  ……

- Time period over which land use change emissions are allocated:……

  ……

- Land categories considered in the model, their definition, and associated estimates of above and below-ground carbon:……..

  ……

- Data set that provides baseline land cover or land use for the model; categories of land cover that are assumed to be available for human use:……..…

  ……

4. Briefly describe the type of international indirect land-use changes accounted for. Examples include (but are not limited to) identifying or describing:

- Areas of land that change land use by type (such as forest, grassland, peat lands, pasture, to commodity production):……

  ……

- Carbon stocks, before shift to bioenergy feedstock production, on lands that change land use by type (such as forests, grassland, peat lands, pasture, to commodity production):……

  ……

5. The following impacts of international indirect land use change are accounted for:

Accounted for net changes of carbon stocks in[3]:

__ living above ground biomass;

[3] Depending on choice of methodology and temporal system boundary, the net changes in carbon stock in these carbon pools from land use conversion may be positive (increased carbon stock) or negative (decreased carbon stock). In responding to this question, please indicate the reason for including or disregarding changes in any of the carbon pools.

__ living below ground biomass;

___ dead organic matter,

___ soils

6. The methodology and data used are publicly available:

   Methodology (Y or N) ___

   Data (Y or N) ___

7. Explain the methodological approach to timing of emissions allocation associated with international indirect land use change:.....

Step 4: Biomass feedstock production

Step 4 consists of two parts – 1) a checklist reflecting direct sources of emissions related to feedstock production, and, 2) a checklist of embodied sources of emissions (i.e., emissions that occur in the production of inputs used in feedstock production.

GHG Sources and Sinks due to land use and management:

1. Sources of direct GHG emissions and removals are accounted for (check all that apply):

___ Emissions from operating farm/forestry machinery

___ Emissions from energy used in irrigation

___ Emissions from energy used to prepare feedstocks (drying grains, densification of biomass, etc.)

___ Emissions from energy used in transport of feedstocks

___ CO_2 emissions from lime/dolomite applications

___ N_2O emissions resulting from the application of nitrogen fertilizers:

__direct; __volatilization; __runoff/leaching

___ N2O emissions resulting from the application of manure to soils:

__ direct; __volatilization; __runoff/leaching;

___ N2O emissions resulting from the application of other fertilizers (e.g. compost) to soils:

__direct; __volatilization; __runoff/leaching;

___ CH_4 emissions;

___ Net changes in soil organic carbon (due to management practices, not land use conversion (step 3a.5 and 3b.5, for both domestic and international)[4]

[4] Depending on choice of methodology and temporal system boundary, the net changes in carbon pool due to management practices may be positive (increased carbon stock) or negative (decreased carbon stock). In responding to this question, please indicate the reason for including or disregarding changes in this carbon pool.

___ Other (please specify):…….

2. For all checked, clarify assumptions and emissions reference values used:……

……..…

……..

3. The methodology and data used are publicly available:

   Methodology (Y or N) ___

   Data (Y or N) ___

Emissions sources included:

1. Sources of GHG emissions accounted for (check all that apply):

   ___ manufacture of farm/forestry machinery;

   ___ construction of buildings;

   ___ manufacture of fertilizer inputs;

   ___ manufacture of pesticide inputs;

   ___ purchased energy:

   ___ electricity; ___ transport fuels; ___ other (e.g., fuel for heat)

   ___ production of seeds;

   ___ Other (please specify):……

2. For all checked, clarify assumptions:……

……..

3. The methodology and data used are publicly available:

   Methodology (Y or N) ___

   Data (Y or N) ___

Step 5: Transport of biomass

Production chains of bioenergy commonly include a number of transport processes. Following parameters have a decisive effect on the level of transport contribution to the GHG balance of a biofuel: The distance between the location of production and of use, the number of single stages, the type of vehicle and the question whether there are empty returns. The user is asked to give information about these parameters.

There are several transport data models available which facilitates data provision, transparency and standardization. The user shall explain if such a data model is applied.

Biomass is transported from farm/plantation/forest to processing plant: (Y or N) ____

If yes:

1. ___ The biomass transported in a different commodity type.

    1a. ___ If available, provide a description of intermediate processing steps:

    ……..

    1b. ___ Emissions associated with intermediate processing are accounted for (including, e.g., electricity used for processing).

2. ___ There is a multi-stage transport chain (e.g. truck to ship to truck or train).

    2a. List all stages in the transport chain:……

    ……..

    2b. Specify the stages for which emissions are accounted:…….

    ……

3. Transport from production site to use/processing plant is dedicated to this purpose (Y or N) ___

If Yes:

    3a. ___ All transport emissions are included

If No:

3b. ___ If available, provide the portion of transport emissions allocated, and the allocation methodology:……....

