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NOTE ON THE
CONDUCTING AND VERIFYING ACTUAL CALCULATIONS
OF GHG EMISSION SAVINGS

Complementing the Communication from the Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme (2010/C 160/01) and the Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels (2010/C 160/02), this note aims to provide voluntary schemes with further guidance on how the procedures ensuring the provision of correct data on actual GHG emission savings can be further improved. This concerns, in particular, the transmission of relevant information through the chain of custody, certain methodological choices concerning specific elements of the GHG emission calculation formula, the use of standard values and auditing.

Options for reporting GHG emissions

The Renewable Energy Directive allows economic operators to calculate actual values of GHG emissions, to use default values or to use a combination of disaggregated default values and calculated actual values. In principle, economic operators can decide at any stage of the chain of custody which option they choose for reporting GHG emissions. However, this would require having all information available that is needed to decide whether default values can be used or in case of actual values all information needed to calculate upstream GHG emissions. Such large amount of information usually cannot be transmitted through the chain of custody.

This has consequences for application of the GHG emission calculation methodology. For instance this means that in practice actual values of emissions from cultivation can only be determined at the origin of the chain of custody.

Similarly, economic operators will only be able to use actual values for transport if emissions of all relevant transport steps are taken into account. Therefore, in case no information on actual transport emissions is available at a stage where transport emissions should have occurred, the calculation of actual transport emissions cannot be considered as an option.

In analogy, the use of actual values for processing is only possible if information on the emissions of all processing steps was included at the appropriate processing step.

To ensure that these principles are applied it is necessary to communicate whether the calculation of actual values remains an option. Therefore, whenever information that is relevant for the calculation of actual emissions is not adequately taken into account, it must be clearly documented that default values have to be used.

Default values listed in Annex V can be applied only if the process technology and feedstock used for the production of the biofuel match their description and scope. In most cases, it can be checked easily which default value should be applied because many specify only the feedstock used for the production of the biofuel. Others depend also on the energy carrier used for processing. Two pathways require additionally the use of processes with methane capture at the oil mill. These default values can be applied by economic operators only when the approved methane capture methods and auditing requirements are described in detail in the scheme documents. Methane capture methods can only be approved when their application ensures that the methane is captured in an efficient manner similar to what has been assumed in the calculation of the default values. For the calculation of the default values, it was assumed that methane emission are reduced so that without allocating emissions to palm oil mill effluent (POME) plants emit less than 5.46 kgs of methane per tonne of CPO.

Further default values can be used only if no land use change has occurred. Otherwise, the related emissions must be added.

Transmission of information relevant for GHG emissions through the chain of custody

All information that is relevant for establishing compliance with the EU sustainability criteria for biofuels must be transmitted through the chain of custody. This includes information on GHG emissions. The following describes what kind of information must be submitted and which units have to be used.

In order to establish whether the minimum GHG emissions savings have been achieved, GHG emissions from biofuel production are compared to the relevant fossil fuel comparator. GHG emissions are measured in this context in the unit CO_2eq/MJ of biofuel. Hence, for final biofuels GHG emissions have always to be reported in this unit.

The situation is different for raw materials and interim products though. In case actual values are calculated for raw materials and interim products, GHG emissions cannot be reported in the unit CO_2eq/MJ of biofuel because this would require knowing how efficiently these are converted into final biofuels. For obvious reasons, this information is not available at the early stages of the chain of custody (i.e. before this conversion has actually taken place). Instead, for raw materials and interim products information on GHG emissions has to be provided in the unit g CO_2eq/dry-ton feedstock or g CO_2eq/dry-ton intermediary product, respectively.

To receive information on emissions per dry-ton feedstock the following formula has to be applied:

$$e_{ec}feedstock_a \left[\frac{gCO_2eq}{kg_{dry}}\right] = \frac{e_{ec}\, feedstock_a \left[\frac{gCO_2eq}{kg_{moist}}\right]}{(1 - moisture\ content)}$$

The moisture content should be the value measured after delivery, or, if this is not known, the maximum value allowed by the delivery contract.

Information on GHG emissions must include accurate data on all relevant elements of the emission calculation formula. As explained above, when default values are used, information on GHG emissions should be only reported for final biofuels and can be reported as an aggregate. When actual values are calculated, it is necessary to split the total amount of emissions into all elements of the GHG emission calculation formula that are relevant. This applies also to the elements of the formula which are not included in the default values such as e_l, e_{sca}, e_{ccr}, e_{ccs} and e_{ee}. This measure is required to ensure transparency and robustness of the calculation of actual GHG emissions, particularly, having in mind that certified material can be exchanged between schemes. If only aggregated values were used, it would not be sufficiently transparent which elements of the GHG emission calculation formula are comprised in the transmitted value. This would be in particular problematic at later stages of the chain of custody when it still could be decided to use disaggregated default values of individual elements of GHG emissions calculation formula.

In this context, it is worth noting that the Commission Decision of 12 January 2011 on certain types of information about biofuels and bioliquids to be submitted by economic operators to Member States (Decision 2011/13/EU) requires that voluntary schemes inform the Member States whether either the factor for emissions savings from soil carbon accumulation via improved agricultural management (e_{sca}) or the bonus for the restoration of severely degraded or heavily contaminated land was used[1]. Therefore, it is already obligatory today to provide information on some elements of the formula.

In case actual values are not used, information on the amount of GHG emissions should not be transmitted through the chain of custody (before the last processing step) as it would be difficult to know at later stages of the chain of custody whether these emissions represent actual values or are derived from (disaggregated) default values. Furthermore, it would unnecessarily increase the administrative burden. Therefore, it is the responsibility of downstream operators to include information concerning the (disaggregated) default GHG emission values for the final biofuels when reporting to the Member States.

Actual values for emissions from cultivation *(e_{ec})*

The sustainability scheme allows in case of emissions from cultivation, the use of average values for a region as an alternative to disaggregated default values or actual values. The Commission Communication 2010/C 160/02 lists the elements that need to be taken into account in the calculation, and provides guidance on the appropriate geographic coverage of the averages. Additionally, an annotated example of an actual calculation can be found on the Commission web site.

Member States or competent authorities of third countries may submit to the Commission reports including data on typical emissions from cultivation of feedstock[2]. As laid set out in Commission Communication 2010/C 160/02 the values from the "NUTS 2" reports, which were submitted to the Commission by the Member States as requested in Article 19(2) Renewable Energy Directive can be used by voluntary schemes. The calculation of

[1] Application of the bonus by the voluntary schemes will only be possible after the Commission has established definitions, including technical specifications required in this regard

[2] Article 19(3) Directive (2009/28/EC)

these values has been scrutinised by the Commission services and thus voluntary schemes may allow operators to apply these values as an alternative to actual values provided these are available in the unit g CO_2eq/dry-ton of feedstock on the Commission web site. The calculation of alternative averages for areas and crops which are covered by the NUTS 2 reports should under normal condition not be deemed appropriate as the appropriate averages have already been calculated by the national authorities.

In this context, it is important to note that at the values included in the NUTS 2 reports do not represent disaggregated default values. Therefore, they can at the time being only be used as an input for the calculation of actual values but cannot be used to report emissions from cultivation in the unit CO_{2eq}/MJ of biofuel.

Adjusting GHG emissions estimates throughout the chain of custody

Whenever actual values are calculated at each step of the chain of custody, the additional emissions from transport and/or processing need to be added to e_p and/or e_{td}, respectively.

Additionally, a 'feedstock factor' needs to be applied to all emissions to take the energy losses occurred into account. This applies to each processing step, but can be also relevant for other steps in the chain of custody e.g. drying of feedstock and seasoning of woody biomass.

Whenever a processing step yields co-products, emissions need to be allocated as set out in the GHG emission calculation methodology.