……

4. ___ Return run of transport equipment is accounted for.

4a. During the return run, transport equipment is:

___ empty ___ otherwise utilized

5. For relevant sections, clarify assumptions:…….

……..

Step 6: Processing into fuel

The user is asked where biomass is processed into fuel which associated GHG emissions related to this process are taken into account. For those types of emissions where different methods of taking them into account could be envisaged, further specification is asked in order to allow for a complete comparison of LCAs.

The biomass requires processing to produce fuel: (Specify Y or N for each)

1. ___ GHG emissions associated with material inputs used in the conversion process (e.g. chemicals, water) are accounted for: (Y or N) ___

Specify method used to account for emissions:

2. ___ GHG emissions associated with the energy used in the conversion process are accounted for: (Y or N) ___

Specify the method used to account for grid-related emissions (e.g. average/marginal, national/regional, actual/future, emission factors): ……..

…….

3. ___ GHG emissions from wastes and leakages (including waste disposal) are accounted for: (Y or N) ___

4. ___ Other GHG emissions from the process are accounted for: (Y or N) ___

List which ones:……

5. ___ GHG emissions associated with the plant construction are accounted for: (Y or N) ___

Estimates of emissions associated with plant construction have been pro-rated to account for:

___ Other uses of the plant

___ Design life of the plant

___Other parameters; specify which ones:……

6. For relevant sections, clarify assumptions:…….

……..

Step 7: By-products and co-products

The user is asked how co- and/or by-products are considered in the LCA. whether co- and/or by-products are accounted for and the methodology to take them into account. On some of those points, further methods are asked to allow for a full comparison.

By-products or co-products are produced: Specify Y or N for each)

1. ___ By/Co-products from the biomass are accounted for: (Y or N) ___

2. ___ By/Co-products from non-biomass feedstocks are accounted for: (Y or N) ___

3. Explain definition of by/co-products:…….

……..

4. Select type of method used to analyze by-products or co-products, and the by-products or co-products for each:……

   …….

5. An allocation method is used: (Y or N) ___

   ___ Allocation by mass;

   ___ Allocation by energy content;

   Method to determine energy content: ……

   ___ Allocation by economic value;

   Method to determine economic value: ……

   ___ Other allocation method;

   Specify method: ……

   Method to determine parameters needed: …….

6. A substitution method is used: (Y or N)___

   - Identify method used to determine the exact type of use/application of a by/co-
     product:……

     ……

   - Identify method used to determine what product the by/co-product would substitute for and what the associated GHG emissions are for that product:…..……
     ……

6. Another method or combination of methods is used: (Y or N) ___

   - Specify method:……
   - Method to determine parameters needed:…….

7. For relevant sections, clarify assumptions:…….

……..

Step 8: Transport of fuel

This step asks the user to describe how emissions related to transportation of the biofuel from the processing plant to the end use are accounted for.

Fuel is transported from processing plant to use site: (Y or N) ____

If yes (check all that may apply)::

(please consider all emissions, including, for example, methane emissions from biogas equipment)

1. ___ The fuel transported in a different commodity type.

    1a. ___ If available provide a description of intermediate processing steps is available:……

    ……..……

    1b. ___ Emissions associated with intermediate processing are accounted for (including, e.g., electricity used for processing): (Y or N) ___

2. ___ There is a multi-stage transport chain (e.g. truck to ship to truck or train or animal-traction vehicles to truck or train):

    2a. List all stages in the transport chain:…….

    ……

    2b. Specify the stages for which emissions are accounted:…….

    ……

3. Transport from the processing plant to the use site is dedicated to this purpose: (Y or N) ___

    If Yes:

    3a. ___ All transport emissions are accounted for.

    If No:

    3b. ___ Transport emissions are pro-rated. Provide a description of the methodology for pro-rating:…….....

    ……

4. ___ Return run of transport equipment is accounted for.

4a. During the return run, transport equipment is:

___ empty ___ otherwise utilized

5. For relevant sections, clarify assumptions:…….

……..

Step 9: Fuel use

The use of biomass is the core process converting the carbon feedstock into energy. At the beginning the basic type of use has to be explained: biofuel for transportation or biofuel for stationary use (e.g. electricity, heat). In both cases the user shall explain whether efficiency of use is taken into account, and if yes, the approach shall be explained.

For solid biomass and liquid and gaseous fuels used in stationary applications:

1. Identify fuel use:

2. Specific emissions are addressed by the usage. (Y or N) ___

   Identify conversion/combustion technology:

3. Analysis addresses electricity and/or heat (thermal energy)? (Y or N) ___

   3a. Facility is a CHP plant? (Y or N) ___

   3b. Electric efficiency of the use process:……

   3c. Thermal efficiency of the use process:……

   3d. Electricity sent to a general grid: (Y or N) ___

   3e. In case of CHP, indicate method used to account for emissions due to electricity and heat (i.e., allocation, substitution, etc.), as in LCA Step 7:……..

   …….

4. Does the methodology account for significant emissions of any of the following non-CO2 GHGs?

   ___ N_2O (e.g. CFB-type boilers);

   ___ CH_4 (e.g. low level technique or small-scale);

   ___ Other:…….

If any of these non CO_2 GHGs is omitted from the analysis, please explain why:

5. Biomass is mixed/blended with fossil material (e.g. in case of waste sources):(Y or N) ___

If yes, provide analysis on degree of fossil content, if available:……

……

6. The analysis addresses a technology upgrade (e.g. pile burning to modern energy technology):

If yes, provide emissions data on the replaced way of biomass burning, if available:……

…….

7. For relevant sections, clarify assumptions:……

……

For transport fuels:

1. Distance (km and miles) per energy unit are addressed: (Y or N) ___

1a. Distance (km and miles) per energy unit: ……....

1b. Describe how energy efficiency is factored into fuel use analysis:…….

……

2. Tailpipe gas is addressed (Y or N) ___.

If yes, describe methodology:…….

……..

e.g.: CO_2 emissions associated with combustion source and feedstock sink are netted out; CH_4 and N_2O emissions from combustion are included.

3. Describe assumptions (e.g. type of vehicle, engine efficiency, etc):

Step 10: Comparison with replaced fuel

The production processes of fossil fuel and biofuels are intrinsically different. Therefore, some of their stages are not directly comparable. It is important to list every single stage of the production processes and evaluate which of them should be included in the LCA, being comparable to one another or not. One of the main difficulties in setting up a comparison between the fossil fuel LCA and the biofuel LCA is exactly the depth of this analysis, that is, the production stages included and evaluated in both LCAs should present an equivalent level of complexity.

Rationale: The production stages included and rigour of the methodology should be comparable in both LCAs. The user is asked to answer all questions listed in step 10 keeping in mind what was considered in previous steps.

1. An LCA is performed on the replaced fuel(s) / energy production system(s). (Y or N) ___

1a. Please list any sources of inconsistency between LCA of biofuel and LCA of replaced fuels/systems:

1b. Describe the system boundaries:

1c. Indicate how direct and indirect land use change is addressed in the LCA of the replaced fuels/systems:

2. Identify Methodology for LCA of replaced fuel(s) / energy production system(s):

……..

3. This methodology is publicly available: (Y or N) ___

   - If yes, provide references: ……

4. GHGs covered:

   CO_2 ___

   CH_4 ___

   N_2O ___

   HFCs ___

PFCs ___

SF_6 ___

Other:…….

Please report global warming potential used for each GHG covered (if different from IPCC SAR values):……

…….

5. Specify which sources of emissions embodied in fossil fuel infrastructure related to replaced fuel(s)/energy production system(s), are accounted for and clarify assumptions.

___ Emissions embodied in buildings and facilities:……

___ Emissions embodied in transportation fleet and infrastructure:……..

…….....

___ Emissions embodied in the manufacture of machinery:……

…….

___ Other sources of emissions embodied in infrastructure (please specify):……..

…….

I. Biofuel is used to replace transport fossil fuel (for stationary use, skip to section II)

6. Relevant characteristics of crude:

6a. Type of crude:

___ Conventional crude;

___ Oil sands;

___ Heavy oil;

___ Other (please specify):…….

___ Not specified.

6b. Origin of fuel (region, refinery, etc), if specified:……

6c. Other important fuel characteristics, if specified:……

6d. Applicability conditions of the replaced fuel characteristics:

___ The reference fuel is a world average;

___ The reference fuel applicable only to one region (specify region):……

___ Other applicability conditions apply (please specify):…….

7. Emissions prior to extraction/production are accounted for: (Y or N) ___

7a. If yes, specify pre-production sources included (e.g., geophysics, prospecting) and geographic/temporal coverage of analysis:…….

…….

7b. Explain method for applying pre-production emissions to per barrel calculations:……

…….

8. Emissions from extraction/production are accounted for: (Y or N) ___

8a. Direct and embodied emissions in extraction/production accounted for:

___ Fuel combustion from drilling;

___ Fugitive methane emissions from equipment;

___ Fuel combustion from turbines and compressors;

___ Transportation emissions from helicopters and supply vessels;

___ Use of electricity (e.g., gasoil or fuel oil generators);

___ Use of chemical inputs;

___ Other:…….

8b. Natural gas emissions accounted for:

___ Emissions from flaring natural gas;

___ Emissions from combustion equipment (specify gases included);

___ Emissions from reinjection of natural gas;

___ Emissions from direct use of natural gas;

___ Emissions from other processing of natural gas;

___ Emissions from gas processing point to remove liquids;

___ Emissions from extracted liquids;

___ Emissions from electricity production.

8c. Describe method for allocating emissions between crude oil and natural gas production:……

……..