Put more formally, the following formula should be applied to emissions from cultivation when processing intermediate products:

$$e_{ec} intermediate\ product_a \left[\frac{gCO_2eq}{kg_{dry}}\right] = e_{ec}\ feedstock_a \left[\frac{gCO_2eq}{kg_{dry}}\right] * Feedstock\ factor_a * Allocation\ factor\ intermediate\ product_a$$

Where

$$Allocation\ factor_{\ a} = \left[\frac{Energy\ in\ intermediate\ product_a}{Energy\ in\ intermediate\ \ products\ and\ co-products}\right]$$

$$Feedstock\ factor_a = [Ratio\ of\ MJ\ feedstock\ required\ to\ make\ 1\ MJ\ intermediate\ product]$$

At the last processing step, additionally, the emission estimate needs to be converted into the unit CO_2eq/MJ of final biofuel.

For this transformation, the following formula should be applied to emissions from cultivation:

$$e_{ec}biofuel_a \left[\frac{gCO_2eq}{MJ\ biofuel}\right]_{ec} = \frac{e_{ec}\ feedstock_a \left[\frac{gCO_2eq}{kg_{dry}}\right]}{LHV_a \left[\frac{MJ\ feedstock}{kg\ dry\ feedstock}\right]} * Feedstock\ factor_a * Allocation\ factor\ biofuel_a$$

Where

$$Allocation\ factor\ biofuel_a = \left[\frac{Energy\ in\ biofuel}{Energy\ biofuel + Energy\ in\ co-products}\right]$$

$$Feedstock\ factor_a = [Ratio\ of\ MJ\ feedstock\ required\ to\ make\ 1\ MJ\ biofuel]$$

Similarly, also the values for $e_{p,}$ $e_{td,}$ e_l and e_{ee} need to be adjusted. As mentioned above in case of $e_{p,}$and e_{td}, the emissions from the relevant processing step must be added. For (e_{ccr}) and carbon capture and geol. storage (e_{ccs}), dedicated rules apply as described below.

For the purpose of this calculation, feedstock factors and allocation factors based on plant data and the LHV values for dry-ton feedstock have to be applied. The assumptions applied in the framework of the calculation of the default values are provided in table 1 for information (assuming that the biofuel is produced in one production step). Further, an illustrative example how information on the emissions from cultivation and processing can be adjusted at different points of the chain of custody has been attached (example rape seed biodiesel). The plant specific assumptions may differ from the actual situation and, therefore, the values used in the example should not be applied for the calculation of actual values.

Voluntary schemes should lay down in detail in the scheme documents how all required information of GHG emissions is transmitted through the chain of custody, and how the values are calculated.

Carbon capture and replacement (e_{ccr}) and carbon capture and geol. storage (e_{ccs})

The Renewable Energy Directive sets out that emission savings from carbon capture and replacement, e_{ccr}, shall be limited to emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 used in commercial products and services. Emission savings from carbon capture and geological storage (e_{ccs}) that have not already been accounted for in e_p, shall be limited to emissions avoided through the capture and sequestration of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel.

As the provision on carbon capture and replacement is applied more frequently than in the past, we would like to provide you with more guidance on how to implement both elements.

First of all, for both elements, the emission saved must, to our understanding, relate directly to the production of the biofuel they are attributed to. It would, for instance, not be justified to allocate arbitrarily different amounts of savings to biofuels obtained from the same process i.e. all biofuels originating from the same process would need to be treated equally in this regard. If the CO_2 is not captured continuously, it might be appropriate to deviate from this approach and to attribute different amounts of savings to biofuel obtained from the same process. However, in no case a higher amount of savings

should be allocated to a given batch of biofuel than the average amount of CO_2 captured per MJ of biofuel in a hypothetical process where the entire CO_2 stemming from the production process is captured.

Further, it needs to be taken into account that capturing and processing of CO_2 has its own GHG emission footprint. Those emissions have to be taken into account in the calculation applying the appropriate emission factors for the energy consumed and the inputs used for capturing and processing of CO_2.

To verify that the capturing of CO_2 is used in commercial products and services to replace fossil-derived CO_2, it would suffice to check that the CO_2 was sold to an economic operator that can be expected to have an economical meaningful use for the CO_2. In order to ensure that e_{ccr} is limited to emissions avoided through the capture of CO_2 and to verify that fossil-derived CO_2 is replaced, it is necessary to gather this type of information. Therefore, the buyer should provide information how the CO_2 that is replaced was generated previously and declare, in writing, that due to the replacement emissions are avoided. It would be for the auditor to decide case by case whether the requirements of the Renewable Energy Directive are met including that emissions are actually avoided. Good examples for a replacement which can be expected to avoid CO_2 emissions are cases where the CO_2 that is replaced was previously produced in a dedicated process aiming at the production of CO_2 such as a CO_2 generator burning natural gas to produce CO_2 to stimulate the growth of vegetables in a greenhouse. Until further notice it is not required to conduct audits on the premises of the buyer as the buyer of the CO_2 is not part of the chain of custody related to the biofuel production, unless there is reasonable suspicion that the written declaration contains false information.

Standard calculation values

As laid down in the Renewable Energy Directive, actual GHG emission savings means greenhouse gas emission saving for some or all of the steps of a specific biofuel production process calculated in accordance with the methodology laid down in part C of Annex V. Thus, actual calculation of GHG emission savings requires the assessment of the GHG emissions that actually occur. Still, in the framework of this assessment it is necessary to apply standard calculation values such as GHG intensities for chemicals and energy inputs which do not depend on the biofuel production process itself.

We highly recommend voluntary schemes to use for the purposes of biofuel sustainably certification the standard calculation values which will be published on the Commission website dedicated to the GHG emission savings methodology. This list is not exhaustive. However, whenever an item is covered by the list, the use of alternative values must be duly justified. In case alternative values are chosen, this must be flagged up in the documentation of the calculations in order to facilitate the verification by auditors.

Please note that the list does not include Member State specific values for the emission intensity of grid electricity as, in the view of the Commission, the most logical choice is to use the EU value for all Member States. In the case of third countries, where grids are often less linked-up across borders, the national average could be the appropriate choice.

The list of standard calculation values might be subject to changes resulting from technological progress, new scientific evidence or changes to the legal framework.

Verification of actual GHG emission calculations

In line with the general requirements for conducting audits, auditors verifying the calculation of actual GHG emission need to have the appropriate specific skills, including relevant experience in this field. Due to the complexity of the tasks, is seems still challenging to conduct such a verification in the context of a pure on-site audit. To improve the robustness of the verification procedure, it is therefore required that economic operators make available to the auditors all relevant information concerning the calculation of actual GHG emissions in advance of the planned audit. The auditor in turn should record the emissions from the processing occurring at the audited site (emissions after allocation) and if relevant the achieved savings in the auditing report in order to document that the calculation was thoroughly verified and understood. In case those emissions deviate significantly from typical values the report should also include information that can explain the deviation.

Table 1: Assumptions applied for the calculation of default values

Pathway	Crop	LHV: MJ/kg dry feedstock	MJ feedstock /MJ biofuel	Kg dry feedstock /MJ biofuel
Sugar beet ethanol	Sugar beet	16.3	1.840	0.1129
Wheat ethanol	Wheat	17.0	1.882	0.1107
Corn ethanol	Corn	18.5	1.958	0.1059
Sugar cane ethanol	Sugar cane	19.6	2.772	0.1414
FAME biodiesel from rapeseed	Rapeseed	26.4	1.729	0.0655
FAME biodiesel from sunflower	Sunflower seed	26.4	1.610	0.0610
FAME biodiesel from soybeans	Soybeans	23.5	3.078	0.1308
FAME from palm oil	FFB	24.0	2.018	0.0841
HVO from rapeseed	Rapeseed	26.4	1.705	0.0646
HVO from sunflower	Sunflower seed	26.4	1.588	0.0601
HVO from palm oil	FFB	24.0	1.992	0.0830
Pure vegetable oil from rapeseed	Rapeseed	26.4	1.718	0.0651