8d. Emissions for other extraction/production by/co-products are accounted for (Y or N) ___

- If yes, describe methodologies for calculating emissions and for allocating emissions between crude and by/co-products:……

  ……..

9. Crude is transported to the refinery (Y or N) ___

   9a. Specify transport distance and mode(s) of transport (pipeline, tanker, etc.):

   ……

   ……..

   9b. For internationally transported crude, specify whether domestic, international, or total transport emissions are accounted for:……

   ……..

   - Describe use of country-specific parameters in calculating transport emissions:……..…

     ……..

   9c. Fugitive emissions during transport are accounted for (Y or N) ___

   9d. Return journeys of transport fleet are accounted for (Y or N) ___

   9e. The production/transport system involves liquefied natural gas (Y or N) ___

   9f. Emissions from the regasification plant are accounted for (Y or N) ___

10. Refinery emissions are accounted for: (Y or N) ___

    10a. Describe assumptions on refinery characteristics (e.g., existing, typical, local average):……

    ……..

    10b. Describe method for calculating direct refinery emissions:……..

    ……..

10c. Emissions embodied in chemicals (catalysts, solvents, etc.) are accounted for: (Y or N) ___

- If yes, describe method:…….

10d. Fugitive emissions accounted for: (Y or N) ___

- If yes, describe method:…….

10e. Emissions for hydrogen production are accounted for: (Y or N) ___

- If yes, specify the production process:……..

  …….

10f. Emissions for purchased and generated electricity are accounted for: (Y or N) ___

- If yes, specify electricity mix of the purchased electricity:……

  ……

10g. Emissions from wastes and leakages are accounted for: (Y or N) ___

- If yes, describe method:……

10h. Emissions for refinery by-products and co-products are accounted for: (Y or N) ___

- If yes, describe methodologies for calculating emissions and for allocating emissions between fuel and by/co-products:……

  ……

11. Fuel is transported or distributed prior to use: (Y or N) ___

    11a. Specify transport distance and mode(s) of transport (truck, tanker, etc.):..

    …….

    11b. For internationally transported fuels, specify whether domestic, international, or total transport emissions are accounted for:…….

    - Describe use of country-specific parameters in calculating transport emissions:……..

    11c. Fugitive emissions during transport are accounted for: (Y or N) ___

    11d. Return journeys of transport fleet are accounted for: (Y or N) ___

12. Fuel use emissions are accounted for: (Y or N) ___

(please consider consistency with Step 9)

If no:

12a: Please explain how equivalency with the biofuel system is defined (e.g. lower heating value):…….

If yes:

12b: Please explain how equivalency with the biofuel system is defined:

Do you refer to energy content of the fuel:……

Do you refer to miles (km) per energy unit:…….

12c: Describe how energy efficiency is factored into fuel use analysis:……...

……

12d: Tailpipe gas is addressed: (Y or N) ___

If yes, describe methodology:……

…….

13. Please identify any elements of the fossil fuel LCA not included in the above questions and describe methodology used to calculate emissions:……

…….

II. Stationary use of biofuel for electricity/heat

6. Describe technologies, methodologies and data for calculating the extraction/production/transport of replaced energy source, using Transport Fuel questions 6-11, above, as guidance where appropriate:……....

……

7. Fuel use emissions are accounted: (Y/N) ___

(please consider consistency with Step 9)

If no:

7a: Please explain how equivalency with the biofuel system is defined (e.g. lower heating value of utilized fuel):……..

……

7b: What type of fossil fuel is assumed to be replaced by the biofuel system?.....

Explain the assumption:……

If yes:

7c: Please explain how equivalency with the biofuel system is defined.

Do you refer to energy content of the fuel? (Y/N) ___

Do you refer to useful energy taking end use efficiency into account? (Y/N) ___

If yes:

7d: Which method is used to define the production of replaced electricity/heat?

___ national average mix

___ marginal production

___ other:……

Please explain your choice and assumptions:……..

……

7e: Report energy efficiency for electricity generation, and/or heat generation and describe how it is used in emissions analysis:……..

……

7f: Describe methodology for calculating evaporative emissions:…….

……

7g: Describe conversion/combustion technologies and method for calculating associated emissions, including trace gases:……

……

8. Please identify any elements of the fossil fuel LCA not included in the above questions and describe methodology used to calculate emissions:……

……